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EDITORIAL

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ORIGINAL ARTICLE

A population-based analysis of insulin management patterns in a province of southern Spain (2014-2018)

José Escribano-Serrano, Enrique Jiménez-Varo, María-Isabel Méndez-Esteban, Antonio García-Bonilla, Manuela Márquez-Ferrando, Antonio Hormigo-Pozo, José Mancera-Romero, and Alfredo Michán-Doña

REVIEW ARTICLE

The basics of journal-level metrics: What clinical researchers need to know

José M. Porcel and Leyre Liesa

Medical errors and communication

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The interest sparked by “medical error” can be seen in the medical literature on the PubMed search engine. In a search of entries under this heading conducted on July 12, 2022, 156,899 references are found, of which 63,322 correspond to the last ten years and 5760 to reviews. Of them, 1880, 788, and 87 are publications in Spanish, respectively.

In 1999, the World Health Organization (WHO) and the Institute of Medicine’s (IOM) Committee on Quality of Health Care in America published landmark reports which, using data from the states of Colorado, Utah, and New York, estimated that nearly 100,000 patients died each year from problems arising from medical errors^{1,2}. Extrapolating the results of these reports to North American health-care databases, it can be concluded that around 3% (2.9%–3.7%) of hospitalizations would have experienced adverse side effects secondary to medical errors made during the hospitalization and that between 6.6% and 13.6% of these errors would have had a fatal outcome. The reports stated that one of every two incidents could have been avoided. At that time, these provocative reports generated a great deal of debate, both in public opinion and in the medical field.

If we perform the theoretical exercise of transferring these results to Spain’s Basic Minimum Data Set (CMBD, for its initials in Spanish) (a registry of specialized healthcare activity from the Ministry of Health), in 1999, there would have been no < 50,000 avoidable

adverse events due to medical error among hospitalized patients in our country, of which between 4000 and 5000 would have been fatal³.

Based on these data, it is not too bold to claim that medical error is among the main causes of death in Western societies, causing a similar number or even more deaths than traffic accidents or breast cancer, and many more than due to acquired immunodeficiency syndrome.

Later analyses—which included new works based on different methods that attempted to update the data reported by the IOM in 1999 as they considered them limited and out-of-date—considerably increased the number of medical errors. These analyses asserted that medical error is the third leading cause of death in the United States of America (USA), behind only cardiovascular diseases and cancer, and that they account for more than seven times the number of fatalities due to traffic accidents or firearms^{4,5}. Classen et al. describe a medical error rate of 1.13% which, applied to Medicare data from the period from 2013 to 2015, would entail more than 400,000 deaths per year in the USA. This is four times higher than the estimate made by the IOM in 1999⁶.

The fact that medical error is very likely underestimated makes this even more worrying. On the one hand, medical errors, whether they lead to the patient’s death or not, are not classified as such in the International Classification of Diseases 9th or 10th edition (ICD-9, ICD-10). Therefore,

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registries based on this classification have a very limited capacity for detecting them. This index of codes is used in official health-care registries in practically all countries that have these coding services. Indeed, a recent search conducted in July 2022 using the International Classification of Diseases, 10th Revision, Clinical Modification, 3rd edition from January 2020 (ICD-10-ES), which is current in Spain, did not find any diagnostic or procedure code that could encompass medical error, not even among its special codes. The same occurs with death certificates, which only specify the organic origin of the death and do not refer to other possibilities outside of a violent death.

The term “medical error,” in its intrinsic meaning of an erroneous action, has a negative, culpable connotation. Therefore, some authors have used the description of “incident” for adverse effects caused by an erroneous action by a health-care professional or the healthcare system itself. Medical errors can include problems in clinical practice, medical products used, procedures performed, and systems used. The National Patient Safety Foundation prefers to use the term “error in medical care” instead of medical error and defines it as “an undesired result of medical care arising from a defect in the medical care provided to a patient⁷,” such that it includes both errors due to action and due to omission, as established by The Australian Health Care Study^{8,9}.

Given the magnitude of the problem, it is essential to fight to prevent medical errors using any of the methods that have been proposed for this purpose, such as using support systems for clinical decision-making, notification of results, education and training of professionals, the promotion of teamwork, and the organization of clinical sessions aimed at reflecting on diagnostic errors. However, the effectiveness of these methods is limited and their use does not seem to lead to a radical improvement in outcomes^{10,11}.

Nevertheless, there are promising results with the use of checklists in various healthcare actions. For example, with the use of a simple surgical safety checklist, a decline in the mortality rate from 1.5% to 0.8% and a decline in in-hospital complications from 11% to 7% has been observed in the surgical activity of eight very different hospitals included in the WHO’s Safe Surgery Saves Lives program¹².

Along these lines, a recent systematic review on the reduction of medication error in adults in the hospital setting concluded that compared to routine care, a medication conciliation, assisted electronic prescribing systems, bar codes, and error reports provided to professionals could reduce adverse events and

medication errors. However, the best way of implementing these interventions is not so clear¹³ and thus, questions remain about the real effectiveness of any of the measures recommended for reducing medical errors.

In addition to the foregoing, communication with patients, their families, and their loved ones about medical errors is an aspect with plenty of room for improvement, something that perhaps is justified given the negative connotations and potential legal repercussions for professionals as well as the poorly understood corporate defense professional organizations provide to their members. Although physicians often intuitively recognize that they will make mistakes over the course of their career, many have not received training on the analysis and disclosure skills necessary for approaching the errors. In consequence, the traditional response to errors has left much to be desired for patients, families, health-care teams, and hospitals.

Substantial changes are still needed, but this movement can be strengthened by encouraging local practice communities to create policies and environments favorable to the presentation of open reports, respectful disclosure to patients, and support for the health-care workers involved.

It has been proposed that future research should center on the comprehensive description of the nature and frequency of errors in medical practice as well as on conducting prospective assessments of institutional programs designed to improve disclosure practices and the emotional recovery of both patients and healthcare workers¹⁴.

In these circumstances, new regulations have emerged which recognize patients’ rights, specifically the right to necessary information. Articles 10.2 and 24 of the European Council’s Oviedo Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine of April 4, 1997, which institutionalized the Patient Autonomy Law in Spain¹⁵, clearly state the obligation to inform patients and their families of all happenings, erroneous or not, which occur during their contact with the health-care system.

The traditional response to errors has not been sufficient for patients, families, health-care teams, and hospitals and a change toward a culture of greater transparency and support for the victims of medical error is beginning to emerge. In regard to the patients’ and their families’ expectations regarding errors, it should be taken into account that they expect an explicit

statement that an error occurred, an understandable description and explanation of its causes, plans to correct it, and how the error may influence the patient's health. All this information must be provided in clear, empathetic language with sincere apologies, a recognition of emotion, and a willingness to then monitor both the investigation into the case and the patient's progress¹⁶.

Be that as it may, we also cannot forget the situation of the healthcare workers involved in an error and the subjective sensation of abandonment by institutions that are so often noted¹⁴. The physicians and nurses involved in an error may have a devastating emotional response. The negative outcomes of poor management of the consequences of medical error can be mitigated by focusing on supporting the patient and promoting sincere, empathetic listening that makes effective, emotional communication with patients and their families a reality¹⁷.

Very recently, a significant decline has been reported in the adverse event rates according to medical records of patients hospitalized in the USA for acute myocardial infarction, heart failure, pneumonia, and major surgical procedures between the years of 2010 and 2019, which undoubtedly is a cause for hope¹⁸.

Plausibly, the comprehensive use of proposed measures should reduce medical errors, but this makes the need to train health-care professionals on techniques for communicating results to other healthcare actors and to patients and their families to achieve technically flawless and ethically ideal outcomes all the more evident.

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A population-based analysis of insulin management patterns in a province of southern Spain (2014-2018)

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Abstract

Aim: The aim of this study was to analyze the patterns of insulin consumption between 2014 and 2018 in Cádiz.

Methods: This study was a cross-sectional retrospective study. All people that used any insulin were included in the study. The Cadiz Diabetes Database includes data on yearly anti-diabetic prescriptions and hemoglobin A1c (HbA1c) levels.

Results: The prevalence of insulin-users was 2.15%. More prevalent in women and increased with age (0.18% in the 0-15-year-old group to 8.53% in the > 75-year-old group); insulin users represent 28.8% of the total population with diabetes mellitus treatments. Seventy percent of insulin-treated patients (ITP) were over 60 years old. Long-acting insulin was consumed by 79% of users, representing 55% of the total insulin types consumed. Glargine was the most consumed (4,654,000 defined daily dose and valuing > 7.000.000€ in 2018). In > 75-year-old group, 50% were treated with long-acting and fast-acting insulin combinations. Annual HbA1c was determined for two out of three ITP and 37% of these had HbA1c < 7% (53 mmol/mol). **Conclusions:** The Cadiz population presents a high consumption of insulin. Insulin prescription patterns have changed during the study. Long-acting insulins, especially Glargine (alone or in combination), are the most widely used types of insulin. In the group of elderly patients, the patterns found are not in line with the current recommendations. ITP in Cadiz has a poor glycemic (median HbA1c 7.84%) control and a low amount of HbA1c determinations.

Keywords: Diabetes mellitus. Insulin-treated patients. Prevalence insulin consumption. Insulin patterns. Glycemic control.

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Introduction

In 2010, the prevalence of known diabetes mellitus (DM) in Spain was 7.8%, it increased significantly with age and was higher in men than in women. According to data from a survey (Di@bet.es study), < 2% of the general population (1.79%) had an insulin treatment¹. Among patients with known DM, 15% of them were treated with insulin alone and 8% had a treatment based on a combination of insulin and non-insulin anti-diabetic drugs (NIADs)².

Insulin is the cornerstone of anti-diabetic therapy for individuals with type 1 diabetes³. The diabetes control and complications trial (DCCT) showed that intensive therapy with multiple daily injections improved long-term glycemic results⁴. The individuals with a recent diagnosis of latent autoimmune diabetes in adults are characterized by having a slower process leading to an absolute insulin dependency state. Insulin therapy is essential in patients with an absolute loss of pancreatic β -cells⁵.

Pregnant women with a high level of glycaemia may require an earlier initiation of pharmacologic therapy. Insulin treatment is the first anti-diabetic therapy recommended to treat gestational DM in Spain⁶.

Many patients with DM type 2 eventually require insulin therapy^{3,7}. The United Kingdom Prospective Diabetes Study (UKPDS) reported that microvascular events were reduced in patients with the early use of therapy based on a combination of insulin and sulfonylureas. These results were not obtained for macrovascular complications⁸. Based on the UKPDS, clinical doctors were encouraged to prescribe an early insulin therapy due to the low targets for glycemic control.

The DCCT and UKPDS studies were carried out using treatments with short- and intermediate-acting human insulin^{4,8,9}. However, since these studies were conducted, a good number of new, long-acting insulin analogues and fast-acting insulin analogues have been developed. These analogues are associated with less hypoglycemia, less weight gain, and lower hemoglobin A1c (HbA1c) levels compared to human insulin treatment outcomes in diabetes patients^{9,10}.

According to the Agencia Española del Medicamentos y Productos Sanitarios, the use of insulin increased significantly until 2014¹¹. Moreover, intermediate-acting insulin types have been mainly switched to long-acting insulin analogues. The use of the latter has been increased up to six fold¹¹⁻¹⁵.

There is a general lack of data on the real-world treatment of type 2 DM patients, especially around initiation of insulin therapy¹⁶. This lack of up-to-date data constitutes a real limitation to knowing the current

consumption of the different insulin types available, and how these insulin types are being prescribed in each situation. Moreover, nowadays, the global prevalence of patients treated with insulin is still unknown in Spain.

The objective of this study is to calculate the rates of insulin use, the characteristics of the insulin users, and the different patterns of this insulin use relating to different age groups. As a second objective, we have described the number of HbA1c determinations in our population and correlated the different patterns of insulin use with the degree of diabetes control determined by these data.

Material and methods

This study was a cross-sectional retrospective study, approved by the Ethical Committee of Cádiz, between 2014 and 2018 using the Cádiz Diabetes Database (CDD)¹⁵. The CDD includes the treatment and laboratory information of patients from fifty primary care centers and five hospitals of the Andalusian Health Service, which represents 97% of the Cadiz population (1.19 m people).

Study population

Any patient that had used any kind of insulin available was considered as “insulin-treated patients” (ITP). The CDD includes each onset of ITP (which provides incidence) and excludes them when patients died or moved to another province.

Insulin data

Yearly anti-diabetic prescription data of each ITP were collected using the information provided by the pharmacy invoicing data of Andalusian Health Service. Glycemic levels were evaluated using HbA1c¹⁵. According to the Anatomical and Therapeutic System Classification (ATC), different kinds of insulin were included in the A10A group and the A10B group includes all NIADs.

Prandial insulin types (the A10AB group) include short-acting human (Regular) and fast-acting insulin analogues (Aspart, Glulisina, and Lispro). Basal insulin types, including Intermediate-acting insulin types, were Neutral Protamine Hagedorn (NPH) and Neutral Protamine Lispro (the A10AC group), and long-acting insulin analogues were Glargine, Detemir, and Degludec (the A10AE group). The A10AD group includes the different mixtures of insulin.

Treatment options for anti-diabetic therapy were categorized in “therapeutic patterns,” those using basal (intermediate or long acting) insulin with NIADs or basal insulin alone, and those using basal and prandial (fast acting) insulin combined with NIADs or not.

The consumption of insulin types was calculated using the parameters: defined daily dose (DDD), DDD per 1000 inhabitants per day (DHD), L/year, and quantification of consumers. The prevalence of insulin use was calculated as the equation of the number of ITP divided by the population entitled to healthcare. The estimate of accumulated insulin incidence was evaluated by dividing the new cases of ITP by the population entitled to healthcare.

Glycemic control data

Outcomes for glycemic control in adults with DM may vary based on the patient's characteristics and by the doctor's criteria. According to the American Diabetes Association (ADA) / European Association of Study Diabetes (EASD) guidelines, having an HbA1c of < 7% (53 mmol/mol) is suggested as a reasonable goal for most adults¹⁷. The National Institute of Clinical Excellence guideline recommends increasing the treatment if HbA1c > 7.5% (58 mmol/mol)¹⁸. On the other hand, having HbA1c < 8% (64 mmol/mol) or < 8.5% (69 mmol/mol) may be more appropriate for certain populations including older patients, those with a high level of comorbidity or previous hypoglycemia¹⁹. Having an HbA1c > 10% (86 mmol/mol) is considered as a very poor control.

Statistical analysis

Quantitative descriptive data are expressed as the mean \pm standard deviation for normally distributed variables or medians and interquartile ranges for non-normal distribution variables. All statistical calculations were performed using MedCalc Statistical Software version 19.0 (MedCalc Software bvba, Ostend, Belgium; <http://www.medcalc.org>; 2019).

Results

Insulin consumption

During the study period, 48 million DDD of the insulin types available were consumed, this DDD corresponds in 2018 to 27 DHD, which is an annual cost of over 14 million euros/year. Table 1 shows ITP, L/year, DDD, and DHD and evolution during the last 3 years according to ATC classification.

Consumption of biphasic and intermediate-acting insulin types declined by 30% and 47%, respectively, during the study period. However, the consumption of fast-acting and long-acting insulin analogues increased by 15% and 20% during the same period (Fig. 1). Despite the decrease

in the number of users and volume of insulin in 2017, the consumption of insulin analogues increased in 2018, with the consequent increase in the associated cost (Table 1).

Long-acting insulin was used by 79% of the ITP and this represented 55% of the total insulin types consumed (Fig. 1 and Table 1). Glargine with 12.75 DHD and aspart (alone or in combination) with 5.04 DHD were the most consumed insulin types during the year 2018. Aspart and Glargine together represented almost 2/3 of the total insulin consumption. In 2018, Glargine was the most consumed insulin with a volume of more than 4.6 million DDD/year (1.5 for Glargine 300) which represented a cost superior to 7 million euros in that year.

The median daily dose of long-acting insulin was 20.6 IU (IQR: 14.8–32.9), 50% ITP consumed a daily dose of \leq 20 UI, while 84% used daily doses of \leq 40 IU (Fig. 2).

The prevalence and incidence

In 2018, there were 25,570 ITP, of which 52% were women and 70% were more than 60 years old. General characteristics are detailed in table 2.

The prevalence of DM patients treated was 7.45%, with the same proportion between sexes. The numbers of ITP correspond to a prevalence of 2.15% for the total Cadiz population (2.20% for women and 2.09% for men) and it represents 28.8% of the total population with DM treatments.

Figure 3A shows the prevalence of insulin users according to sex and age groups. The prevalence of insulin users was < 1% for those under 30 years old (regardless of sex). It increased to 1.04% in women and 1.32% in men in the 30-59 age group. Finally, it increased 6 times for people over 75 (7.11% in men and 7.12% in women) with respect to the middle age group. More than 60% of ITP were more than 60-years-old and insulin use was more prevalent in women (73.6%).

The incidence of people who started treatment with insulin reached the highest value in 2016, with 1.17 per 1000 (1,304 ITP). However, this decreased to an incidence of 0.85 per 1000 in 2017 and increased again to 1.06 per 1000 in 2018.

Insulin consumption patterns

Insulin consumption in DHD was 26.6 in the 1st year of the study. The maximum value was reached in 2016 with a DHD of 27.01, staying for the past year of the study period with a DHD of 27.00. Eighty-five percentages of the total insulin types consumed in 2018 were analogues of insulin.

Table 1. Insulin consumption profile and cost during the period of study (2016-2018)

Type	2016					2017					2018				
	ITP	Litres	DDD	DHD	Costs	ITP	Litres	DDD	DHD	Costs	ITP	Litres	DDD	DHD	Costs
Basal	22,962	2,411	6,028,341	16.52	ND	22,411	2,227	5,568,185	15.26	8,552,190	22,689	2,493	6,231,898	17.07	9,788,180
A10AC	4,262	451	1,126,942	3.09	ND	3,138	367	918,483	2.52	918,483	2,635	324	810,698	2.22	810,698
NPH		434	1,083,753	2.97	ND		367	918,458	2.52	918,458		324	810,698	2.22	810,698
NPL		17	43,189	0.12	ND		0	25	0.00	25		0	0	0.00	
A10AE	18,700	1,961	4,901,400	13.43	ND	19,273	1,860	4,649,703	12.74	7,633,708	20,054	2,168	5,421,200	14.85	8,977,482
DEGLUDEC		42	104,094	0.29	ND		92	229,800	0.63	671,016		147	366,638	1.00	1,070,583
DETEMIR		245	611,889	1.68	ND		175	436,500	1.20	907,920		160	399,938	1.10	831,871
GLARGINA		1,539	3,846,304	10.54	ND		1,205	3,011,255	8.25	4,577,108		1,254	3,135,148	8.59	4,765,425
GLAR U300		136	339,114	0.93	ND		389	972,148	2.66	1,477,664		608	1,519,476	4.16	2,309,604
A10AD	4,710	794	1,984,665	5.44	ND	3,719	633	1,582,890	4.34	2,026,099	3,578	625	1,562,693	4.28	2,000,247
ASP/ASP		443	1,106,546	3.03	ND		361	902,588	2.47	1,155,312		361	903,188	2.47	1,156,081
LIS/LIS		281	703,325	1.93	ND		219	546,375	1.50	699,360		215	538,200	1.47	688,896
HUMAN		70	174,794	0.48	ND		54	133,928	0.37	171,427		49	121,305	0.33	155,270
A10AB	9,431	738	1,845,464	5.06	ND	9,325	705	1,762,803	4.83	2,185,875	9,905	824	2,060,739	5.65	2,555,316
ASPART		321	801,414	2.20	ND		307	767,940	2.10	952,246		370	925,413	2.54	1,147,512
GLULISINA		126	313,949	0.86	ND		119	296,663	0.81	367,862		130	324,413	0.89	402,272
LISPRO		246	615,491	1.69	ND		240	600,888	1.65	745,101		285	713,438	1.95	884,663
HUMAN		46	114,610	0.31	ND		39	97,313	0.27	120,668		39	97,475	0.27	120,869
Total	26,014	3,943	9,858,469	27.01	ND	25,369	3,566	8,913,878	24.42	12,764,165	25,570	3,942	9,855,330	27.00	14,343,744

ITP: insulin-treated patients, DDD: doses diary defined, DHD: DDD per 1000 inhabitants per day, A10AB insulins and analogues for injection, fast-acting, A10AC insulins and analogues for injection, intermediate-acting, A10AD insulins and analogues for injection, intermediate- or long-acting combined with fast-acting, A10AE insulins and analogues for injection, long-acting, ND: not determined.

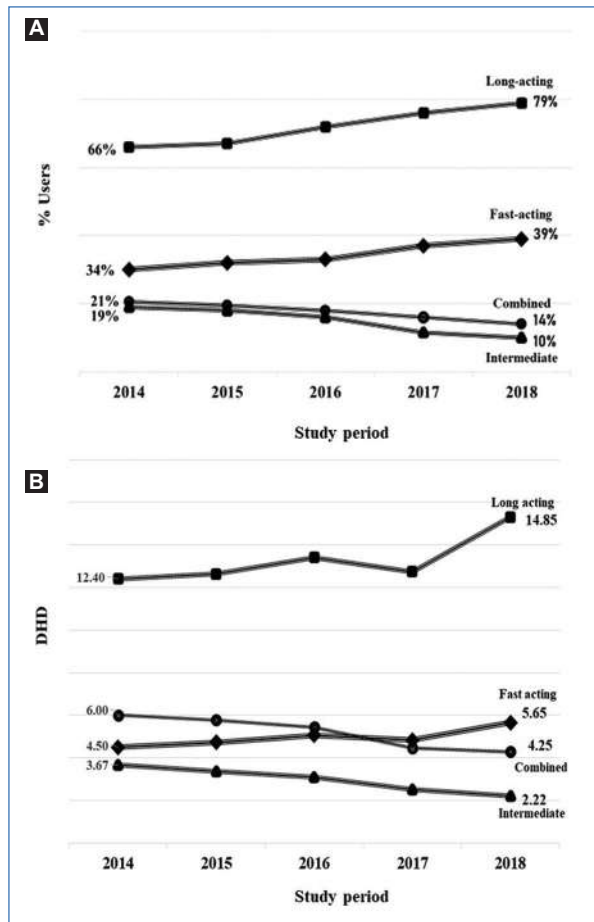


Figure 1. Evolution of different insulin Anatomical and Therapeutic System Classification group consumed during study period. **A:** estimation by users percentage. **B:** estimation by defined daily dose per 1000 inhabitants per day.

Figure 1 shows the evolution of the different insulin groups consumed. A marked decreased in these years in the number of DM patients treated with intermediate-acting insulin and a combination of insulin types may be observed. However, the DM patients treated with fast-acting and long-acting insulin increased during the time of the study (from 34% to 39% and from 66% to 79%, respectively). A basal prandial regimen is any combination of basal insulin (intermediate action and long action) with fasting insulin (human or analogues).

There were 25,570 ITP in 2018. 12,893 (50%) of those were treated with just basal insulin, of which the 82% used long-acting analogues. The other 50% were treated with a combination of basal and prandial insulins, of which 4123 (32%) used a fixed dose of mixture of insulin (Fig. 3B). In ITP older than 75 years, the combination of prandial and basal insulin was used in 40% of them.

Table 2. Distribution of diabetes mellitus insulin users patients' along the period in study (2014-2018)

Features	2014	2015	2016	2017	2018
Total DM people	86,368	86,737	88,140	88,674	88,695
Number of insulin users	25,844 29.9%	25,831 29.8%	26,014 29.5%	25,369 28.6%	25,570 28.8%
Basal prandial					
N	13,081	13,094	13,279	12,786	12,776
%	15.1	15.1	15.1	14.4	14.4
Woman					
N	14,039	13,961	13,968	13,603	13,365
%	54	54	54	54	52
Age					
Median	68	68	66	68	69
IQR	56-75	56-75	55-75	56-77	56-77
< 15 years					
N	329	350	358	365	342
%	1.3	1.4	1.4	1.4%	1.3
15-74 years					
N	17,372	17,509	17,639	16,894	16,872
%	67.2	67.8	67.8	66.6	66.0
≥ 75 years					
N	8,143	7,972	8,017	8,110	8,356
%	32	31	31	32	33
Incidence					
N		1,135	1,304	1,048	1,806
%		1.02	1.17	0.94	1.62
ITP with A1c					
N	17,775	17,982	17,911	17,935	18,212
%	69	70	69	71	71
HbA1c					
frecuence	1.70	1.58	1.40	1.60	1.70
N	0.93	1.00	1.04	0.86	0.66
%					
> 1 det A1c					
N	8,652	7,707	7,705	7,841	7,370
SD	48	43	43	43	47
A1c < 7%*					
N	5,823	5,913	6,536	6,600	6,584
%	33	33	36	37	36
A1c < 8%*					
N	11,033	11,898	12,442	12,101	12,352
%	62	66	69	67	68
A1c > 10%*					
N	1,742	1,303	1,231	1,218	1,190
%	9.8	7.2	6.9	6.8	6.5
A10AC					
N	4,972	4,648	4,023	3,070	2,635
%	5.8	5.4	4.6	3.5	3.0
A10AD					
N	5,313	5,026	4,710	4,023	3,578
%	6.2	5.8	5.3	4.5	4.0
A10AE					
N	17,107	17,382	18,700	19,273	20,054
%	19.8	20.0	21.2	21.7	22.6

*Percentage of people with A1c realized. DM: diabetes mellitus, ITP: insulin-treated patients, SD: standard deviation, CI: confidence interval, IQR: interquartile range, Hb1Ac: glycohemoglobin A1c. A10AB: insulins and analogues for injection, fast-acting. A10AC: insulins and analogues for injection, intermediate-acting. A10AD: insulins and analogues for injection, intermediate- or long-acting combined with fast-acting. A10AE: insulins and analogues for injection, long-acting. A basal prandial regimen is any combination of basal insulin (intermediate action and long action) with fasting insulin (human or analogues).

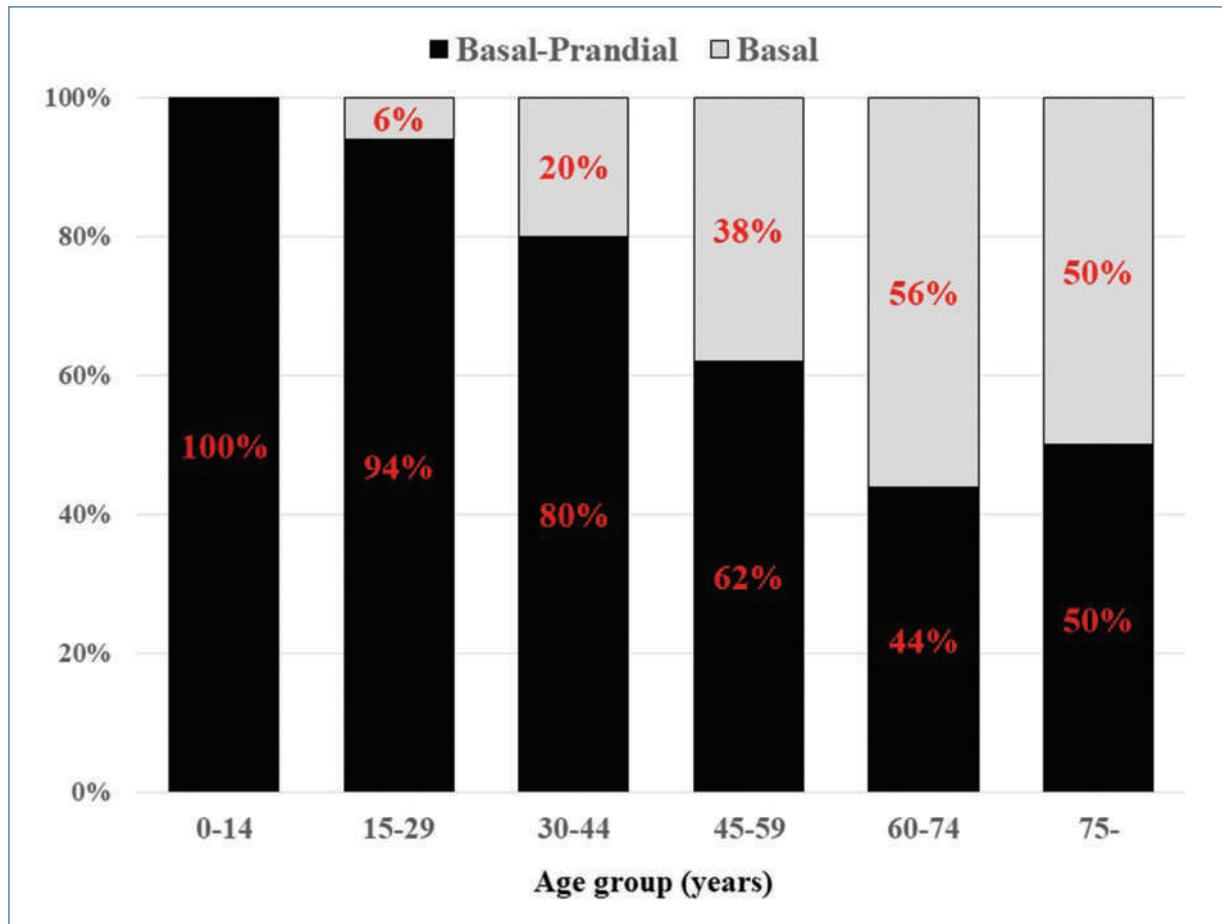


Figure 2. Mean daily dose of basal insulin consumed by each user, calculated through the annual consumption obtained in defined daily dose (DDD), and stratified by age group. The DDD for all types of insulins is 40 international units.

The HbA1c results

Table 2 shows that annual Hb1Ac determinations were not performed for one out of three ITP, independently of the year or the age group studied. Hb1Ac determinations were not performed during all the years studied in 1691 ITP (9%). Furthermore, HbA1c was monitored a minimum of 2 times per year during the study in only 10% of ITP.

Table 2 and figure 4 show the Hb1Ac determinations measured in 2018, 6600 (37%) of ITP had Hb1Ac levels lower than 7%, 8598 (50%) had Hb1Ac levels below 7.5% and 12,101 (67%) presented results of Hb1Ac lower than 8%, independently of the anti-diabetic therapeutic strategy used.

Discussion

The prevalence of patients treated with insulin in the province of Cadiz during the study period remained above 2% and stayed steady during study. This use is

more prevalent in women and increases with age, especially in patients older than 75, in which group, it is 6 times that of the 30-59 age group. ITP represents 28.8% of the total population with DM treatments, a percentage significantly higher than 23% of the total number of people who suffer from diabetes referred to in the Di@bet.es study¹.

Since ITP may use different insulin combinations in their anti-diabetic therapy, the prevalence based on people (2.15%) is lower than that based on insulin consumption (2.70%). This prevalence was stable until 2017. From this year on, the volume of insulin consumption and, hence, insulin consumers decreased. At this time, we cannot affirm whether this is a one-off event punctual fact, or the beginning of a trend in the lower insulin consumption, because, in 2018, a return to the previous level of consumption is perceived.

Previous publications and our results demonstrate a real alteration in the patterns of insulin consumption in

our country in recent years¹¹⁻¹⁵. Long-acting has mainly displaced intermediate-acting insulin types in anti-diabetic therapy consumption patterns. It is evident that basal insulin strategy is based on the use of long-acting analogues, and basal and bolus insulin strategy is based on the use of long-acting analogues combined with one or several doses of fast-acting insulin analogues.

Many patients above 75 are actually treated with prandial and basal combinations nowadays, which is far from the current recommendations of the diabetes guidelines¹⁹. Age and duration of diabetes are direct risk factors for hypoglycemia; therefore, “the hypoglycemia risk assessment” should be recommended routinely to take an appropriate decision to reduce glucose-lowering therapies in hypoglycemic risk patients²⁰.

Although our annual results of HbA1c measurements are frequently low (1.63 in 2018), these are better than the results previously published by other authors (0.9 in 2014)²¹. It is remarkable that many ITP cases had a poor control according to HbA1c determinations. In fact, only around a third of ITP maintained HbA1c levels lower than the general outcome of 7%.

Analyzing our results based on age, the young group (15-30 years) had the poorest results (58% HbA1c > 7.5%), showing the problems of switching patients from pediatric to adult care. Less than 50% of the middle-aged group (30-60 years) maintained HbA1c < 7.5%, nevertheless, a high percentage of these patients were treated with low and median doses of long-acting insulin. In contrast, over 50% of older patients conserved HbA1c < 7.5% and nearly a quarter lower than 6.5%; this may be due to the high use of prandial insulin in this group. Finally, we must emphasize the drop in HbA1c > 10% during the study period in 3% of determinations.

In 2000, the prevalence of insulin users in the Andalusian population was 1.33% and DHD was 13.54, estimated from anti-diabetic drug consumption data (similar to our methodology)¹³. The prevalence of total DM has been duplicated in Cadiz over 15 years¹⁵. The present study adds the fact that both ITP and insulin consumption have also doubled.

In 2010, the Di@bet.es study¹ described 1.48% of the prevalence of ITP, lower than the prevalence described in this work, reflecting an increasing trend in insulin use in the past 8 years. This increase is in agreement with the estimation of some authors that insulin consumption will increase by approximately 20% in the future²². Nonetheless, it is not supported by the clear maintenance of the volume of insulin consumed in the past 5 years.

Mancera-Romero et al.¹⁴ described an insulin consumption of 19.54 DHD between 2008 and 2012 and

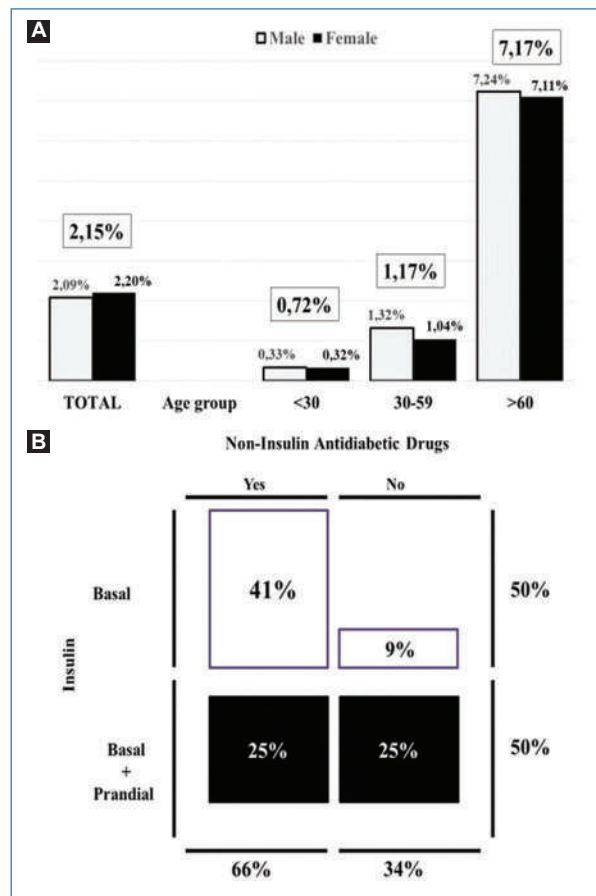


Figure 3. A: prevalence of insulin users according to sex and age groups. **B:** description of therapeutic patterns based on the percentage of insulin users for each type of pattern. Basal identifies users an intermediate acting insulin or long acting insulin. Basal + Prandial identifies patients who use a basal pattern with fast acting insulin added or patients who use fixed-dose combinations.

López-Sepúlveda et al.²³ a consumption of 18.35 DHD in Andalusia in 2014. In Spain, the AEMPS showed data of 17.32 DHD in 2014¹¹. These three studies described a trend of progressive increase in general anti-diabetic consumption and for insulin consumption. Nevertheless, the DHD data of their studies were much lower than the ones reported by our group in 2014 (26.6 DHD). Mata-Cases et al.¹² stated that 25% of DM patients were ITP. In our investigation, 28-30% of DM patients (independently of age) were ITP in any period of the study. These results are clearly higher than the ones from the above-mentioned studies.

Variations among the populations included in the studies may explain those differences. The studies using pharmacological databases were limited to DM patients whose insulin prescriptions originated in a primary care

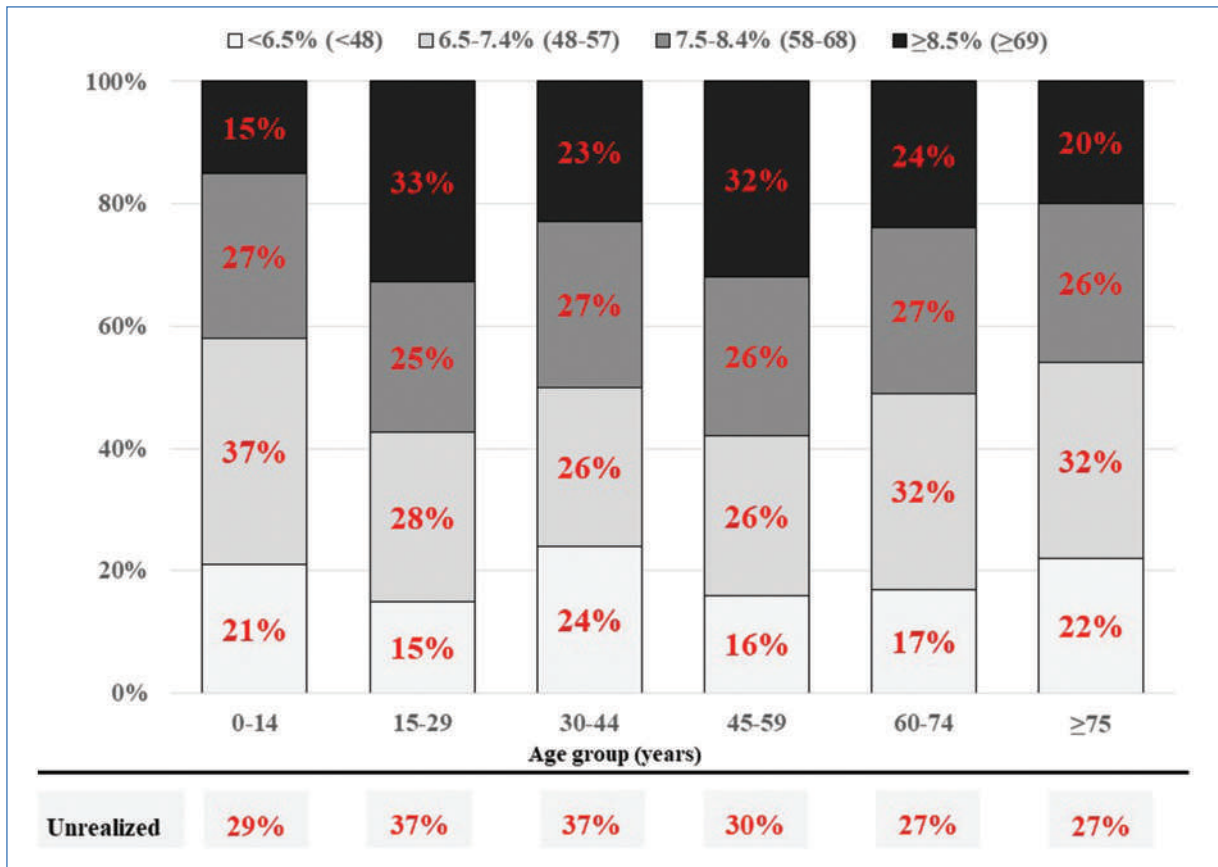


Figure 4. Results of hemoglobin A1c (HbA1c) determinations performed in insulin-treated patients (ITP) during year 2018 and below number and percentage of ITP without HbA1c determination.

center and probably only included adult patients, with the consequent exclusion of pediatric patients and those with hospital prescriptions. Furthermore, the research carried out on DM patients with previously established anti-diabetics therapy was focused fundamentally on adult type 2 DM patients. The present study describes the full population treated with insulin therapy, without any limitations concerning age or type of DM.

We found huge differences among all the studies performed outside of Spain. In Denmark, insulin consumption was 19.2 DHD in the year 2017²⁴. According to the Norwegian Prescription Database, the prevalence of ITP results was 1.25% in 2017²⁵. Furthermore, the prevalence rate of insulin use in the UK population was 0.67 in 2010²⁶. In the USA, a cross-sectional study with 4947 DM patients showed that 30% of the patients with DM had stable insulin treatment²⁷.

This disparity in the use of insulin between countries could be partially explained due to the differences in the availability of anti-diabetic drug types and to the high cost of insulin treatments in some countries. This issue

is becoming a real health-care problem, as patients who need insulin treatment have low insulin adherence due to the high cost of their treatments²⁸.

Strengths and limitations of this study

This is the first study that describes the prevalence and incidence of insulin therapy and patterns of insulin prescriptions according to age in our country. To compare our study with previous research, we needed to use indirect data since very few studies focus on describing patterns of insulin consumption.

Furthermore, other limitations are due to our study's methodology design. First, we cannot describe the type of DM precisely for each patient. Second, more common complications of DM were not collected, mainly, low glomerular filtration rates that can affect anti-diabetic therapy patterns. Finally, due to the lack of clinical data no individual outcomes are known, therefore, we can only perform a descriptive analysis of the HbA1c levels.

Conclusions

Data about insulin use are sparse, and the Cadiz population presents the highest consumption, which has remained almost steady during the past few years, compared to other data on insulin prevalence published to date in Spain or Europe.

The patterns of insulin prescriptions have changed during the study, long-acting insulin, in general, and Glargine (alone or in combination) are the most consumed insulin types.

Our study shows that DM patients in Cadiz have a low control concerning the low rates of HbA1c determinations (clinical inertia)²⁹. Surprisingly, middle-aged people had a poorer control than the more elderly ones (therapeutic inertia)²⁹.

Furthermore, in the older group, most of the ITP are treated with basal and prandial insulin and maintain levels of HbA1c below 7.5% (inverse therapeutic inertia)²⁹, so they may need a simplification of the treatment pattern used³⁰. Despite everything, the estimated doses per annual consumption of long-acting insulin are unexpectedly low, suggesting a possible lack of adherence to insulin treatment³¹.

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Conflict of interest

The authors declare that they have no conflict of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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The basics of journal-level metrics: What clinical researchers need to know

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Abstract

Journal prestige is the most important factor for an initial manuscript submission. The authors use various journal-level metrics, commonly provided by the citation databases Web of Science and Scopus, as criteria for identifying a reputable journal. However, no single metric can serve as a perfect assessment of a journal's value. This article summarizes the main journal-level metrics (Journal Impact Factor, Journal Citation Indicator, CiteScore, and their respective percentiles), in addition to other complementary and less applied metrics. It also highlights the distinction between impact metrics and normalized metrics, using examples from Spanish journals in the area of Internal Medicine.

Keywords: Journal impact factor. Bibliometrics. Internal medicine.

Introduction

Bibliometrics can be defined as the application of mathematical and statistical methods to analyze and measure the quantity and quality of scientific publications and researchers themselves¹. Publishing has inevitably evolved into a competitive and exigent task, which has become paramount to achieve a good academic and professional position. Knowing how health-care institutions and universities measure the impact of research can help focus our efforts toward reputable journals. Journal-level metrics is a category of bibliometrics that ranks journals according to how often their articles have been cited. This review provides a brief overview of the main journal-level metrics. Other categories of bibliometrics, such as article-level metrics (citation indexes, Altmetrics), author-level metrics (h-indexes), or departmental/institutional metrics are beyond the scope of this paper.

Citation databases

The two most important tools that provide bibliometrics are Web of Science (WoS) and Scopus. They are considered as reliable and rigorous sources and are often the only ones taken into account in professional promotion processes.

WoS Core Collection, now owned by Clarivate™, is the world's leading citation database with the best name recognition. It is organized into different indexes, including the Science Citation Index Expanded™ (SCIE) and the Emergent Sources Citation Index (ESCI). SCIE is a multidisciplinary index to the journal literature of the Sciences (e.g., medicine) and now indexes over 9500 journals across 178 scientific disciplines, dating from 1900 to present. Moreover, ESCI contains over 7800 titles, with backfiles dating back to 2005. For a journal to be included in the SCIE, it must meet a set of 24 quality criteria and 4 impact criteria.

Visual abstract available at https://www.spanishjmed.com/frame_esp.php?id=70

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Table 1. Journal's metrics

Impact metrics ^a	Normalized metrics ^b
Web of Science Total citations Journal Impact Factor (JIF), corresponding year 5-year JIF JIF without self cites JIF rank JIF quartile JIF percentile Immediacy index	Web of Science Journal Citation Indicator (JCI) JCI rank JCI quartile JCI percentile Eigenfactor Normalized Eigenfactor Article Influence Score Average JIF percentile
Scopus CiteScore, corresponding year CiteScore rank CiteScore quartile CiteScore percentile CiteScore Tracker (updated monthly)	Scopus SCImago Journal Rank (SJR) SJR quartile Source Normalized Impact per Paper (SNIP)
Google Scholar h-5 index	

^aMetrics focused on the citation impact of the journals. ^bMetrics that have been adjusted mathematically to a particular context.

Those journals that meet only the quality criteria, but not the impact criteria, enter the ESCI. These are dynamic collections, subject to continuous evaluation and revision, so that ESCI journals that gain impact move to SCIE, whereas SCIE journals that decrease in impact move to ESCI.

Scopus is an Elsevier's citation database curated by independent subject matter experts. Its health science area covers nearly 15,000 titles, mainly peer-reviewed high-quality scholarly journals. A Content Selection Advisory Board continually reviews titles for inclusion using 14 transparent and stringent quantitative and qualitative criteria related to journal policy, content, standing, regularity, and availability. A journal can also be discontinued when losing these criteria, similar to how WoS does.

Google Scholar indexes a greater number of works than WoS or Scopus, but there is no editorial control of the quality of sources. This means that predatory journals and low-quality papers may appear alongside the top journals. Even so, Google Scholar is popular because it is a freely accessible web search engine. It should be noted, however, that this resource evaluates journals using the h-index, a metric that is more commonly applied to assess authors rather than journals. The lack of transparency, poor historical coverage, and difficulty to obtain a lengthy list of journals with metrics, among other limitations, make this resource of little value for estimating journal's quality.

Finally, Dimensions are the most recently launched database which allows to analyze research publications and their impact. Beyond the free available version,

Dimensions offer other product versions (e.g., Dimensions Analytics, Dimensions Profiles, Dimensions Life Sciences and Chemistry, and Dimensions on Google BigQuery), which have to be paid for. It provides article-level metrics (instead of journal-level metrics), including the Field Citation Ratio, the Relative Citation Ratio, and the Altmetric Attention Score.

Journal-level metrics

Journal-level metrics can be categorized into impact metrics and normalized metrics (Table 1). Normalization refers to the process of putting a citation count into context by showing how a paper or a group of papers performs relative to papers that are similar in age, topic, and type. Not all metrics will be described, but only those most used and valued^{2,3}. In this author's opinion, the Journal Impact Factor (JIF), CiteScore, and Journal Citation Indicator (JCI) with their respective percentiles are the primary resources for ranking journals.

Journal impact factor

The JIF created by Eugene Garfield in the early 1960s is the most widely used indicator for journal importance⁴. It is available from the Journal Citation Reports™ (JCR), a subscription service from Clavirate™ (WoS). The JIF is a ratio which divides a journal's received citations by a count of its published articles. Specifically, the numerator contains the number of citations to a journal in a given year to items that were

published in the previous 2 years. These citations are sourced from any document type included in WoS. The denominator contains the number of Articles or Reviews (referred to as “citable items”) this journal published in the prior 2 years. Thus, items such as editorials, letters, and meeting abstracts are excluded from the denominator, but not from the numerator⁵. A sample calculation for the JIF of *Revista Clínica Española* in 2021 is:

Journal Impact Factor™ is calculated using the following metrics:

$$\frac{\text{Citations in 2021 to items published in 2019 (73) + 2020 (264)}}{\text{Number of citable items in 2019 (52) + 2020 (58)}} = \frac{337}{110} = 3.064$$

If a journal has a JIF of 3 in 2021, it means that articles published in 2019 and 2020 were cited 3 times on average.

It should be noted that, as a journal-level metric, the JIF does not measure the contribution of individual papers or authors. Furthermore, JIF should be interpreted in context, so that this metric cannot compare journals from different subject files or disciplines. In addition, one journal may be assigned to more than one discipline (e.g., CHEST is included in the categories of “Respiratory System” and “Critical Care Medicine”) and have a different JIF quartile and percentile in each category. The quartiles rank the journals from highest to lowest based on their JIF (or a similar metric). Quartile 1 (Q1) is occupied by the top 25% of journals in the list; quartile 2 (Q2) by journals in the 25 to 50% group; quartile 3 (Q3) by journals in the 50 to 75% group; and quartile 4 (Q4) by journals in the 75 to 100% group. Similarly, the JIF percentile indicates the relative standing of a journal in its subject field, thus allowing to compare between journals from different fields⁶. A 95th JIF percentile means the journal is in the top 5% of its subject field.

In 2021, the two best ranked journals in the area of “Medicine, General, and Internal” were *The Lancet* (IF = 202.731) and *The New England Journal of Medicine* (IF = 176.079), while in the category of “Respiratory System,” they were *The Lancet Respiratory Medicine* (IF = 106.642) and the *European Respiratory Journal* (IF = 33.795). Note that it cannot be concluded that *The New England Journal of Medicine* is clearly a “better” journal than the *European Respiratory Journal* based on the absolute JIF value, because they belong to different categories. A better approach is to consider the JIF percentile, which transforms the rank in category by JIF into a percentile value, allowing more meaningful cross-category comparison. In this

example, *The New England Journal of Medicine* reaches the JIF percentile 99.13, and the *European Respiratory Journal* the JIF percentile 97.69 of their respective categories; thus, only a minimum percentile difference (1.44) despite an apparent much greater distance in absolute JIF figures (142.284 points).

The JIF is susceptible to manipulation by publishers through different methods: (1) to increase the number of some articles types that either can only raise the numerator but not the denominator of the JIF calculation formula (e.g., editorials), or are more likely to be citable (e.g., review articles); and (2) to increase self-citations and citation stacking (i.e., a donor journal cites a recipient journal at an unusually high rate that is concentrated in the JIF window)⁷. The latter tactic, however, may lead to a temporary loss of the JIF as occurred with *Archivos de Bronconeumología* in 2010 and 2011, and *Revista Clínica Española* in 2012. Suppressed journals represent outliers in citation behavior and exceed normal ranges within their category (usually > 30% self-cites in JIF numerator). In general, journals are more prone to be suppressed due to an excessive self-citation if they demonstrate great gain in rank or impact. Notice that not only recipient’s journals of citations, but also donor’s journals may be suppressed by this malpractice. It is worth noting that JCR gives information on the JIF once self-citations are eliminated from the numerator as well. For instance, the 2021 JIF of *Revista Clínica Española* was 3.064, but without self-citations dropped to 2.755.

Journal citation indicator

The JCI is a category-normalized impact metric calculated for all journals in the WoS Core Collection, including the SCIE and ESCI⁸. The JCI is the average of the Category Normalized Citation Impact (CNCI) of the journal’s articles and reviews published in the prior 3-year period. The CNCI is the ratio of actual citations an article or review received, to expected citations for documents of the same type, year, and category. A journal with a JCI of 1 means that published papers across the journal received citations equal to the average (mean) for the category. Values > 1 mean better than expected citation performance in category, whereas values < 1 are below expected citation performance in category. For example, journals with a JCI of 1.5 have 50% more citation impact than the average in that category. In the “Medicine, General, and Internal” category, the two best positioned journals in 2021 were *The New England Journal of Medicine* (JCI = 22.26, percentile

Table 2. Spanish medical journals categorized in quartiles 1 (Q1) and 2 (Q2) of the Journal Citation Reports (JCR) and their corresponding categorization in Scopus (year 2021)

Journal	JCR (Web of Science)		Scopus	
	Quartile	JIF Percentile	Quartile	JIF Percentile
Emergencias	Q1	85.95	Q1	78
Journal of Investigational Allergology and Clinical Immunology	Q1	83.33	Q2	55
Archivos de Bronconeumología	Q1	79.23	Q3	38
Neurología	Q1	79.01	Q2	64
Revista Española de Cardiología	Q1	77.27	Q2	68
Revista de Psiquiatría y Salud Mental	Q1	77.10	Q1	76
Gastroenterología y Hepatología	Q2	69.35	Q3	31
Medicina Clínica	Q2	56.69	Q2	57
Nefrología	Q2	56.11	Q3	49
Adicciones	Q2	54.76	Q2	66
Revista Clínica Española	Q2	53.20	Q2	68
Medicina Oral, Patología Oral y Cirugía Bucal	Q2	50.54	Q1	79

JCR: journal citation reports; JIF: journal impact factor.

99.85%) and The Lancet (JCI = 21.81, percentile 99.54%), whereas in the “Respiratory System” category the best ones were The Lancet Respiratory Medicine (JCI = 13.47, percentile 98.98%), The American Journal of Respiratory and Critical Care Medicine (JCI = 4.11, percentile 96.94%), and the European Respiratory Journal (JCI = 3.60, percentile 97.45%). The JCI complements the JIF helping to assess journal performance with added context.

CiteScore

The CiteScore is the Scopus counterpart of JIF, but it has three key differences with the latter⁹: (1) Citations are analyzed over a 4-year instead of 2-year period; (2) For CiteScore calculation, both numerator and denominator include the same five publication types: articles, reviews, conference papers, data papers, and book chapters; this makes manipulation of the calculation more difficult; and (3) The evaluated journals are those incorporated into the Scopus instead of the WoS database. For example, the 2021 CiteScore counts the citations received in 2018-2021 to the preceding mentioned publication types, and divides this by the number of these documents published in 2018-2021. Like the JIF, this Scopus metric does not allow for comparison

of journals in different subject fields because it is not field-normalized. By way of illustration, the two most prestigious journals under the “General Medicine” category in Scopus 2021 were, like in WoS, The Lancet (CiteScore = 115.3, 99% percentile) and The New England Journal of Medicine (CiteScore = 110.5, 99% percentile). However, under the “Pulmonary and Respiratory Medicine” category, The Lancet Respiratory Medicine (CiteScore = 61.6, 99% percentile) and The American Journal of Respiratory and Critical Care Medicine (CiteScore = 26.5, 98% percentile) occupied the top position, whereas the European Respiratory Medicine (CiteScore = 18.9, 97% percentile) ranked fourth among 140 journals in the field. The CiteScore is continuously updated on a monthly basis (CiteScore Tracker) until the next annual CiteScore calculation. The CiteScore Tracker is calculated in the same way as CiteScore, but for the current year rather than previous complete years.

Other metrics

The Scimago Journal Rank (SJR) is an open-source metric extracted from the information contained in the Scopus database which expresses the average number of weighted citations received in the selected year by

Table 3. Metrics of Revista Clínica Española and Medicina Clínica in 2021

Metric	Revista Clínica Española	Medicina Clínica
Journal Impact Factor (JIF), category "Medicine, General and Internal"	3.064	3.200
JIF without self citations	2.755	2.963
JIF rank	81/172	75/172
JIF quartile	Q2	Q2
JIF percentile	53.20	56.69
5-year JIF	1.851	2.423
Journal Citation Indicator (JCI)	0.36	0.33
JCI rank	143/329	154/329
JCI quartile	Q2	Q2
JCI percentile	56.69	53.34
CiteScore, category "Medicine: General Medicine"	2.4	1.8
CiteScore rank	261/826	351/826
CiteScore quartile	Q2	Q2
CiteScore percentile	68	57
CiteScore Tracker 2022 (5 July 2022)	2.6	1.8
SCImago journal rank (SJR)	0.300	0.325
SJR quartile, category "Medicine (miscellaneous)"	Q3	Q3
Source Normalized Impact per Paper (SNIP)	0.732	0.532
Eigenfactor Score	0.00084	0.00273
Normalized Eigenfactor	0.18087	0.58395
Article Influence Score	0.324	0.462
Immediacy index	2.072	1.608
h-5 index (Google Scholar)	19	29

the documents published in the journal in the 3 previous years. Therefore, SJR weights the prestige of the citing journal, so that citations from highly ranked journals are given more weight than citations from lower ranked journals². This metric is normalized for the subject field and, therefore, it can be used to compare journals from different disciplines.

The Source-Normalized Impact per Paper (SNIP) measures actual citations received relative to citations

expected for the journal's subject field². The impact of a single citation is given higher value in subject areas where citations are less likely, and vice versa. SNIP is a normalized metric that enables direct comparison of sources in different subject fields. It is calculated using a 3-year window with data from Scopus.

The Eigenfactor is an open-source metric that measures the journal's total importance among the universe of journals included in Clarivate's JCR². Considering that the Eigenfactor scores of all journals listed in JCR equals 100, if a journal has an Eigenfactor score of 0.56 (e.g., The Lancet), it has 0.56% of the total influence of all indexed publications. The Eigenfactor metric collects 5 years of citations and weights citations based on the prestige of the citing journal while removing journal self-citations. In the Normalized Eigenfactor Score, the total number of journals in the JCR each year is scaled, so that the average journal has a score of 1. Journals can be compared and influence measured by their score relative to 1; a journal with a normalized Eigenfactor score of 120.9 (The Lancet) has 120.9 times the total influence of the average journal in the JCR.

The Article Influence Score normalizes the Eigenfactor Score according to the cumulative size of the cited journal across the prior 5 years. It is calculated by dividing a journal's Eigenfactor Score by the number of articles in the journal. The mean Article Influence Score for each article is 1.00. A score > 1.00 indicates that each article in the journal has above-average influence.

The 5-year JIF is the average number of times articles from the journal published in the past 5 years have been cited in the current JCR year. Its calculation is performed by dividing the number of citations in the JCR year (e.g., 2021) to articles published in the previous 5 years (e.g., 2016-2020) by the total number of citable items in the 5 previous years (e.g., 2016-2020).

The immediacy index is the average number of times, an article is cited in the year, it is published. Hence, this metric indicates how quickly articles in a journal are cited.

The average JIF percentile takes the sum of the JIF percentile rank for each category under consideration and then calculates the average of those values. It makes sense for those journals categorized under two or more different fields. For example, CHEST has a JIF percentile (2021) of 91.54% for Respiratory System and a JIF percentile of 84.29% for Critical Care Medicine; so, the average JIF percentile will be 87.92% $[(91.54 + 84.29)/2]$.

Finally, the *h*-5 index from Google Scholar is the *h*-index of articles published in the past 5 years. For 2021, it refers to the largest number *h* in that *h* articles published between 2017 and 2021 must have at least *h* citations each.

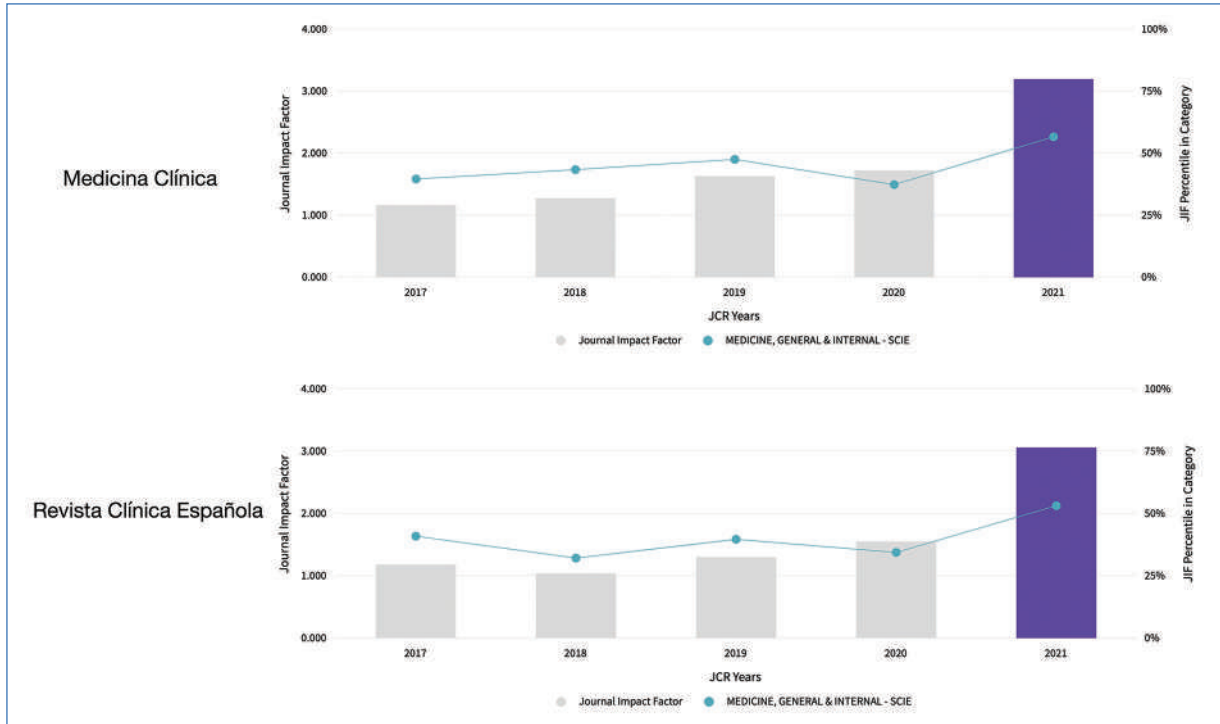


Figure 1. Journal Impact Factor trend of Medicina Clínica and Revista Clínica Española, Journal Citation Reports (JCR); Journal Impact Factor (JIF).

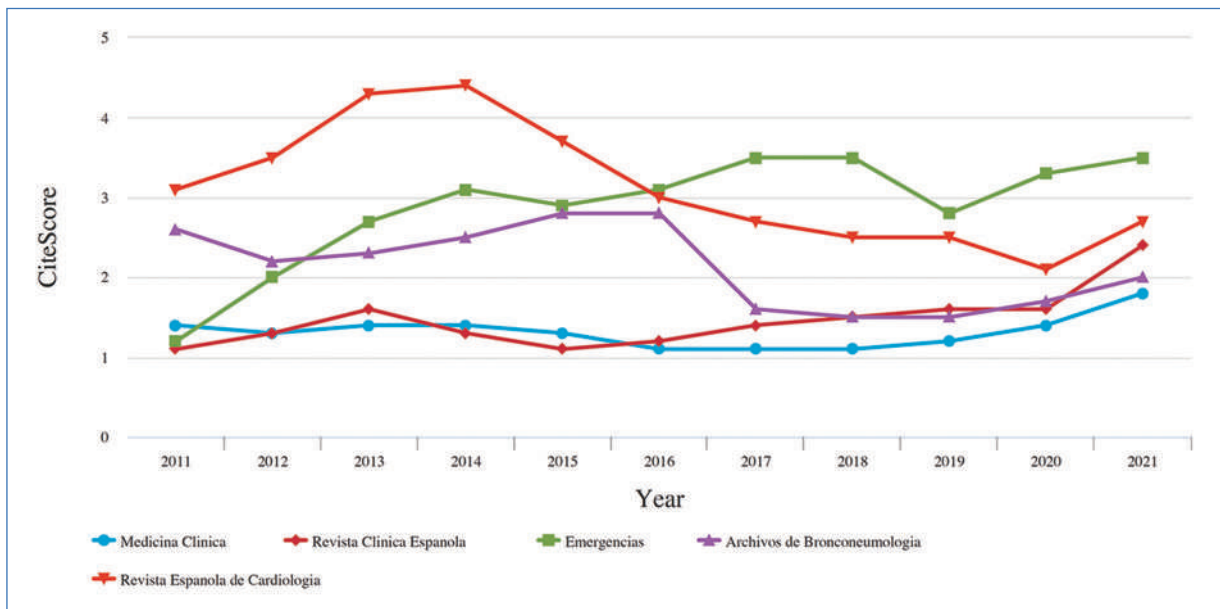


Figure 2. CiteScore trends in several Spanish medical journals.

The profile of top Spanish medical journals

There are currently 33 Spanish medical journals that have an impact factor in JCR (year 2021), of which six are

positioned in Q1, and another six in Q2 (Table 2). However, the classification of these journals in WoS does not necessarily match with that established by Scopus and, in fact, there may be striking differences. For example,

Archivos de Bronconeumología is a Q1 journal in JCR according to its JIF, but it drops to Q3 using the CiteScore Scopus metric. The opposite occurs with the journal Medicina Oral, Patología Oral y Cirugía Bucal, which is bordering Q3 in WoS, but is ranked as Q1 in Scopus.

Revista Clínica Española and Medicina Clínica, the two leading Spanish journals of Internal Medicine, show quite similar metrics, with Scopus slightly favoring the former and WoS the latter (Table 3). It should be noted that journal-level metrics are revised yearly and there may be variations over time (Figures 1 and 2). Obviously, whether WoS or Scopus metrics are preferred that will depend on which of the two are more favorable to the journal in question¹⁰.

Conclusions

WoS and Scopus are the two major comprehensive sources of publication metadata and impact indicators. Both bibliographic databases complement each other. Journal-level metrics rank journals based on how many times their articles are cited by other journals. They are not intended to evaluate individual researchers, but rather, as their name indicates, only the quality or prestige of a journal. The journal performance indicators most used and accepted include the JIF (WoS) and the CiteScore (Scopus). However, JIF and CiteScore are not normalized for discipline and, therefore, they should not be used to compare journals from different subject fields. For this last purpose, normalized metrics such as the JCI (WoS) or SJR (Scopus) are the choice.

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Conflict of interest

The authors declare that they have no conflict of interest.

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