

Global Dialysis Perspective: Spain

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Introduction

Spain is a country in Southwestern Europe, with a population of 46.7 million in 2018. Its territory is organized into 17 autonomous communities, formed in turn by 50 provinces, and two autonomous cities (Ceuta and Melilla) in the north of Africa. According to the principle of decentralization promulgated by the Spanish Constitution, health competence is transferred to each of these autonomous communities. Health care in Spain, paid for by public funds, is guaranteed to those persons who pay into the system, or are its beneficiaries within the National Health System.

Treated Patients with Kidney Failure in Spain

Most data shown here were presented during the XLIX meeting of the Spanish Society of Nephrology (A Coruña, October 2019) and obtained from the Spanish Registry of Renal Patients (Registro Español de Enfermos Renales, <http://www.registrorenal.es/>), which collects the information of treated patients with kidney failure registered by the 17 autonomous communities and the two autonomous cities of Spain (1). In addition, some data from regional registries of kidney patients were also added (2–5).

Incidence

According to the Registro Español de Enfermos Renales, 6883 patients with kidney failure started KRT in 2018, representing an incidence rate of 147.3 per million population (pmp). Considering the regional distribution, the highest incidence rate was in Ceuta (258.4 pmp), followed by Catalonia (183.4 pmp), and Asturias (166.3 pmp) (1).

Regarding the evolution of the incidence rate for treated kidney failure in Spain, it remained between 128 and 130 pmp from 2006 to 2008, decreased to 120–121 pmp from 2009 to 2012, and then progressively increased from 2013 (125.4 pmp) to 2018, the year with the highest recorded incidence rate. This upward trend in the incidence rate since 2013 has occurred along with the progressive growth of the number of patients with kidney failure older than 65 years who have started KRT, the highest rate of which (496 pmp) was recorded during 2018 in patients older than 75 years. Year after year, diabetic nephropathy remained the most frequent etiology of patients

with kidney failure to start KRT (about 25% of patients per year) (1).

The most frequent modality to start KRT in Spain from 2006 to 2018 was hemodialysis (HD, around 100–116 pmp), well above that of peritoneal dialysis or pre-emptive kidney transplantation. However, these two modalities of KRT have increased during this time, from 17.2 to 24.1 pmp and from 1.8 to 7.0 pmp, respectively (1).

Prevalence

On December 31, 2018, there were 61,764 patients with kidney failure on KRT in Spain, accounting for a prevalence rate of 1321.9 pmp, which was the highest prevalence rate ever reached in our country (1). In fact, the prevalence rate in Spain did not stop growing progressively over the 10 years from 994.8 pmp (2008) to the top levels (in 2018). The highest prevalence rate in 2018 was recorded in Catalonia (1469 pmp), followed by the Canary Islands (1449 pmp), and Valencia Community (1445 pmp). Considering five age groups between 2013 and 2018, mostly patients on KRT were in the age bracket of 65–74 years old (1).

Regarding the distribution of the KRT modality in 2018, most patients with kidney failure were treated with kidney transplantation (33,766 patients, 722.7 pmp), followed by HD (24,900 patients, 532.9 pmp), and peritoneal dialysis (3098 patients, 66.5 pmp) (1). The most impressive change in the KRT modality over time in Spain has been evidenced by the number of prevalent patients with kidney failure having a functioning kidney graft, which has increased from 490.2 pmp in 2006 to the historical maximum in 2018 (1). In fact, most prevalent patients with kidney failure in 2018 had a functioning kidney graft (55%) and the remaining were treated through some kind of dialysis technique (HD 40%, peritoneal dialysis 5%). According to the Global Observatory on Donation and Transplantation, Spain registered the highest worldwide kidney transplantation rate in 2018 (3313 patients, 70.8 pmp) (1).

Mortality

The all-cause mortality rate of patients with kidney failure on KRT in Spain during the period 2007–2018

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remained between 8% and 9% annually (1). During these years, the mortality rate was associated with KRT modality: patients with kidney failure treated with HD and kidney transplantation showed the highest (around 15%/yr) and the lowest (<3%/yr) mortality rate, respectively; patients treated with peritoneal dialysis showed an in-between mortality rate (around 9%/yr). The maximum mortality rate was recorded in patients older than 75 years for all KRT modalities. The all-cause mortality rate was 8% in 2018 (5128 deaths over 61,764 prevalent KRT patients) and distributed as HD 16%, peritoneal dialysis 10%, and kidney transplantation 3% (1).

Considering only data of the registry from Catalonia, 1024 patients treated with kidney failure died in 2018, and cardiovascular disease was the main known cause of death (35%) followed by infection (19%) (2). Regarding the evolution of the annual all-cause mortality rate over time per 100 KRT patients/yr in Catalonia, there was a significant decreasing trend in all age groups throughout the period 1986–2018 (2).

Survival

The median of survival analyzed in 77,629 incident dialysis patients (HD 84%, peritoneal dialysis 16%) during the period 2004–2018 in Spain was 6.55 years (95% confidence interval, 6.45 to 6.65) (1). The overall survival of incident patients who started KRT in Catalonia during the period 1984–2018 ($n=30,986$) at 1, 3, 5, 10, 15, 20, 25, and 30 years was 87%, 70%, 55%, 35%, 25%, 19%, 15%, and 11%, respectively (2).

According to a multivariate survival analysis of 19,874 incident patients on KRT from 2000 to 2018 in Catalonia, survival was associated with age group, sex, primary kidney disease, functional status, situation on the waiting list for kidney transplantation, and comorbidity at starting KRT (2). In addition, the survival of patients treated with HD was also associated with the first vascular access used: starting HD through a central vein catheter was associated with a 1.36-fold higher risk for all-cause mortality over time than when using an arteriovenous fistula (2).

Dialysis Treatment According Regional Registries from Andalusia and Catalonia in 2018

Hemodialysis

Data from autonomous communities showed that 1181 and 1392 patients with kidney failure started KRT in Andalusia and Catalonia, respectively (incidence rate 140.9 and 183.2 pmp, respectively) and most of them through HD (80% and 79%, respectively) (2,3).

On December 31, 2018, there were 10,430 and 11,162 patients with kidney failure on KRT in Andalusia and Catalonia, respectively (prevalence rate 1244 pmp and 1468.7 pmp, respectively) and most of them had a functioning kidney graft (around 57% in both communities). HD treatment accounted for 39% and 38% in Andalusia and Catalonia, respectively (2,3). The proportion of patients on HD treated with online hemodiafiltration in Spain is variable between autonomous communities and among HD units of each community (2,4).

Regarding the duration of the HD session, most patients on HD were treated for 12 h/wk in Catalonia (81%) (2). The percentage of patients on HD treated for more than 12 h/wk in Catalonia (9%) varied according to sex, age, and body mass index: men, from 15 to 64 years with a body mass index over 29 are those who had longer HD sessions in Catalonia (2).

The mean prescribed pump speed was 378.5 ± 62.0 ml/min in Andalusia, and it was higher for patients dialyzed through an arteriovenous fistula than a tunneled catheter (393 versus 353 ml/min, respectively) (4).

Regarding HD adequacy, mean spKt/V and urea reduction ratio in Andalusia were 1.76 ± 0.45 and $76.3 \pm 7.8\%$, respectively (4). Mean equilibrated Kt/V reported in Catalonia over the last 5 years was around 1.6 and women over 75 years old with a body mass index under 20 treated by online hemodiafiltration through fistula was the patient profile showing the highest equilibrated Kt/V level (2).

Peritoneal Dialysis

From the statistical reports, 15% and 14% of patients with kidney failure started KRT during 2018 through peritoneal dialysis in Andalusia and Catalonia, respectively (2,5). On December 31, 2018, only 4% of patients with kidney failure were treated with peritoneal dialysis in Andalusia and Catalonia (2,5). Continuous ambulatory peritoneal dialysis was slightly more commonly used than automated peritoneal dialysis in Catalonia (53% versus 47%) during 2018 (2).

The peritonitis rate (cases/patient per year) was 0.30 and 0.20 in Andalusia and Catalonia, respectively (2,5). When considered separately, automated peritoneal dialysis and continuous ambulatory peritoneal dialysis techniques in Catalonia comprised 0.13 and 0.25 cases/patient per year, respectively (2).

Vascular Access for HD

Most patients with kidney failure started HD through a catheter in Catalonia (59%) and only 40% through a mature arteriovenous fistula in 2018 (2). This percentage of fistula as the first vascular access decreased progressively in Catalonia over the last 20 years from 1998 (around 50%) to 2018 (around 40%) (2). The factors associated with the probability of starting HD through a mature arteriovenous fistula in Catalonia were previously analyzed (6).

Considering a quality indicator of the current Spanish Guidelines (nephrology predialysis care higher than 6 months) (7), most patients with kidney failure started HD in Andalusia through a mature fistula (62%) and the remaining through a catheter (tunneled catheter 23% and untunneled catheter 15%) (3).

The proportion of prevalent patients on HD dialyzed through a mature fistula in Spain is variable between autonomous communities and among HD units of each community. On December 31, 2018, 64% of patients on HD were dialyzed through a fistula in Andalusia (4) and 60% in Catalonia (2). The factors related to the likelihood of the prevalent patient being dialyzed through a fistula in Catalonia have recently been analyzed (8). According to the Dialysis Outcomes and Practice Patterns Study (DOPPS 5, 2012–2014), the vascular access distribution in prevalent patients on HD in Spain was 65% arteriovenous fistula,

Table 1. Characteristics of dialysis in Spain, 2018

Characteristic	
Number of patients on dialysis, <i>n</i> (per million population)	27,998 (5994)
Percentage of patients on home dialysis (%)	5.2
Dialysis sessions: covered by insurance vs patient pays	100% covered by the National Health System
Dialysis units: hospital based or freestanding	Both
Dialysis units: economic model	Private, mostly for profit. Public, none for profit.
Reimbursement per hemodialysis session ^a	Variable according the autonomous community, no fixed rate for all of Spain
Dialysis delivery staff	Only dialysis nurses
Nurse to patient ratio in the dialysis units ^a	1:4–1:5
Hemodialysis session length (min)	≥240 for most patients
Frequency that patient is seen by a nephrologist	Each hemodialysis session
Vascular access for hemodialysis (%)^b	
Arteriovenous fistula	65
Arteriovenous graft	6
Central vein catheter	29

^aSee the text.^bSee reference (9).

6% arteriovenous graft, and 29% central vein catheter (Table 1) (9).

Considering four types of vascular access (arteriovenous fistula, arteriovenous graft, tunneled catheter, and untunneled catheter), the fistula was the vascular access associated with the lowest incidence of hospital admissions due to complications in Catalonia during 2018 (8% with ≥ 1 admission), whereas the arteriovenous graft showed the highest (34% with ≥ 1 admission). Furthermore, arteriovenous graft showed the highest incidence of outpatient procedures for the treatment of any complication (37% of patients) (2).

Medication Utilization Patterns for Patients on HD

An observational study of 7316 patients on HD in Spain, performed in a network of clinics from an international dialysis organization, showed the following distribution of medication from both incident ($n=2637$) and prevalent ($n=4679$) patients on HD: erythropoiesis-stimulating agents 97% and 93%, statins 58% and 53%, angiotensin converting enzyme inhibitors 45% and 34%, other antihypertensives 77% and 60%, insulin 23% and 17%, oral antidiabetics 4% and 3%, oral vitamin D (calcitriol or paricalcitol or vitamin D native) 62% and 67%, phosphate binders 80% and 83%, and cinacalcet 27% and 42%, respectively (10).

From the DOPPS phase 4 (2009–2011), the mean number of prescribed phosphate binders was 5.1 pills/d in Spain, but 39% of patients skipped taking their phosphate binder medication at least once in the previous month (11). According to DOPPS phase 5 (2012–2015), only 13% of 526 Spanish patients on maintenance HD were not treated with erythropoiesis-stimulating agents at DOPPS study entry and, from the remaining patients on HD, the patient erythropoiesis-stimulating agent type distribution was darbepoetin alfa 31%, continuous erythropoietin receptor agonist CERA 4%, epoetin beta 29%, and epoetin alfa 36% (12).

Hypertension and Volume Management of Maintenance Dialysis Patients

According to data from a cross-section of DOPPS II, including 600 Spanish patients on HD, 51% were prescribed any antihypertensive agent, with long-acting dihydropyridines the main class of drug prescribed (27%) (13). Data of EURO DOPPS (DOPPS phase 4, 2009–2011), referring to 1073 patients on maintenance HD from Spain, showed that around 40% of them attained the target BP and the number of antihypertensive drugs taken was zero 25%, one 35%, two 25%, and three or more 15% (14).

The utilization of objective measures of volume status on patients on HD or peritoneal dialysis is spreading in Spanish dialysis units. In recent years, numerous studies have been published on the benefit of the bioimpedance technique to assess the degree of hydration of Spanish patients on maintenance dialysis, which allows us to introduce changes in the treatment schedule for dialysis and, therefore, manage better BP control (15–17). In this way, Vega *et al.* (16) analyzed the hydration status by bioimpedance in 128 patients on maintenance HD showing 96 (75%) with hypertension, of whom 85% were overhydrated and, therefore, had volume-dependent hypertension. In the same line, ambulatory BP monitoring and bioimpedance usefulness for

the treatment and control of hypertension in Spanish patients on maintenance HD has recently been reported (18). In addition, the role of ultrasound in the inferior vena cava and lungs for the patient's hydration assessment has been highlighted in the Spanish consensus document for ultrasound training in the specialty of nephrology (19).

Home HD

Home HD is a minority treatment in Spain. The cumulative incidence of home HD in Spain was reported during the 2019 meeting of the Spanish Society of Nephrology (20). In total, 242 incident patients on home HD were analyzed (mean age 54.4 ± 14 years, 71% male), with a variable distribution according to the autonomous community considered. Most patients were dialyzed at home using a portable HD machine (71%) and with a short daily treatment time schedule (69%). Vascular access distribution was catheter and fistula, at 50% each. The buttonhole technique was the method most frequently used for fistula needling (69%). At the end of the follow-up period, 56% ($n=136$) were still on the home HD program; of the remaining patients who did not continue on home HD (106, 44%), most (61, 58%) received a kidney graft (20).

Characteristics of Dialysis Treatment in Spain, 2018

All HD sessions are covered by the Spanish National Health System. Home dialysis is a minority treatment in Spain, and very few patients are treated using home HD. Most patients on HD were dialyzed in a dialysis unit inside the hospital (public or subsidized HD unit, both nonprofit) or in a private dialysis center (mostly out of hospital and for profit by international dialysis organizations) (Table 1).

Regarding HD reimbursement, sanitary agreements between the health administration and the HD units have been subscribed in each autonomous community, and can differ depending on whether it is a public hospital, a subsidized private hospital, or a dialysis center. For this reason, there is significant variability in the reimbursement per HD session between the different HD units of Spain. For instance, the reimbursement established for an HD session in public hospital HD units is different when comparing Asturias (US\$192.8, single fee), Cantabria (US\$261.8 for an outpatient session), Catalonia (US\$196.6 and US\$180.8 for inpatient and outpatient sessions, respectively), and País Vasco (US\$201.4, single fee) (21–24). Another example of heterogeneous reimbursement for HD sessions in Spain lies within the Valladolid province, where the reimbursement to two different companies hired to manage two private dialysis centers was different for Valladolid capital (US\$133.7–US\$130.7, according to the number of HD sessions per month) and for Medina del Campo (US\$166.5–US\$150.8 according to the number of HD sessions per month) (25). In addition, the reimbursement per session can also be different depending on the HD modality performed and can be US\$39 higher through online hemodiafiltration (23,25). In summary, there is no fixed rate for all of Spain.

Each dialysis center has a reference hospital where it is possible to refer the patient whenever a complication occurs. The staff who perform HD are exclusively made up of registered nurses specialized in HD, and the dialysis

technician does not exist in Spain. In general, the patient-to-nurse ratio is 4:1 for nonprofit dialysis units and 5:1 in for-profit dialysis units. The average length of a dialysis session is ≥ 4 hours for most patients on HD. A nephrologist on rounds sees patients on each HD session.

Areas for Improvement in Spain and Potential Strategies to Address Them

Although the kidney transplantation rate is excellent in Spain, the pre-emptive kidney transplantation rate has room for improvement. Regarding dialysis treatment, there are some aspects that can be improved, such as:

1. Increase the percentage of patients who start KRT by using peritoneal dialysis.
2. Decrease the percentage of patients starting HD using a catheter.
3. Increase the percentage of prevalent patients on HD dialyzed through a mature fistula.
4. Increase the percentage of prevalent patients on HD treated with home HD.
5. Generalize the online hemodiafiltration technique.

It is necessary to take a step forward on the current role of home-based dialysis therapies in Spain, because they are associated with clinical, social, and economic benefits (26–28). It is essential to adequately inform the patient with kidney failure about these techniques in predialysis check-ups, to carry out specific training courses in their use for the professionals who care for these patients, and to encourage health administrations to increase resources to definitively promote these therapies in Spain (26–28).

Regarding vascular access issues in Spain, the following 14 key points for improvement have previously been highlighted and are fully in force today (29):

1. Establish a multidisciplinary team.
2. Set up a structured advanced kidney failure outpatient clinic.
3. Achieve full commitment of the vascular surgeon in vascular access management.
4. Introduce vascular mapping by using Doppler ultrasound in the advanced kidney failure outpatient clinic.
5. Early arteriovenous access creation 4–6 months before the first HD.
6. Close monitoring of arteriovenous access maturation from creation to the first needling.
7. Ensure treatment for the nonmatured arteriovenous access of incident patients with HD through interventional radiology and/or revision surgery to try starting HD using this access.
8. Minimize patients with arteriovenous access thrombosis not related to stenosis.
9. Include each prevalent patient on HD in protocolized vascular access follow-up programs.
10. Upgrade HD units by introducing second-generation follow-up methods for early detection of arteriovenous access stenosis.
11. Increase the diffusion of screening techniques for stenosis on the basis of the indirect determination of arteriovenous access blood flow rate.

12. Introduce the portable Doppler ultrasound machine in all HD rooms.
13. Ensure elective or salvage treatment through interventional radiology and/or revision surgery for the arteriovenous access of prevalent patients on HD with stenosis or thrombosis, respectively.
14. Specific patient with kidney failure education related to their vascular access.

Given the increasing body of evidence on the benefits of online hemodiafiltration (30), the Spanish healthcare authorities should increase economic resources so that as many patients on HD as possible use this HD modality.

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Author Contributions

R. Roca-Tey was responsible for the methodology, and resources, and wrote the original draft; and all authors were responsible for the conceptualization, formal analysis, investigation, supervision, and validation, and reviewed and edited the manuscript.

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