

# The organization and financing of end-stage renal disease in Spain

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## Abstract

While the prevalence of end-stage renal disease (ESRD) in Spain is high, the incidence in comparison to the United States and Japan is low. Spain's rate of deceased organ donation is the highest in the world, and its renal transplant incidence rate is also relatively high. In addition, ESRD care represents a large portion of the overall health care budget. Quality of care in the National Health Service is not determined by competition or performance rewards; instead, several health agencies and scientific societies monitor it. Nevertheless, nephrologists with low salaries have relatively few professional and economic incentives to improve quality.



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## Introduction

The entire Spanish population (including non-residents and immigrants) is covered by the National Health Service (NHS), which provides most medical services and products (excepting dental care). This system is entirely subsidized by the national budget. It also covers the health care of ESRD and renal replacement therapy programs, so that non-residents and immigrants can be eligible for dialysis and transplantation. The number of patients with ESRD has been growing, due to the aging of the population and the increasing incidence of diseases associated with renal failure, such as diabetes and hypertension, among other reasons. Because of this recent growth, national spending for ESRD treatment has been increasing. This growing drain on public resources concerns policymakers who fear that only countries with high levels of economic development and associated gross domestic product (GDP) can sustain such rising expenditures.

A country's percentage of patients receiving renal replacement therapy (RRT) is positively correlated with GDP, especially in countries with a GDP below US\$3,000 per capita (Registro, 2003). This correlation does not seem to hold for all developed countries, which may reflect the fact that above a certain threshold level of development, prevalence of ESRD or RRT depends more on the burden of diseases that predispose to ESRD than on national wealth. International differences in the incidence of diabetes and hypertension, and in public health expenditures on ESRD care, may explain some of the wide differences in ESRD prevalence among the most developed countries. The GDP per capita in Spain is about US\$25,000 (purchasing power parties (PPP) 2005) (OECD, 2006a), high enough to provide care to all patients with renal disease at present, though future prospects are worrisome.

In Spain, dialysis occurs in both private free-standing facilities (60%) and hospital-based facilities (40%). All transplants are performed in high-technology public hospitals. The services provided for RRT, including medication and transport, are universal and unlimited without restrictions for the entire population; there is no co-payment for ESRD care. In general, neither pensioners nor patients with chronic diseases (including ESRD) pay anything for most of the medications they consume.

The prevalence of ESRD in Spain is one of the highest among the countries in this study (Dor, Pauly, Eichleay, & Held, 2007), even though Spain does not have the highest GDP per capita (WB, 2005). As a result of this, and because the cost of ESRD care is growing in real terms, the resources dedicated to ESRD treatment in Spain will need a substantial increase to be able to cover the estimated future need.

## Methods

This paper is part of the International Study of Health Care Organization and Financing (ISHCOF), a sub-study of the Dialysis Outcomes and Practice Patterns Study (DOPPS). The DOPPS is a multi-faceted, multi-year international study of the variations in practice patterns and treatment of ESRD patients on hemodialysis and their impact on clinical and other outcomes (Pisoni et al., 2004a; Young et al., 2000). ISHCOF aims to characterize economic structures and their impact on the delivery of dialysis care. The study is based primarily on one-time

commissioned surveys (2004–2005) and subsequent papers by authors from each of the 12 DOPPS countries. Details of the methods are described in Dor et al., (2007).

Epidemiologic data for Spain were obtained from the “Grupo de Registro de enfermos renales” of the Spanish Society of Nephrology annual reports. Other data sources for this paper were the Spanish Health Ministry (Ministerio Sanidad y Consumo), the National Institute of Statistics (INE), DOPPS, and other published journal articles. All monetary estimates were provided in national currency units and converted to US dollars with OECD purchasing power parities (PPP) from the year of each figure (OECD, 2006b). Due to the small number of economic investigators and countries in this study, all international comparisons reported here are informal and qualitative, unless otherwise noted.

### The gross epidemiology of kidney disease and provision of care in Spain

Of its 42.7 million inhabitants in December of 2002, approximately 39,500 people in Spain have ESRD, which represents a prevalence rate of 925 patients per million population (pmp). This rate of prevalence is the fourth highest among the countries in the ISHCOF (SEN, 2004), with only Japan, Canada, and the United States reporting higher rates (Dor et al., 2007). While the prevalence of ESRD in Spain is high, the incidence of ESRD, 127 pmp in 2004, is lower than in several other ISHCOF countries, as was the trend in new cases between 1998 and 2004, which increased only 3.3% (123 pmp in 1998, 127 pmp in 2004) (Dor et al., 2007). Therefore, in the last 7 years the incidence of ESRD seems to be stabilizing. Since 1998 the incidence of ESRD has been in the range of 123–132 PMP (Amenabar et al., 2002; Ceballos et al., 2005; Comité de Registro, 2001; Lopez et al., 2004; SEN, 1998, 2002, 2004). This incidence is only one-third of the rate seen in the US, is similar to Europe’s average incidence rate, but higher than rates seen in UK, Australia and New Zealand. The differences in the incidence rates of ESRD in different European countries are wide, as are the differences among Spain’s administrative regions (17 autonomous communities and two autonomous cities on the North African coast). In Spain, the Canary Islands community has the highest incidence of ESRD, similar to that seen in Germany (174 pmp) (Quasi-Niere, 2004). The distribution of causes of renal disease across Spain is similar to that seen in the rest of Europe. Diabetic nephropathy represents the main cause of ESRD in Spain (20%) followed by vascular disease associated with arterial hypertension (15.9%); a high percentage of renal disease is of unknown origin (21.5%). The rates of both of these diseases have exhibited a trend toward stabilization: the incidence of diabetic nephropathy has increased very modestly in the last years, and the incidence rates of ESRD due to vascular disease associated with arterial hypertension were 19.5, 20, 19.9 and 15.6 PMP in the years 2000, 2001, 2002 and 2004, respectively (Amenabar et al., 2002; Ceballos et al., 2005; Comité de Registro, 2001; Lopez et al., 2004; SEN, 1998, 2002, 2004). This trend toward stabilization partly explains the stabilization in the incidence of ESRD observed in Spain recently, compared to other countries. In the next few years it will be necessary to confirm this stabilization in the incidence of ESRD in Spain and in other European countries.

In 2004, there were 2197 renal transplants (96.2% of them were cadaveric transplants and only 3.8 % living related donor transplants) performed in Spain (ONT, 2005). This corresponds to an incidence rate of 50 patients per million receiving kidney transplants in Spain, while most other

European countries had an incidence of only 30 transplants per million. The US was the only country whose incidence of kidney transplantation was similar (50 per million) (USRDS, 2003). In the last decade, Spain has had a continuous improvement in cadaveric organ donation. This success may have resulted in part from an active donor detection program performed by well-motivated transplant coordinators, and from adequate economic reimbursement for the hospitals and doctors involved in transplant programs. The creation in 1989 of a national agency, the National Transplant Organization (ONT), has also contributed to this success. The ONT is exclusively dedicated to the development, coordination, and management of the transplant waiting lists; to assisting hospital transplant coordinators in the entire process of organ donation, and to coordinating the distribution of organs (Matesanz, 2004; Naya, Garrido, Cudende, Canon, & Miranda, 2003). Each transplant hospital has a transplant coordinator team (one or two doctors and one or two nurses) that is on call 24 h a day and coordinates the entire process of organ donation and transplantation. Surgeons, anesthesiologists, and nephrologists receive extra money for each transplantation. This incentive for transplant nephrologists represents approximately 10%–25% of their total salary.

Hemodialysis (HD) patients in Spain are treated in both free-standing outpatient and hospital-based inpatient facilities, most of which are urban. Spain's 173 free-standing facilities treat 11,700 HD patients and most operate only during the day. Only 10 (6%) of these facilities are non-profit organizations, the rest are private, for-profit units. Corporate ownership plays a significant role: most of these 163 private for-profit free-standing facilities are owned by large, publicly traded, multinational dialysis facility companies. All 159 hospital-based inpatient facilities are public and treat approximately 8,100 hemodialysis patients, generally operating 24 h a day for acute dialysis; transplantation occurs in these facilities as well. All payments are made to these facilities by the National Health Service. Reimbursements for each hemodialysis session are fixed in advance: approximately €120 (US\$162; PPP 2003) for free-standing outpatient facilities, and €140–175 (US\$189–236; PPP 2003) for hospitals.

Spain has an especially high number of physicians with approximately 460 active doctors per 100,000 inhabitants. This is one of the highest rates among European countries; only Italy (600 per 100,000) has a higher number of doctors, according to Eurostat calculations (MSC, 2006a). The staff available to treat ESRD is more than adequate, with an approximate average of 39 ESRD patients per nephrologist. In comparison, the United Kingdom and United States had, 123 and 66 ESRD patients per nephrologist, respectively, in 2003 (Ansell, Feest, Byrne & Ahmad, 2003; Osinski & Wish, 2005; USRDS 2005).<sup>1</sup> This large supply of nephrologists relative to the number of ESRD patients presumably affects care positively, and may also affect predialysis care. Some studies have demonstrated a beneficial effect of early nephrological care on morbidity and mortality in hemodialysis patients (Gallego et al., 2003). At the same time, the presence of highly trained dialysis facility staff seems to have a significant positive effect on patient adherence, hospitalization, and mortality, although with respect to the physician-patient contact time this positive effect is rather small (Hecking et al., 2004; Saran et al., 2003). One study showing comparative data among different European countries indicates that the level of medical care (understood as contact with the physician at all or almost all dialysis treatments) is significantly higher in Spain, 74% of all dialysis treatments versus 48% that was the average

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<sup>1</sup> Applies only to treated end-stage patients; does not include patients who are pre-ESRD; however, if the supply of nephrologists is high for dialysis patients, it will also be high for the predialysis care.

observed in the European countries of this study (Cruz, Piera, Bragg-Gresham, Feldman & Port, 2003).

It is very difficult to relate Spain's high nephrologist/patient ratio to its low crude mortality rate among hemodialysis patients, the lowest mortality rate in this study: 13.6% vs. 21.2% in the US and 16.1% in the UK (SEN, 2004, 2005). A causal connection may be suspected but has not been proved. Spain's nephrologist/patient ratio is surprising too, given the relatively low salary (US\$71,614; PPP 2004) for these physicians, with only Sweden's physicians earning less (data not shown). Average physician income in Spain is particularly low compared to other countries. Most nephrologists are salaried by the National Health Service, which provides all the resources for ESRD treatment. Nephrologists earn on average €5,000 (US\$71,614; PPP 2004), gross salary annually, while those in Australia, Belgium, Canada, and the US earn well over US\$150,000 after adjustment for PPP (data not shown). Perhaps the low salaries in Spain result from the combination of a free educational system (which trains a very large supply of physicians) and the presence of a single large employer (the National Health Service, which provides employment for most of the physicians).

The training of physicians in Spain comes from an educational system that imposes limits based only on intellectual ability. Those candidates with better school qualifications who pass a selection examination can proceed in the career of medicine. Entry into medicine demands one of the highest qualifications, due to the placement limitations imposed by the government and universities. After medical graduation, all new doctors need to pass a national centralized board examination before the specialized training period as a resident (médico interno residente, or MIR). The selection of specialty and hospital depends on the qualification attained in the examination and the median qualification attained while in medical school. There is a national education program for each specialty. The training in nephrology involves 4 years in a hospital accredited for nephrology teaching by a national commission, which annually selects a maximum number of medical residents for nephrology training. In 2003, 84 places were set for medical residents in nephrology; roughly 95% of places were reserved for EU citizens and 5% were reserved for Latin American physicians (MSC, 2003b). Despite the relatively high nephrologist-to-patient ratio in Spain, the demand for nephrologists is very high. This is because of the increasing demand for nephrologists to cover all dialysis services; for example, they must be present for dialysis sessions. To meet this demand, the national commission is increasing the number of residents accepted into nephrology.

As a result of the universal and free health care coverage by the NHS and the currently adequate numbers of dialysis units and nephrologists, there are no waiting lists for dialysis in Spain. However, some hospitals do have waiting lists for permanent vascular access placement. In a survey of 18 dialysis units in Spain, 22% of medical directors and nurse managers reported a waiting time higher than four weeks between referral and surgical creation of a permanent access for hemodialysis (Cruz et al. 2003; Rayner et al. 2003).

The numbers of cadaveric organ donors in Spain has continued to increase since the 1980s. In 2004 Spain had a total of 1,495 donors, a rate of 35 donors pmp. This rate has not been reached by any other country. Despite these numbers, and as in all other countries in this study, there is a waiting list for renal transplantation, though the size of the list has stabilized in the last 5 years.

In 2004, 4,231 patients were on renal transplantation waiting lists; since 1999, over 2,000 renal patients have been transplanted each year (ONT, 2005).

## Expenditures

Compared to other countries, Spain spends relatively little on general health care, but ESRD care makes up a larger portion of its overall budget. Between 1999 and 2003, public health care expenditures in Spain increased by only 8.6% to €42.6 billion (US\$57 billion; PPP 2003). In 2003, health care expenditure accounted for 7.7% of the GDP (5.6% public and 2.1% private) (INE, 2004; MSC, 2003a; WB, 2005). According to Instituto Nacional de Estadística data, the GDP for Spain in 2003 was €745 billion (US\$1003 billion; PPP 2003) and total health expenditures were €57 billion (US\$77 billion; PPP 2003) (INE, 2004). Of the countries in the ISHCOF, only the UK spent a similarly small fraction of its GDP on health care, at 7.7% in 2002 (WB, 2005). Additionally, with a public health expenditure of €950 per capita (INE, 2004; MSC, 2003a; WB, 2005), and a total per capita health expenditure of €1319 (US\$1779; PPP 2003), Spain ranks as one of the lowest spenders.

However, of the 7.7% of GDP spent on health care, Spain spent approximately 1.5% of total health expenditures on ESRD. Private insurance usually does not pay for chronic treatment of kidney disease. Private insurance only covers the cost of the hemodialysis treatment for less than 1% of hemodialysis patients in Spain. Because nearly the entire cost of ESRD is financed by the public health system, including all medication, erythropoietin (EPO), and transportation (which is free for most ESRD patients), the cost of ESRD represents at least 2% of public health expenditures. In Spain, 72% of overall health care expenditures come from public funds and 28% come from private sources (MSC, 2006b). The entire population is covered by compulsory insurance (NHS), which is funded by social security taxes and federal subsidies funded through taxation. For illness in general, private insurance can also be purchased through competitive private insurers. The whole population is covered by the National Health Service, but approximately 12% of the population has other private insurance in addition to their basic coverage (MSC, 2006b). However, nearly all (99%) of the resources for ESRD treatment come from the NHS, as it is the only payer for this type of care. In ESRD treatment private insurance does not improve access to treatment. Compulsory insurance covers all aspects of ESRD care, including chronic dialysis treatment and transplantation, medications, and lost wages and other medical benefits. Most medications (EPO, iron, vitamin D, antihypertensive medication, statins and antibiotics) are completely free for ESRD patients. This public insurance can also be used to purchase ESRD care in the private sector and private free-standing facilities are reimbursed by the NHS.

Spaniards who choose to obtain supplementary private insurance usually do so to have more rapid and comfortable access to health care, and to receive amenities such as private rooms and personal telephones. As in other countries with universal and free health service, there are waiting lists for the treatment of more common pathologies. Severe illnesses that require advanced technology for diagnosis or treatment, and most complicated surgery, including renal transplantation, are addressed in high-technology public hospitals, most of which belong to the NHS. At the same time, national social security pays a disability pension for those patients who

were active workers when struck with ESRD together with any comorbidity. All patients may be dialyzed temporarily in other Spanish dialysis units during vacation periods without problems and without any additional cost.

Spain is divided politically and administratively into 17 autonomous communities (Comunidades Autónomas) plus two autonomous cities (Ceuta and Melilla) in the north of Africa. Each community manages its own health care resources with funding transferred from the national budget. For purposes of health care administration, each community is subdivided into “Areas Sanitarias” each with its own tertiary care referral hospital. This hospital plays a defining role in ESRD treatment. All patients who receive dialysis in the free-standing dialysis facilities of the sanitary area are provided outpatient medical visits, hospitalization, transplantation, and treatments for all complications related to ESRD treatment through this referral hospital.

Free-standing dialysis facilities are reimbursed entirely on a fee-for-session basis. The payments are made to these facilities by the National Health Service. Hospital inpatient dialysis is also reimbursed through fee per dialysis session. The price paid to the hospital for in-patient dialysis is usually higher than that paid to free-standing dialysis facilities, and depends on the hospital’s characteristics. The hospital inpatient dialysis fee is a fixed price determined by each hospital’s characteristics, though these fees are similar among hospitals of the same technological level. This fee is negotiated each year between the administration of the hospital and each autonomous community’s Council of Health. There is usually a fixed price for a dialysis session, and other fixed fees for renal transplantation and days spent in the hospital. Patients are not required to share any of the cost of their treatment.

For their provision of ESRD care, both primary care and specialist physicians are paid entirely by salary. This payment system, with the NHS as the only large payer and the most important provider of treatment, is not very competitive. It constrains the quality of ESRD care because of the fixed fee for dialysis, and it gives dialysis patients little ability to choose among facilities. The incentive structure that faces doctors, nurses, and providers is based only on salary payments. Doctors receive the same salary regardless of the quantity of patients they handle and the quality of care they provide. Although this system grants all patients equal access to medications and therapies without restrictions, it does not provide incentives for improving the quality of ESRD care.

Competition between dialysis units is further curtailed by the patient’s lack of choice in dialysis center. The Sanitary Authority determines how many units are authorized to cover dialysis and transplantation needs in each autonomous community and then assigns patients to units based on their home address. All NHS patients must attend their assigned center. If a patient wishes to change units, this change must be authorized by the Sanitary Authority, a process that is often difficult. This regulation aims to keep the ESRD-related NHS expenditures relatively equal across sanitary areas. Only patients who have private insurance (less than 1% of the current hemodialysis patients in Spain) may choose their dialysis center. This lack of patient choice results in little competition between dialysis units. If they are guaranteed the income associated with a specified population of patients and have no hope of increasing this income by acquiring new patients, facilities have little financial incentive to improve their services.

## Specific aspects of treatment and financing

In Spain, consumers generally pay only 40% of the cost of medications; the NHS pays the rest. However, most medications for chronic diseases are subsidized further, and ESRD patients pay less than 10% of their cost. Pensioners do not pay anything for medications. Most of the ESRD patients are pensioners and do not have to pay anything for any prescribed medication. For ESRD patients, there is no cost for most of the pharmacological therapy related to their treatment. EPO, iron, vitamin D, antibiotics, antihypertensives and some prescription multivitamins are all covered by public health insurance, with no limitations on reimbursement.

In general, every doctor in Spain has the freedom to prescribe any approved medication; however, only nephrologists can prescribe certain medications, such as EPO. Medications can be prescribed only for those indications authorized by the Spanish Agency of Medication (AEM). The NHS specifies that drugs for certain indications may only be prescribed by certain medical specialists (e.g., EPO for ESRD patients may only be prescribed by nephrologists). Medications are administered by physicians not according to a fixed national protocol but to informal protocols within each hospital, or along the lines of other national and international guidelines.

## Hospitalization

In addition to their routine dialysis sessions, many ESRD patients require inpatient and outpatient hospital visits each year. Based on a personal investigation conducted at several area hospitals, each year Spanish hospitals receive approximately 18,000 admissions of ESRD patients, which represent approximately the half of the number of patients with ESRD. Upon admission, patients typically stay 10.5 days. About 25% of admissions are for treatment of problems with vascular access. Some patients of advanced age and with several comorbidities are admitted several times a year but others are admitted much less frequently. A typical ESRD patient will also make roughly six outpatient hospital visits per year for reasons other than dialysis. In general, nephrologists are primarily responsible for their patients during both inpatient and outpatient visits.

## Transplantation

Spain's remarkable rate of cadaveric organ donation, 35 per million in 2004, is the highest in the world. Whereas most European countries have a renal transplant incidence rate of only 30 transplants per million, Spain's is 50 per million. Spain (435 pmp) and the US (441 pmp) have the highest prevalence of kidney transplantation of all countries in the ISHCOF (data not shown). Forty-one of Spain's 798 hospitals (including seven pediatric hospitals) perform transplantation surgery, which, at 5.1% of all hospitals, is a higher percentage than about half of the ISHCOF countries and similar to percentages seen in Sweden and the US. An average hospital stay for transplantation is 15 days, which is comparable to Italy (Pontoriero, Pozzoni, Del Vecchio, & Locatelli, 2007) and much higher than the US average of 6.6 days (Hirth, 2007) patients generally stay 23 days and in the US they stay only 5 days.

The mortality rate of transplanted patients is significantly lower than dialysis patients, 10 times lower. Whereas peritoneal dialysis patients' gross mortality rate is 10.8% and hemodialysis

patients' is higher at 13.7%, transplantation patients' gross mortality rate is only 1.3% (Ceballos et al., 2005; SEN, 2004). Like other countries, Spain has recently seen considerable improvement in patient survival and graft survival following kidney transplantation. Many factors have probably contributed to the increasing success of renal transplantation. In Spain, as in other countries, transplant recipients are positively selected in terms of lower age and fewer associated comorbidities. Although the most frequent cause of death for kidney recipients is still cardiovascular disease, the reduced incidence of cardiovascular complications following renal transplantation may partly explain these improved posttransplant survival rates (McDonald & Russ, 2002).

Like all other aspects of ESRD treatment, transplantation is covered by national health insurance and patients are not required to share the costs of their transplant in any way. Available kidneys are not explicitly rationed, but certain regions record a higher than average number of transplants. About 20% of kidney transplant recipients come from Madrid (which is home to 13.3% of the general population), and 18% come from Cataluña (15% of the general population). The waiting list of some hospitals in Madrid is increased by relocation of patients from the regions that do not perform renal transplants, which may contribute to these regional differences (SEN, 2004; ONT, 2005). The decision of which transplant candidates receive an organ is determined by clinical and histocompatibility testing criteria. The National Transplant Organization (ONT) helps identify the best recipient for available kidneys not used in a given hospital, looking both within the same community and in different ones.

## Dialysis

ESRD patients in Spain attend approximately 3,000,000 outpatient hemodialysis sessions per year, at a mean cost of €7 (US\$131; PPP 2003) for a dialysis session in a free-standing dialysis facility, which does not include EPO or transportation. (It is not easy to calculate the mean cost of a dialysis session in a public hospital, but it is certainly much higher.) Approximately 40–55% of this cost is for material, 35–45% is for the payment of staff, 10% is for amortization, and 5% is for other expenses.

About 47% of patients with ESRD have received a renal transplant; 48% receive hemodialysis at a dialysis unit, and 5% receive dialysis at home, mostly with peritoneal dialysis (continuous ambulatory peritoneal dialysis, or nocturnal cycling peritoneal dialysis). Home hemodialysis is now merely anecdotal in Spain: less than 0.5% of the ESRD patients receive this technique (SEN, 2004).

No national standard for Kt/V level or duration of dialysis exists, but there are informal limits regarding the adequacy of dose follow the Spanish Society of Nephrology and international guidelines ( $Kt/V > 1.2$ ). Spain's average  $spKt/V$  level is 1.35, similar to that seen in other ISHCOF countries. The average length of hemodialysis treatment time is quite low: 220 min, the same as Italy (Pontoriero et al., 2007) and the second lowest national average in this study. This low mean dialysis time in Spain is associated with the use of dialyzers with the highest membrane surface area (average 1.72 sq. m) and overall mass transfer coefficient ( $KoA$ : 861 ml/min); the higher blood flow rate allowed by these dialyzers permits a dialysis efficacy similar to that seen in countries with higher mean hemodialysis time (Goodkin et al. 2003; Rayner et al.

2004). Although Saran et al. (2006) have found that lower mortality risk is associated with longer treatment time at the same level of Kt/V, the opportunity to improve outcomes in Spain through longer treatment time needs to be confirmed in the future. Dialyzer reuse is not permitted by Spain's Department of Health and all dialyzers must indicate on the commercial label that only one use is allowed.

Missing dialysis sessions, which reduces the dialysis dose delivered and has been associated with increased mortality risk (Goodkin et al., 2003), occurs very rarely in Spain, mostly among younger patients. Less than 0.5% of patients skipped more than one session per month. Shortening of sessions more than 10 minutes per month occurred more frequently (6.6% of HD patients), a percentage that is still the lowest among the European countries in this study (Goodkin et al., 2003).

## Trends and outcomes

Despite a National Health Service that provides universal health care, there are still some differences in the incidence and prevalence of patients receiving RRT, as elsewhere in Europe (Saran et al., 2003). The autonomous communities of Spain that exhibit higher than average incidence and prevalence of ESRD are the Canary Islands, La Rioja, Valencia, Cataluña, Ceuta, and Melilla; lower than average rates are seen in Aragón, the Basque country, Castilla y León, Castilla La Mancha and Andalucía (SEN, 2004). These variations in the ESRD incidence among different regions are not easy to explain. The well-known high prevalence of diabetes mellitus in the Canary Islands may explain that region's high incidence and prevalence of ESRD—the highest in Spain. The Canary Islands differ greatly from other Spanish communities in geographical and sociodemographic terms, as do Ceuta and Melilla, the autonomous Spanish cities of North of Africa. The differences in ESRD incidence across the rest of Spain are more difficult to explain. Other unknown factors not related to patient characteristics or facility practice patterns may contribute to differences between regions and between different centers within the same region.

Among the countries in this study, Spain has the third highest rate of ESRD prevalence, but one of the lowest ratios of incidence to prevalence (Dor et al., 2007). Furthermore, in the last 5 years the incidence of ESRD in Spain seems to have stabilized about 130 pmp. This trend diverges from the general tendency in other developed countries toward a progressive increase in the incidence of ESRD, with a major dispersion among the European countries. The differences in the incidence of the diseases that cause ESRD, including diabetes and vascular renal diseases, contribute to this disparity (Saran et al., 2003; Van Dijk et al., 2001). Spain's ESRD population has a low crude mortality rate (8.3% per year) and a high incidence of transplantation (50 pmp). The mean age of patients and main causes of ESRD are very similar to those seen elsewhere in Europe, but the prevalence is higher. However, the incidence of coronary disease, one of the most important causes of mortality among ESRD patients, is significantly lower in Spain than in other European countries in this study—and, of course, lower than the incidence of coronary disease in the US (USRDS, 2003). Given these factors, it is possible that Spain's low ESRD mortality rate and the high transplant rate could be responsible for the country's higher prevalence of ESRD.

Although Spain's rate of transplantation is high, it is not sufficient to cover the needs of the waiting list: some patients wait more than two years for a renal transplant. More significant efforts are necessary to increase transplantation of kidneys from both deceased donors and living donors. Advances in transplantation could improve the survival rates of ESRD patients facing the substantial waiting list for needed kidneys.

## Conclusion

As in other developed countries, lifestyle changes, obesity, and sedentary habits in Spain's aging population have contributed to a high frequency of diabetes, hypertension, and vascular disease, which in turn have been responsible for a rise in ESRD. Nevertheless, in the last five years Spain has seen a trend toward ESRD stabilization, with an incidence level that is quite low compared to levels seen in Germany, the US, and Japan. This apparent leveling off needs to be confirmed in the future. Even at the current relatively low incidence rate, the number of patients with ESRD could double in a period of about 20 years. The resources necessary to treat such a number of patients would require substantially greater financial resources dedicated to ESRD treatment, though these resources already make up an important part of the NHS budget.

Increasing the resources dedicated to ESRD treatment is especially necessary in Spain, where total national health expenditures represent only 7.7% of the GDP, lower than the spending in other ISHCOF countries and in spite of the fact that RRT services are universal and unlimited.

Spain must increase its overall health care spending to maintain its high level of coverage and services for ESRD care and to maintain a level of health care effectiveness comparable to the other countries in this study, which dedicate higher percentages of the GDP for health resources. Spain's deficit accumulated in recent years due to the health care debt is not sustainable for the budgets of the autonomous communities (this health care-related deficit is approximately €3,000 million per year for the whole country). To address this deficit, Spain has been forced to create an extra fund that requires an important contribution of the national budget; a related new law of autonomic financing for this fund is now being prepared and will probably be debated in Parliament soon.

The Spanish National Health Service has fostered a health care coverage system that is, on the whole, universal, free, equitable, and efficient. However, it does not promote the improvement in health care quality with free competition and rewards for better performance. Quality of care is monitored by the Health Councils of the autonomous communities and National Agencies of Health Control, Evaluation, and Accreditation in order to allow a constant evaluation and improvement of ESRD care. Nevertheless, in Spain there are few professional or economic incentives for nephrologists, who receive low salaries in comparison to nephrologists in other countries. With the ability of EU citizens to work in any member nation, one may wonder whether the Spanish system can be sustained at salaries that represent only a third of the income received by the nephrologists of the other countries of this study, and without stronger professional incentives. The progressively aging population and its increasing burden of hypertension and diabetes could lead to a persistent growth in the ESRD population, which will

likely make financing health care in Spain increasingly difficult. Although the annual growth in the ESRD population has been approximately 3 percent, which is similar to the expected growth in GDP (3% per annum), the aging population is expected to put greater demands on the health budget for many conditions in addition to ESRD. The net result is that the future will be difficult times for the funding of health care in general and ESRD in particular.

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## Appendix: Estimating the expenditure per end-stage renal disease patient in Spain

### Part A: estimating hemodialysis costs

#### Hemodialysis treatment

Each health administration's payments for hemodialysis (HD) treatment in Spain differ according to the type of facility; free-standing units are reimbursed €120 (US\$160; PPP 2003) per treatment, while hospital-based units are reimbursed between €40 and €75 per treatment (mean of €158 or US\$213, PPP 2003). Included in this payment is a fee of €10.5 to €19.5 per treatment (mean of €15 or US\$20, PPP 2003) for physician oversight. To make this estimate comparable to other countries, we have removed the physician fee (medications and transportation are already excluded). Considering that 11,700 hemodialysis patients (59%) are treated in free-standing facilities and 41% in hospital-based facilities we calculated a weighted average per treatment reimbursement rate of €21 (US\$163; PPP 2003).

Assuming 150 treatments per year, the government pays €8,000 or €23,700 per HD patient for annual maintenance dialysis in free-standing and hospital-based facilities, respectively (US\$24,259 or US\$31,941; PPP 2003) (Table A1). These estimates include physician oversight fees, but exclude medications and transportation. Medication estimates are discussed below. Transportation costs are not included in any estimates in this analysis.

**Table A1. Cost per HD Patient per Year in Spain, by Facility Type, 2003**

Component	Cost per HD Patient (€)	
	Hospital-based	Free-standing
HD treatments	23,700	18,000
Hospitalization	4,177	4,177
Erythropoietin	4,450	4,450
Other Medications	2,276	2,276
Outpatient Visits	3,020	3,020
<b>Total</b>	<b>€37,623</b>	<b>€31,923</b>
<b>Total, weighted</b>		<b>€34,317</b>

#### Hospitalization for hemodialysis patients

HD patients are often hospitalized not only for dialysis-related procedures, but also for other health conditions. To estimate the cost of annual hospitalizations for HD patients in Spain, we used data from DOPPS I demonstrating that each HD patient has, on average, 0.8 hospitalizations per year that last 11.4 days each (Rayner et al. 2004). Therefore, an average Spanish HD patient spends 9.12 days in the hospital per year.

No Spanish data currently estimate the cost per hospital day for dialysis patients; however, the Organization for Economic Co-operation and Development (OECD) estimated an annual

hospitalization cost for the general population of €350 in 2002 (OECD, 2004). Assuming a 3% inflation rate between 2002 and 2003, this cost was €361 in 2003. Since this cost applies to an average of 0.111 hospitalizations per year with an average length of stay of 7.1 days (OECD, 2004), the cost per hospitalized day for the general Spanish population was €458 (US\$611; PPP 2003). Assuming that this daily cost also applies to the HD population, an assumption that likely underestimates the true cost, we can multiply it by the average length of stay for HD patients to obtain an average annual hospitalization cost for HD patients of €4,177 (US\$5,572; PPP 2003).

Using the OECD cost per day and the DOPPS estimate of days per year, we estimate an annual hospitalization cost for Spanish HD patients of €3,292 (Table A1).

#### Erythropoietin for hemodialysis patients

To estimate the cost of erythropoietin (EPO) for HD patients, we can use DOPPS data that show that 93% of HD patients in Spain receive EPO at a mean dose of 7,606 units per week (Pisoni et al., 2004b). At €1.25 per 1,000 EPO units, the average HD patient spends €86 (US \$115; PPP 2003) per week on EPO (€4,450 or US \$5,941 (PPP 2003) per year) (Table A1).

#### Medications other than erythropoietin

A study of ESRD care in Canada found that the annual cost of non-EPO medications was 55% of the annual cost of EPO (Lee et al., 2002). We assumed this proportion also applied to drug costs in Spain (Table A1).

#### Physician office visits

In Spain, the physician cost is included in the reimbursement per dialysis session. However, a typical HD patient makes six outpatient physician visits per year for nondialysis purposes. Typically, these visits cost €54 (US \$72; PPP 2003) each. Over a year, the cost would be €324 (US \$433; PPP 2003). This estimate is substantially lower than would be predicted using data from the United States, in which non-dialysis physician visits account for 8.8% of the total expenditure per HD patient (USRDS, 2005). This amount includes payments for these physicians and also for the services provided during these visits. If we apply this 8.8% to the Spanish data, the non-dialysis physician component would cost roughly €3,020 (US\$4,032; PPP 2003) per HD patient per year. In Table A1 we have used this higher estimate.

#### Total year of hemodialysis

Weighting the free-standing and hospital-based estimates by the percentage of Spanish patients in each facility type, we calculated an average annual expenditure per HD patient of €34,317 (US\$45,817; PPP 2003).

## Part B: estimating costs for other modalities

### Peritoneal dialysis

In the United States, total spending (Medicare and non-Medicare) per peritoneal dialysis (PD) patient was 73% of spending per HD patient (USRDS, 2005). Studies in Canada and Australia estimate that PD spending is 53% and 69%, respectively, of HD spending (Lee et al. 2002; Cass et al. 2006). We assume that PD costs 65% of HD, which is the mean of these three country-specific estimates. Applying this ratio to the hospital-based HD cost in Spain yields a PD cost of €24,455 (US \$32,958) (Table A2).

**Table A2. Annual Expenditure per ESRD Patient in Spain, 2003**

Modality	Weight	Annual Cost per Patient	
		EURO	US\$, PPP
HD	0.48	34,317	46,249
Home HD and PD	0.05	24,455	32,958
Transplant	0.47	10,140	13,666
Total, weighted	1.00	22,461	30,270

### Transplantation

The cost for transplant patients in Spain was estimated at €10,140 (US \$ 13,666; PPP 2003) per patient (Table A2). Assuming that the cost ratios of incident, functioning, and average transplant patients is similar in both Spain and the United States, new transplant patients incur 6.2 times the cost of functioning transplant patients, who themselves incur 69% of the average cost for all transplant patients (USRDS, 2005). Using these relationships and the estimated cost for all transplant patients, we calculated that an incident transplant patient costs €39,342 (US\$53,021; PPP 2003) in the year of transplant and functioning transplant patients cost, on average, €6,345 (US\$8,551; PPP 2003) after the first year.

### Total expenditure per ESRD patient

By weighting the modality-specific estimates described above by the proportion of Spanish patients receiving each modality, we estimated the total annual expenditure per ESRD patient in Spain to be €22,461 (US \$30,270; PPP 2003) (Table A2).

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