The Databases: Renal Replacement Therapy Since 1989—The European Renal Association and European Dialysis and Transplant Association (ERA-EDTA)

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Chronic kidney disease is now considered a public health priority, and the prevalence of this disease is approximately 10% in both North American and European countries. Such a phenomenon raises concern about the future increased incidence of ESRD. A recent analysis in the European Renal Association–European Dialysis and Transplant Association Registry shows that the incidence rates in Northern European countries have stabilized at approximately 110 per million people, a phenomenon that is associated with a parallel stabilization in the incidence of ESRD caused by diabetes. Such a stabilization has occurred in the face of an increasing prevalence of diabetes and hypertension in the general population, suggesting that this improvement may be the result of better prevention. Genetic factors, competing risks with other diseases, and other medical factors explain only in part the variability in the incidence of renal replacement therapy in European countries. Health care financing priorities have an obvious influence on the outcome of ESRD. Nonmedical factors seem to be of importance at least equal to that of medical factors. In this respect, Dialysis Outcomes and Practice Patterns Study Europe has revealed relevant differences in clinical policies that are related to ESRD treatment among European countries.

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It has now been approximately 10 yr since nephrologists started considering chronic kidney disease (CKD) a relevant public health problem (1); however, outside of the realm of nephrology, in several countries, the problem is still not considered a priority. Even the World Health Organization, which poses chronic diseases as the major threat to human health, does not list CKD among chronic conditions (2). The National Health and Nutrition Examination Survey (NHANES) is perhaps the best source of information for estimating the dimension of CKD at population level. Estimates in 1988 through 1994 and in 1998 through 2004 documented a 2.3% increase, from 14.5 to 16.8%, in the prevalence of CKD in the United States across these surveys. This increase, which was partly explained by the increasing prevalence of diabetes and hypertension, raises concerns about the future increased incidence of ESRD and attending complications (3). The diseases that are the traditional hunting territory of nephrology (immunologic diseases, primary glomerular diseases, or genetic diseases) contribute very little to CKD epidemics. Collectively, the combined prevalence of these conditions is far less than the actual prevalence of CKD in American and European surveys. Nephrosclerosis (nephron obsolescence triggered by the same risk factors that are also responsible for coronary heart disease, namely obesity, type 2 diabetes, hypertension, and smoking) is now the dominant nephropathy in economically developed countries. The overlapping of risk factors for coronary heart disease and renal disease is now well documented in large studies at population level. In a recent European study (4), Framingham risk factors as well as body mass index and physical activity emerged as independent predictors of new-onset decline in renal function. Similar findings were reported also in Asian (5) and North American (6) populations, and the dominant role of hypertension, overweight, and diabetes for the most advanced CKD stage, ESRD, emerged also in a recent cohort study based on the Northern California Kaiser Permanente Center (7). Furthermore, in the past two decades, acute kidney injury has been recognized as a common condition, occurring in approximately 20% intensive care unit admissions, and there is some evidence that acute kidney injury may significantly contribute to the burden of CKD (8).

The high prevalence of cardiovascular and renal diseases is now viewed as the trade-off of the success of modern medicine. During the past two centuries, the years of epidemiology transition (9), the frequency of infectious diseases declined considerably and famine has virtually disappeared in economically developed countries. As a result, life expectancy in these countries increased by as much as 50% in just one century. The defeat of famine and infectious disease determined a radical change in the very phenotype of humankind: From the slim and pale phenotype of the 1920s to the obese phenotype of the late 20th century. It is precisely this phenotype that is the main factor responsible for the epidemic of risk factors that are now of major public health concern: Hypertension; visceral fat accumulation; and a series of metabolic risk factors including

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high LDL cholesterol and low HDL cholesterol, hypertriglyceridemia, and fasting hyperglycemia. These 20th-century risk factors determined the epidemics of cardiovascular diseases since the world wars. Public health interventions as well as the availability of efficacious antihypertensive drugs and other cardiovascular drugs increased the life expectancy of patients with cardiovascular disease (10). Death postponement and longer life duration then let surface kidney damage, incited by the same risk factors, and eventually triggered today's CKD epidemics. Thus the CKD epidemic is in part a trade-off of the success of modern medicine—the consequence of the successful fight against cardiovascular disease (11).

Also thanks to the pressure by scientific societies and international organizations that are devoted to the fight against renal diseases, such as the American Kidney Foundation, the American Society of Nephrology, the International Society of Nephrology, the European Renal Association–European Dialysis and Transplant Association (ERA-EDTA), and the European Kidney Health Alliance, CKD is now officially dealt with in documents from public health agencies such as the Centers for Disease Control and Prevention in the United States (12) and the European Public Health Project EUGLOREH that was released on March 20, 2009 (13). CKD prevalence is substantially similar across the Atlantic, and the figures are such that this condition is considered a true public health priority.

The ERA-EDTA Registry: Time Trends of ESRD Incidence in European Countries

The ERA-EDTA Registry was started in 1966, 2 yr after the foundation of the European Dialysis and Transplantation Association (EDTA). It was William Drukker, a Dutch nephrologist and one of the founding fathers of the EDTA, who proposed the creation of the registry. The registry was conceived as a centralized structure. It was a successful initiative, but its centralized structure proved to be a weak point. The last decade of the past millennium was a very problematic period and for a series of insoluble managerial problems the registry eventually collapsed in 1999. From 2000 on, the registry was gradually rebuilt into a new, decentralized organization, a federation of renal registries. Today, the ERA-EDTA Registry includes 34 countries/regions with an overall population of 217 million providing disaggregated data and 17 countries (general population 463 million) providing aggregated data only.

The definition of kidney disease has changed considerably over the years (14), and the current definition of ESRD is based on treatment (*i.e.*, on a therapeutic decision dictated by ethical factors, coverage policies, and clinical judgment). This limitation notwithstanding, the temporal profile of incidence rates of ESRD in renal registries is important because it gives valuable information on the dynamics of this disease. After years of continuous growth, in 2006, the US Renal Data System reported that the rate of new patients who were initiating renal replacement therapy (RRT) had begun to decrease slightly. This finding is of relevance, because some investigators had predicted an unrelenting rise in the RRT incidence in affluent Western countries. A recent analysis of a group of countries that contribute to the ERA-EDTA Registry (15) showed that, on average, the incidence rates in Northern Europe have stabilized at approximately 110 people per million (pmp; Figure 1). This stabilization was accompanied by a similar trend in the incidence rate of ESRD associated with diabetes, which remained constant at approximately 24 pmp. Analyses by age strata revealed no change in the 0- to 19- and 20- to 44-yr age groups but a decrease in the 45- to 64- and 65- to 74-yr age groups (−6.1 and −3.4%, respectively). In contrast, the incidence rate of RRT rose by 8.4% in patients who were older than 75 yr. The time trend of this indicator in southern European countries differed from that in northern countries in that it continued to rise since 2002, with an increase of 8.8% to 129 pmp. The increase was particularly high in patients with ESRD associated with diabetes (12.4%). A small part of the increase in incidence rates in the years around the turn of the millennium might be due to starting RRT at a higher level of estimated GFR (eGFR). In this respect, it is of interest that in a selection of European countries, the median eGFR at the start of dialysis increased from 7.0 to 7.7 ml/min per 1.73 m^2 (16). The ERA-EDTA Registry does not have any eGFR data after this period. Overall, the incidence rates in southern Europe were higher than in northern Europe across all age strata. Similar to northern European countries, the incidence of RRT in southern countries remained stable in younger age strata but rose in the 65- to 74-yr (8.4%) and the 75-yr (16.2%) strata. Germany was set apart in this scenario because incidence rates rose 11.7% to 194 pmp since 2002. In 2004, RRT for ESRD from diabetes hit the 66-pmp mark in Germany, which is a very high rate compared with the rest of Europe.

The seeming stabilization of the incidence rate of RRT in Europe in recent years may result from several causes, including a stabilization in the prevalence of renal diseases in the population and a reduced progression rate of these diseases, but also from early death in patients with CKD. The finding

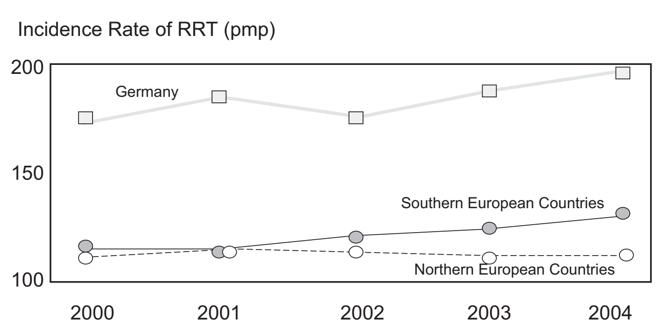

Figure 1. Time trends of RRT in northern and southern Europe. Northern Europe includes the registries of Belgium (Dutch-speaking and French-speaking registries), Denmark, Finland, Iceland, Norway, Sweden, England, Wales, and Scotland. Southern Europe includes Austria, Greece; the regional registries of Abruzzi, Basilicata, Liguria, Lombardy, Marche, Piedmont, Sardinia, Trentino-Alto Adige, Tuscany, Valle d'Aosta, and Veneto (Italy); and the regional registries of Basque country, Catalonia, and the Valencian community (Spain). Data for northern and southern European countries are adjusted for age and gender; data for Germany are unadjusted.

that the observed stabilization in RRT occurs in the face of an increasing prevalence of diabetes (17) and hypertension (18) in the general population suggests that this improvement may be the result of increased awareness by the medical community and the public of the risk posed by CKD and of more attentive application of available treatments aimed at slowing renal disease progression.

Nonmedical Risk Factors and Renal Outcomes

Even though the issue is still scarcely focused, medical factors explain just a relatively small fraction of observed clinical outcomes. To make an example related with nephrology, it is widely known that in patients with chronic nephropathies, the time to ESRD is quite variable, from a few months to several decades. Standard risk factors, such as proteinuria, BP, race, cholesterol, and other factors, explain just the 35% of progression to ESRD (19). Part of the unexplained variability may depend on other, still unknown and unmeasured medical risk factors, but there is evidence that nonmedical risk factors play a relevant role in the explanation of renal outcomes.

The incidence rate of RRT in the largest European country, Germany, is 213 pmp, but it is only 18 pmp in Ukraine (20). Even though the frequency of ESRD as a result of diabetes in Germany is particularly high, medical risk factors fail to account for such a high variability. These differences call into question nonmedical factors (*i.e.*, suggest that the way in which health systems in these countries are organized determine the growth rate of the dialysis population).

To compare incidence rates among countries, one should preliminarily frame the general relationship between the RRT and the parent general population as well as health system organization in the same countries. Thus, age and gender distribution in the general population, prevalence of underlying diseases, and survival from other diseases as well as health care access and delivery, health care financing priorities, and nonreferral should be considered if we are to explain intercountry differences in the incidence rate of RRT.

Relevant differences in survival exist among the general populations of European Union (EU) countries. Background mortality now has emerged as in important factor in the explanation of mortality of the corresponding RRT populations. In fact, both in a worldwide extended study (21) and in a European study (22), background mortality was closely associated with ESRD mortality. Within western European countries that contributed to these analyses, ESRD mortality was lowest in Italy, which also had the lowest background mortality, and maximal in Scotland, the country with the highest background mortality, and there was a mortality gradient from southern European countries (95 deaths per 100,000) to northern European countries (164 deaths per 100,000), yet, in these analyses, background mortality explained only 35% of the variability in ESRD mortality among these countries.

Among factors that may affect the dimension of the population on RRT, the wealth of nations and health expenditures that they can afford seem to be of obvious relevance. In this respect, an analysis of the link between annual health expenditures expressed in purchasing power parity per patient with ESRD and the corresponding health expenditure per capita provides interesting information (23). As shown in Figure 2, even though total health expenditures in Belgium are less than in Germany, Belgium is the top spending country for RRT in Europe, closely followed by France, Switzerland, and Austria. Overall, only 22% of RRT expenditure in these countries is explained by variability in health expenditure per capita. This finding indicates that ESRD is considered a special case in terms of organization and financing and that different countries allot to ESRD a variable proportion of the financial resources that they invest on health. It was reported (24) that both in a country with a restricted number of renal physicians, such as England, and in a country with a relatively higher number of specialists, such as Germany, there is a close association between the number of nephrologists and the incidence rate of ESRD. Factors that drive this association still remain to be clarified. Nonetheless, this association indicates that the intensity of the human resources that are deployed by health systems on renal replacement programs determines the capacity of the system to capture and accommodate the ESRD population in need of dialysis. Differences in the number of nephrologists between England and Germany were accompanied by parallel differences in geographic access to dialysis, the number of dialysis units being just four per million population in England *versus* 14 per million in Germany.

In summary, genetic factors, prevalence of underlying renal diseases, competing risks with other diseases, and other medical factors explain only in part the variability in the incidence of RRT. Nonmedical factors are of importance at least equal to that of medical factors. Health care financing priorities and nonreferral may influence the outcome of ESRD. In this respect, Dialysis Outcomes and Practice Patterns Study (DOPPS) Eu-

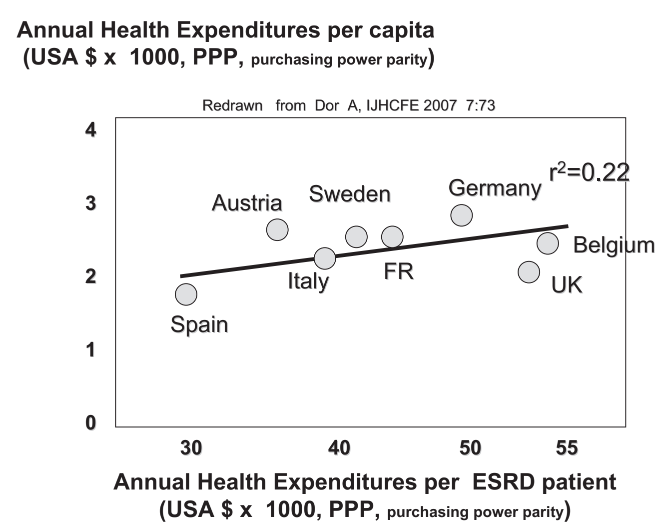

Figure 2. Relationship between ANNUAL health expenditures expressed in purchasing power parity per patient with ESRD and the corresponding health expenditure per capita in European countries that participated in the DOPPS. The shared variance of the two parameters in these countries was calculated by data reported in reference (20).

rope has shown relevant differences in clinical policies related to ESRD treatment among European countries (25).

The ERA EDTA Registry: The Present and the Near Future

As alluded to, the ERA-EDTA Registry is based on a federation of renal registries in Europe. Most of these registries collect very basic information. Even though a number of national or regional renal societies have successfully extended the scope of their registries or are in the process of doing so, until recently, the information included in these databases was mainly used for dialysis center planning and to produce fundamental information on patient outcomes. On average, EU countries spend approximately 2 to 3% of their overall health budget on RRTs; therefore, monitoring the quality of care is increasingly perceived as a fundamental goal for ethical, professional, and financial reasons. Patient organizations, health authorities, and doctors alike now increasingly demand credible, well-validated information on the quality of care of dialysis and transplant patients. The ERA-EDTA has made major efforts to produce and promote evidence-based clinical practice guidelines for dialysis and transplant patients, the European Best Practice Guidelines (EBPG). These guidelines have been widely disseminated, but their actual impact on clinical practice still remains a black box in the majority of EU countries. Promoting the creation of databases that allow direct comparisons of EBPG goals with actual clinical achievements is the basis for quality improvement programs. There is a need for a gradual transition of renal registries toward systems that are capable of sustaining these programs, and a few registries have already successfully extended the breadth of their data collection to start quality improvement programs. As a development of a specific initiative launched in 2006 (QUality European Studies [QUEST] [26]), the ERA-EDTA Registry will extend the data set collection, through development of a European standard for transmission of data between renal information technology systems. This special project awarded by the European commission (27) NephroQUEST will promote quality control activity and the comparison of data between renal units, nationally and internationally.

Epidemiology and clinical epidemiology, the basic sciences whereupon quality assurance programs should thrive, still represent a research area of very limited interest by the vast majority of European renal physician (28). To stimulate interest on this science, the ERA-EDTA Registry started itinerant introductory courses on epidemiology. Such courses were held in 10 European cities and have been quite successful. These educational meetings formed the basis for a series of articles (29) aimed at discussing epidemiologic and statistical concepts at a simple level, limiting the mathematics to the essentials. The series provides an epidemiologic basis to nephrologists who are performing clinical epidemiologic research or who wish to increase their ability to appraise the literature critically. We are confident that this educational initiative is a worthy medium-to long-term investment for strengthening the ERA-EDTA Registry network of regional and national renal registries.

As discussed, the incidence of RRT shows considerable variation both worldwide and among European countries. To have a deeper insight into this problem, Drs. Fergus Caskey and Alison MacLeod, within the framework of the QUEST initiative, recently started an international collaborative project involving nephrologists, epidemiologists, and health economists in various countries aiming at defining how much of the variation in RRT incidence, dialysis modality mix, and patient survival is attributable to economic and organizational factors. Renal registries and national experts in 46 countries provided data to this project. The results of this study will contribute to a better understanding of the organizational and financial factors that influence the development of services for patients with ESRD, which is fundamental information for planning future investments on renal disease prevention and treatment in a scenario in which available resources hardly match the increasing demand for health by the population.

Disclosures

None.

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