

Chronic renal diseases as a public health problem: Epidemiology, social, and economic implications

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Chronic renal diseases as a public health problem: Epidemiology, social, and economic implications. The impact of chronic kidney disease (CKD) on the global burden of diseases is probably underestimated by current methods of evaluation. However, CKD are emerging as a major health problem. First, the costs of renal replacement therapy are exceedingly high and are consuming a significant proportion of health care budgets of developed countries, while in developing countries are out of reach. Second, complex interaction are clearly emerging between chronic kidney, cardiovascular disease, and diabetes.

CHRONIC RENAL DISEASES AS A PUBLIC HEALTH PROBLEM

Chronic kidney disease (CKD) is a worldwide public health problem. According to the World Health Report 2002 and Global Burden of Disease (GBD) project, diseases of the kidney and urinary tract contribute to the global burden of diseases, with approximately 850,000 deaths every year and 15,010,167 disability-adjusted life years [1–3]. They are the 12th cause of death and the 17th cause of disability, respectively. The global incidence and prevalence of CKD, however, may be underestimated by these data for a number of reasons.

First, in the World Health Report, the item “Disease of Genitourinary System” is articulated in only 2 specific cause groups: “Nephrosis and nephritis” and “Benign prostatic hypertrophy,” a classification that does not provide any significant insight into the contribution of specific kidney diseases to the global burden of disease.

Second, patients with CKD are at high risk of cardiovascular diseases (CVD) and cerebrovascular diseases, and they are more likely to die of CVD than to develop terminal renal failure. Moreover, patients with CVD often develop CKD during the course of their disease. Therefore, an unknown proportion of people whose death and disability are attributed to CVD have kidney disease as well.

Key words: global burden of diseases, chronic kidney disease, epidemiology, renal replacement therapy.

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Diabetes mellitus is responsible for 895,000 deaths and 3,412,231 disability-adjusted life years worldwide, according to the GBD project. There are currently 170 million patients with diabetes: approximately 30% of them have diabetic nephropathy, and this proportion is even higher in some ethnic groups. The presence of CKD increases the risk of death of CVD in patients with diabetes.

In summary, the contribution of CKD to the global burden of disease may be currently underestimated by numbers provided by the GBD project.

PREVALENCE OF END-STAGE RENAL DISEASE

Renal registries offer an important source of information on several aspects of chronic kidney disease (CKD). They are useful in characterizing the end-stage renal disease (ESRD) population, describing the prevalence and incidence of ESRD and trends in mortality and disease rates, and investigating relationships among patient demographics, treatment modalities, and morbidity. In summary, renal registries are very useful to gain insight on the burden of kidney diseases and allow comparisons among countries [4–6].

Unfortunately, the quality of these national registries is uneven. For example, some registries are updated yearly, and data reflect variations of the ESRD population almost in real time. Other registries are updated less promptly. The items covered by questionnaires are not the same in all registries, and the completeness of data is not even; in some countries not all dialysis facilities answer to the questionnaire. In summary, renal registries are a very important tool to measure the capability of nations to provide renal replacement therapy (RRT) and also allow international comparisons, even considering the limitations mentioned previously.

We know much less about the prevalence and incidence of ESRD in those countries in which a regular national registry is not available. For some countries, data are provided by small observational series or rely on reports from personal experience of kidney physicians, but the quality of these data is uneven [7].

A recent global estimate of the global burden of ESRD was provided by Moeller and colleagues [8]. According to their survey, which included 122 countries, the approximate total number of patients on RRT is over 1.4 million. More than 80% of patients on RRT live in Europe, North America, and Japan.

There is a wide variation in prevalence rate, expressed as number of patients per million population, among countries. There is a strong relationship between prevalence rate and per capita income, and governmental infrastructure, which can influence both the availability and quality of dialysis and transplantation services.

The prevalence rate of RRT is 644 patients per million people in the 15 countries of the European Union [9], where the average gross income is over US \$22,000 per capita, as compared with a prevalence rate of 166 patients per million population in Central and Eastern European countries, where the average per capita income is US \$4480 [10].

If we take more extreme examples, the dependence of availability of dialysis is even more striking. Prevalence rate of ESRD is 582 patients per million people in Finland, which had an average income of US \$25,130 in the year 2000, and as low as 52 patients per million people in Bangladesh, where the average income is only US \$370 per capita [6].

Treatment of ESRD is a low priority for cash-strapped public hospitals and in the absence of health insurance plans. In India and Pakistan, less than 10% of all patients receive any kind of RRT [11]. The vast majority of patients starting hemodialysis dies or stops treatment because of cost constraints within the first 3 months. Although renal transplantation is the cheapest option, only about 5% of all patients with ESRD have a transplant.

ESTIMATED PREVALENCE OF KIDNEY DYSFUNCTION

Renal registries record data of patients who are at the last stage of kidney disease. Much less is known about the prevalence of earlier stages of CKD, when symptoms may be mild or neglected by patients or their caring physicians. Indeed, it has been acknowledged that the majority of individuals at early stage of CKD have gone undiagnosed and undertreated. Poor standardization of CKD definition has hampered the assessment of the burden of CKD even in high-income countries. Late detection of CKD is a lost opportunity for application of therapeutic measures shown to retard progression of CKD.

An estimate of the prevalence of CKD in a high-income country has been provided by the Third National Health and Nutrition Examination Survey. The survey was conducted from 1988 to 1994 by the National Center for Health Statistics of the Centers for Disease Control in the

United States [12]. A sample of 15,625 noninstitutionalized individuals aged 20 years and older was analyzed.

The estimated prevalence of CKD is 11% of the adult population in the United States (19.2 million). By stage, an estimated 5.9 million have stage 1 CKD (persistent albuminuria with normal glomerular filtration rate), whereas the remaining 13 million have variable degrees of kidney dysfunction, from mild to severe functional impairment. A sizeable proportion of these patients will eventually progress toward ESRD and will require RRT. Early detection of CKD is therefore important for implementing all available measures that are known to retard or arrest loss of renal function, and also for forecasting the need of dialysis in a given region or country.

GLOBAL PERSPECTIVES IN RRT

Although there is a lack of uniform data around the world, the total number of those who need RRT is growing in all high-income countries and also in upper middle-income countries.

In the United States in 2003, 360,000 people with ESRD were on RRT. There were 150,000 10 years ago, and according to a recent forecast analysis there will be 650,000 10 years from now. The forecasted point prevalence of total ESRD counts had an exponential growth trend, whereas the forecasted incident counts demonstrated a more linear trend [13]. This different pattern of growth is probably attributable to improved survival rates for dialysis and transplantation: death rates are lower and patients are accumulated at a rate that exceeds reduced influx of new patients.

Growth in the ESRD population has relevant implications for health care systems. The 1-year cost per patient on maintenance hemodialysis is more than US \$52,000, and the cost for transplantation is approximately US \$18,500 [6]. In the United States, the expenditure of Medicare for dialysis is 5% of total budget but serves only 0.7% of patients assisted by Medicare [6]. In Europe, the proportion of the total health care budget absorbed by RRT varied in 1994 from 0.7% in the United Kingdom to 1.8% in Belgium, whereas the population with ESRD is only 0.022% to 0.04%, respectively, of the total population [14].

Although there are not similar studies in other countries, it is likely that in all high-income countries, the number of people requiring RRT will grow at a similar rate during the next decade.

It is interesting to examine the changing pattern of ESRD in Central and Eastern Europe [10]. Data collected from 15 Central and Eastern European countries documented an expansion of renal replacement in this region during the last decade. When these countries were associated with the former Soviet Union, the availability of RRT was very poor. From 1990 to 1996, a period

that followed profound socioeconomic changes in Central and East Europe from 1989, the number of hemodialysis centers increased by 56% and the number of centers performing peritoneal dialysis increased by 296%. The number of patients increased by 78% (hemodialysis) and 306% (peritoneal dialysis), respectively. Still, the total number of patients on dialysis (prevalence) and the number of those who initiate every year (incidence) are still different in the European Union and Central and Eastern Europe [9]. Such a great difference clearly underlines that socioeconomic status is the major determinant of availability of RRT.

Data for many of the low-income countries are not available, but given the prevalence of poor socioeconomic factors, the incidence of ESRD is likely to be greater than in high-income countries. In poor nations, for example in sub-Saharan Africa, economic and manpower factors dictate a conservative approach to therapy in most instances, but the majority of those with ESRD perish because of lack of funds; very few can afford regular maintenance dialysis and renal transplantation is often not available [15]. Limitations to regular maintenance dialysis include the paucity of dialysis units, restriction of those units to urban centers, and absence of government funding or subsidy and health insurance to cover high costs of dialysis. The few available units are plagued with multiple problems: old machines frequently break down, and there is an absence of adequate maintenance, technical support, and spare parts, and lack of consumables and frequent power outages.

In India and Pakistan, treatment of ESRD is a low priority for cash-strapped public hospitals, and in the absence of health insurance plans, or private insurance, less than 10% of all patients receive any kind of RRT [11]. The vast majority of patients starting hemodialysis dies or stops treatment because of cost constraints within the first 3 months, and less than 2% of patients are started on ambulatory peritoneal dialysis. Although renal transplantation is the cheapest option, only about 5% of all patients with ESRD end up having a transplant.

In summary, the incidence of ESRD is increasing worldwide at an annual growth rate of 8%, far in excess of the population growth rate of 1.3%. Nearly 1 million people or only 15% of the world population are receiving hemodialysis worldwide, 80% of whom are treated in Europe, North America, and Japan. Twenty percent are treated in 100 developing countries that make up over 50% of world population, and a sizeable proportion of people living in the poorest countries dies of uremia because of the complete lack of RRT.

MODALITY OF RRT

Modality of RRT varies widely around the world, and differences depend mostly on health care systems.

Hemodialysis is the most used modality of RRT, with a utilization rate that ranges from 40% of prevalent patients in Australia to 95% in Japan. The use of peritoneal dialysis is very low in Japan (only 5% of patients on prevalent dialysis) and very high in New Zealand (58.7%). In most countries, the percentage of patients on peritoneal dialysis ranges from 10% to 25% [6].

The use of kidney transplants also differs widely around the world. In 7 European countries and in North America, transplant prevalence rates are greater than 30 per million population [6]. The rate of functioning grafts is also very high in Europe and North America and is increasing over time, which indicates that there is an improvement in graft survival. There is also a growing attitude to perform transplantations in older patients. However, efforts to expand transplant programs are limited by organ availability, a problem that exists in all developed countries.

In low-income countries, the use of transplant as a modality of RRT is not widely available [16]. In Bangladesh, the prevalence rate of functioning graft is only 2.6 per million population. In India and Pakistan, only about 5% of all patients with ESRD receive a kidney transplant [11]. Living related donor transplants constitute 30% to 40% of all transplants in India, but there is a conspicuous gender bias with female donors donating kidneys to their male relatives. Cadaveric transplantation has yet to increase and accounts for less than 2% of all transplants. The enactment of legislation to regulate renal transplantation in India has not been able to prevent unrelated (paid) donor transplants, which constitute 60% to 70% of all renal transplants.

In North Africa (Egypt, Libya, Tunisia, Algeria, Morocco), renal transplantation, largely from live (often unrelated) donors, is offered to less than 5% of patients with ESRD [17].

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