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Chapter 2

# **End-Stage Renal Disease: Scope and Trends**

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## END-STAGE RENAL DISEASE DEFINED

The primary functions of the kidney are to remove waste products generated by the body's metabolism and to regulate the body's balance of fluid and electrolytes. *Chronic renal failure* refers to the permanent deterioration of the kidney's ability to adequately perform these functions, and *uremia* refers to the symptomatic phase of renal failure. The toxic products that cause the symptoms of uremia have not been fully elucidated. Candidates include small molecules such as urea and creatinine that come from the breakdown of proteins and so-called middle molecules (substances with molecular weights of around 5,000). The exact nature of middle molecules remains obscure as does their importance.

Renal function is classically measured in terms of the ability of the kidney to clear urea or creatinine from the blood. *Clearance* of a specific sub-

stance is defined as the volume of plasma containing an amount of the substance equal to that removed per unit of time into the urine or dialysate. For example, if in 1 minute the urine excreted by the kidneys contains 50 mg of urea (volume not considered), and if the concentration of urea in the plasma were 50 mg per 100 ml, then the clearance would be 100 ml/min. Normal clearance values are 40 to 80 ml/min for urea and 80 to 125 ml/min for creatinine. Values below 5 ml/min for creatinine are generally judged to be an absolute indication for dialysis treatment, though this criterion is not universally accepted. The presence of symptoms of uremia, such as nausea or shortness of breath, or deleterious physical findings, such as mental stupor, pleural fluid, or bone disease, may lead physicians to begin treatment at higher levels of residual renal function.

## PREVALENCE OF END-STAGE RENAL DISEASE

The prevalence of end-stage renal disease (ESRD) is usually equated to the number of patients receiving chronic renal dialysis rather than to the number of people with any given level of renal failure. In the United States, where access to treatment has been made essentially universal because of Medicare's ESRD program, this assumption has some validity. Other countries, however, have established restrictive criteria for admission to chronic dialysis programs. In these countries, including several in Western Europe, dialysis rates substantially underestimate the true prevalence of disease. Moreover, patients who have undergone successful renal transplantation are removed from the ESRD pool of patients by this definition, even though they remain on immunosuppressive therapy and are susceptible to

substantial risks and infectious complications as a result.

An estimated 70,000 persons in the United States were receiving chronic dialysis at the end of 1982, including 65,438 enrolled in the ESRD program and an additional 4,000 to 5,000 persons who are treated by the Veteran's Administration or by State programs. Patients diagnosed with ESRD for the first time during 1982 numbered slightly fewer than 23,000, and the net increase in patients on chronic dialysis during 1982 was 6,212 after accounting for deaths, transplants, and returns to chronic dialysis after rejection of transplanted kidneys (see table 2-1).

The size of the chronic dialysis population is projected to increase by about 5 percent per year

**Table 2-1.—Estimated Prevalence and Incidence of End-Stage Renal Disease in the United States, 1982**

Prevalence:		Losses:	
Dialysis population on Jan. 1, 1982.....	58,948	Deaths:	
Incidence:		Center dialysis. . . . .	11,018
Started on dialysis for first time ever:		Home dialysis . . . . .	1,484
Center dialysis. . . . .	20,098	Recovered kidney function:	
Home dialysis . . . . .	2,699	Center dialysis. . . . .	744
Restarted on dialysis:		Home dialysis . . . . .	78
Center dialysis. . . . .	493	Received transplant:	
Home dialysis . . . . .	53	From center dialysis.. . . .	4,078
Returned to dialysis after transplant:		From home dialysis . . . . .	682
Center dialysis . . . . .	1,415	Discontinued dialysis (? reason):	
Home dialysis . . . . .	148	Center dialysis. . . . .	559
	24,906	Home dialysis . . . . .	51
			18,694
		Prevalence <sup>m</sup>	
		Dialysis population on Dec. 31, 1982 . . . . .	65,160 <sup>a</sup>

<sup>a</sup>Differs from the 65,785 reported in the survey summary table for undefined reasons, perhaps related to Missing data for some categories

SOURCE: ESRD Medical Information System—Facility Survey Tables (Jan. 1-Dec. 31, 1982).

between 1980 and 1990 and, thereafter, decline gradually to a growth rate of 1 percent per year by 2020 (11). Many factors will affect these projections, including changes in the age distribution of

the population, changes in the incidence of ESRD, changes in the mortality rates of individuals on chronic dialysis, and changes in the use rate and success of renal transplantation.

## MEDICARE'S END-STAGE RENAL DISEASE PROGRAM

The ESRD program was authorized in the Social Security Amendments of 1972 (Public Law 92-603) and was implemented in 1973. The program recognized the availability of life-saving, though imperfect, treatment for ESRD by hemodialysis and renal transplantation and the catastrophic financial consequences of these treatments for the afflicted individuals. For some analysts, the ESRD program provided a limited test of issues relevant to universal national health insurance.

The program's growth has been dramatic. In 1974, 16,000 persons were enrolled, and the cost to U.S. taxpayers was about \$250 million. By 1981, enrollees had grown to over 64,000 at a cost of \$1.6 billion. The annual growth rate was 42 percent between 1974 and 1975, 24 percent between 1977 and 1978, and 11 percent between 1980 and 1981 (11). This decreasing rate of growth reflects primarily the success of the program in enrolling the pool of patients with ESRD who previously had been untreated or were defraying the cost of treatment in other ways.

About 93 percent of persons with ESRD are eligible for benefits (9). Persons covered by the armed services, or by certain State or private insurance programs are exceptions, while many veterans have dual entitlement to the Veteran's Administration health care system and Medicare's ESRD program,

The ESRD program covers not only the costs of dialysis or renal transplantation but also provides the full spectrum of Medicare benefits whether or not they directly relate to the care of ESRD or its complications. In 1979, 55 percent of ESRD program costs were estimated to be for outpatient dialysis services, 29 percent for hospital care, 15 percent for physician services, and 1 percent for other miscellaneous items (12). Escalation in the total costs of the program reflects primarily the increasing numbers of persons enrolled and the increasing costs of hospitalization rather than increases in the costs of dialysis. Reimbursement rates for dialysis have, in fact, been frozen since 1979.

## CLINICAL CHARACTERISTICS AND OUTCOMES OF PERSONS ENROLLED IN THE ESRD PROGRAM

New enrollees in 1980 were older, more likely to be black, and more likely to have diabetic nephropathy than enrollees in earlier years. The proportion of the ESRD population having diabetic nephropathy, for example, increased from 7 percent in 1973 to 16 percent in 1977 and to 22 percent in 1980 (11). This trend toward increased enrollment of diabetics in the United States stands in contrast to other countries where diabetes, until recently, has often been an indication for withholding therapy.

Survival of patients on chronic dialysis remained stable between 1977 and 1980, with slightly over 80 percent of patients surviving 1 year and 54 to 57 percent surviving 3 years (11). Survival varied considerably according to the age of the patient, however, with 1-year survival after the onset of renal failure during 1973-79 ranging from 88 percent in patients 24 years of age or younger to 64 percent in those over 75 years of age. Corresponding 5-year survival rates were 64 and 22 percent, respectively. These figures exclude renal transplant patients (11). Patients with

a primary diagnosis of glomerulonephritis fared considerably better than those with a diagnosis of diabetic nephropathy (5-year survival of 47 percent vs. 21 percent).

The survival rates between 1977 and 1980 were stable despite trends toward enrolling persons who were at higher risk of mortality by virtue of being older and more likely to have diabetic nephropathy. Compensatory improvements in dialysis technology or general medical management may account for the stability of survival rates, but no direct evidence on this point is available.

Persons enrolled in the ESRD program, excluding those receiving renal transplants, were hospitalized an average of 1.6 times during 1981 for a total of 16.7 days (11). Hospitalization rates were age dependent and ranged from an average of 12.8 days in persons 25 years of age or younger to 20.3 days in persons 65 years or older. ESRD program beneficiaries spent more than four times as many days in the hospital than other Medicare recipients (45).

## TRENDS IN THE USE OF CHRONIC DIALYSIS MODALITIES

Dialysis can be provided either in centers located in hospitals or in independent facilities or can be performed at home. Hemodialysis (HD) and intermittent peritoneal dialysis (IPD) may be performed either in centers or in the home, while continuous ambulatory peritoneal dialysis (CAPD) is solely a home technique. In 1980, 47 percent of the chronic dialysis population received dialysis in hospital centers, 39 percent in independent centers, and 14 percent at home. Since that time, the proportion of patients on home dialysis has increased steadily to 18 percent in 1982, primarily as a result of the increased use of CAPD. About 32 percent of home dialysis patients were on CAPD at the end of 1980, 47 percent by the end of 1981, and 56 percent at the end of 1982.

More than two-thirds of all home dialysis patients were estimated to be on CAPD by March 1983 (46).

Dialysis rates and the utilization of home dialysis techniques vary widely among the States (38). In 1979, the number of patients dialyzed per million of population ranged from a low of 20 (Wyoming) to a high of 383 (Hawaii). Even among States with populations of 3 million or more (a population size chosen to minimize statistical fluctuations), the rate varied from 119 per million (Kentucky) to 282 per million (New York). Use of home dialysis at the same time varied from zero (North Dakota, South Dakota, and Wyoming) to over 40 percent (Indiana, Utah, and Washington).

Complex interactions of patient characteristics, demographic factors, physician acceptance, and entrepreneurial motivations, no doubt, underlie both variations in dialysis rates and variations in the popularity of home dialysis.

Future increases in the use of home dialysis will depend on these same factors and will may be influenced by the financial incentives created by Medicare's 1983 composite reimbursement rates that favor home dialysis.