

Chapter XII

International Comparisons of ESRD Therapy

Key Words:

Dialysis modality

ESRD incidence

ESRD-International comparisons

ESRD prevalence

ESRD registry

Renal transplantation

The current international chapter draws attention to many broad issues concerning the status of End-Stage Renal Disease (ESRD) worldwide, including trends in the utilization of renal replacement therapies among countries, whose registries shared their data. The establishment around the world of several national and international registries of patients on renal replacement therapy allows healthcare providers a unique opportunity to identify populations who are receiving ESRD therapy and to appraise current efforts and successes of delivering effective health care to patients with ESRD.

The data collected may be purposefully used for:

- 1) Identifying trends in incidence and prevalence of ESRD across national boundaries.
- 2) Identifying the utilization and trends over time of various modalities of renal replacement therapy among countries.
- 3) Comparing the efficacy of currently available methods for renal replacement therapy within and among countries.
- 4) Comparing survival rates in patients on different forms of ESRD therapy within and among countries.

However, the use of data from large renal registries to make important observations on the health of patients with ESRD is contingent upon certain prerequisites. First and foremost, the database should be a validated one, as the extent and accuracy of the data collected may vary widely and present a threat to external validity. The USRDS covers more than 93 percent of all patients treated for ESRD in the United States through mandatory counts of patients paid for by Medicare. Non-Medicare patients are also included in the database as dialysis facilities in the United States have been required to complete a HCFA Medical Evidence Form on all incident patients since 1995. Several international renal registries function on the basis of voluntary submission of data. As a result, data collection may be more limited in some of them. The largest European Registry of ESRD patients, the European Dialysis and Transplant Association (EDTA) Registry, has been in existence since 1964. It provides data on 36 countries of European and Mediterranean coastal regions. The percentage of patients included in the database varies from country to country, thus there may be under-representation of patient subgroups. Although voluntary submission of data may not be the optimal method for data collection, some renal registries have reported a 100 percent response rate to facility and patient questionnaires. The Japanese Society of Dialysis Therapy report a 99.8 percent response rate to their

1994 survey whereas the European registry reports an overall response rate of 66 percent to a center questionnaire and 55 percent to a patient questionnaire in 1994 (Valderràbano).

International comparisons of data on ESRD patients and renal replacement therapy should be interpreted in light of potential differences in acceptance to therapy, patient demographics, socioeconomic burdens, and national healthcare legislature (Kjellstrand). Access to different forms of renal replacement therapy, in addition to the quality and quantity provided, is in part dependent on the healthcare system of the country. Such variables cannot be adjusted for easily in most statistical analyses.

Data Source

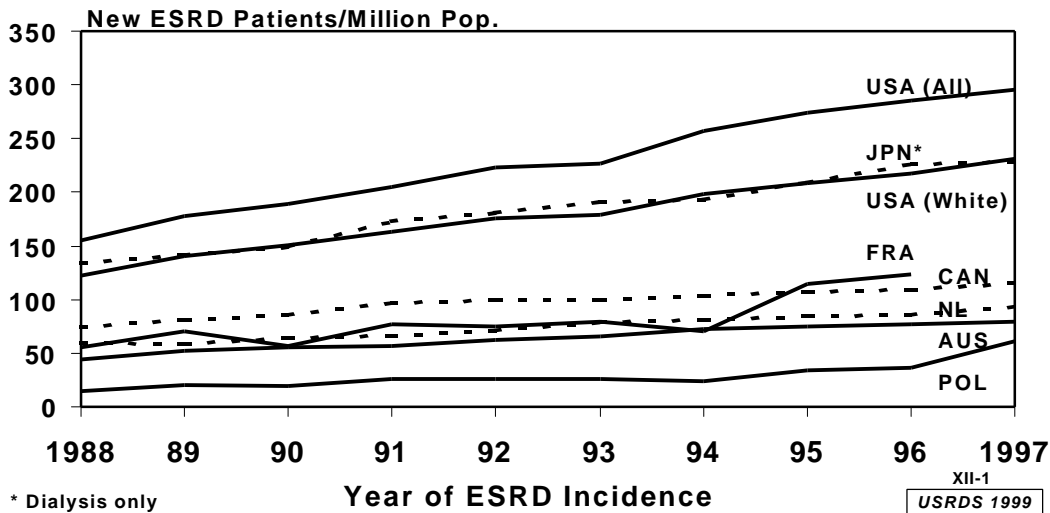
The international data in this chapter are based on reports from the following ESRD patient registries: the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA), the Belgian Renal Registry (Collart), the Brazilian Dialysis and Transplant Registry (Garcia), the Canadian Organ Replacement Registry (CORR), the Chilean Dialysis Registry (Poblete-Badal), the Danish Dialysis and Transplant Registry, the French Renal Registry

(Canaud), the German QuaSi-Niere (Frei), the Hong Kong Renal Registry, the Irish National Transplant Registry, the Italian Renal Registry (Colosanti), the Japanese Society of Dialysis Therapy (Maeda), the Netherlands Dialysis Registry, Organizacion Nacional de Transplantes, the Polish Dialysis Registry (Rutkowski), the Singapore Renal Registry (Woo), the Swedish Renal Registry (Schon), United Kingdom Transplant Support Service Authority, the USRDS, and the Uruguyan Renal Registry (Mazzuchi).

Incidence of Treated ESRD

The incidence of treated ESRD (annual counts of new patients per million population) continues to increase worldwide (Figure XII-1). The rates of newly treated ESRD vary from country to country, which may reflect differences in acceptance and referral patterns among countries. During 1997 the incidence rate was highest in the United States at 296 patients per million population. Japan and Singapore have the next highest incidence rates (229 and 158 patients per million population respectively). In all selected countries the number of new ESRD patients continues to climb annually, in part, indicating a greater acceptance of patients. In Poland, a sharp increase in the incidence of new ESRD was observed,

Treated ESRD Incidence Rates for Selected Countries, 1988-97



* Dialysis only

Figure XII-1

Treated ESRD incidence rates per million population (unadjusted) for Australia, Canada, selected European countries, Japan (dialysis patients only), and the U.S. (total and white-only patients) for 1988-1997. See Table XII-1 for country codes. Source: Reference Table A.3 for U.S. data.

Percent of Incident ESRD Patients with Diabetic Nephropathy for Selected Countries, 1997

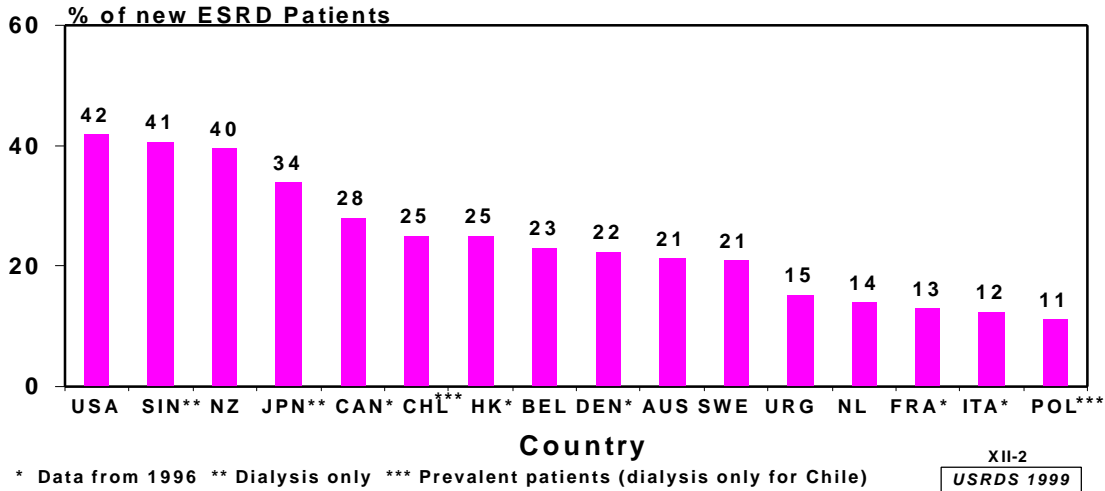


Figure XII-2

Percentage of incident ESRD patients with diabetic nephropathy as a cause of ESRD for Australia, New Zealand, Canada, Chile (prevalent patients, dialysis only), Uruguay, Japan (dialysis only), Singapore (dialysis only), Hong Kong, Poland (prevalent patients), selected European countries, and the U.S. for 1997. (Data from Canada, Denmark, France, Hong Kong, and Italy are from 1996.) See Table XII-1 for country codes. Source: Reference Table A.1 for U.S. data.

in the period 1996-97, probably indicating improved health resources with greater acceptance of new ESRD patients. For better comparisons with European countries, the United States incidence rates are shown not only for the total but also for the White-only sub-population that is mostly of European descent. These rates are not adjusted for international differences in age distributions. An increase in international incidence rates of treated ESRD may reflect changes in acceptance to ESRD therapy, improved survival from other diseases (competing risk), and/or an increase in the true incidence of renal disease.

A description of the fraction of incident ESRD patients whose cause of ESRD was diabetes serves to emphasize two issues. First, the acceptance to ESRD therapy of sicker patients, and secondly, an indication of comorbid conditions among patients starting renal replacement therapy. Figure XII-2 shows for selected countries the percentage of new ESRD patients who have diabetic nephropathy. As the figure illustrates, there is wide variation from 11 percent to 42 percent. In the United States, Singapore, and New Zealand, a greater proportion of incident patients had diabetes as their primary diagnosis than was observed in other countries. In fact, in these countries, the fraction of

ESRD patients with diabetes as a primary cause of ESRD was almost twice that of many European countries (Belgium, Denmark and Sweden). These differences in the rates of acceptance of diabetic ESRD patients among countries might explain differences in survival that exist among countries since those with diabetic more likely to have greater comorbidity.

Prevalence of Treated ESRD

The prevalence of ESRD is an indicator of the overall burden of disease on the health resources of a nation. Both incidence rates of disease and the survival rates (effectiveness of currently available therapies) influence it. The point prevalence counts and prevalence rates of ESRD patients alive and registered on treatment as of December 31, 1997 are described for selected countries in Table XII-1. Japan records the highest prevalence rate (1,397 per million population) during this period, followed by the United States. Greater incidence rates of treated ESRD in the United States compared to Japan, in addition to a greater proportion of those treated with functioning renal allografts, would lead us to expect that the prevalence of ESRD in the United States

Treated ESRD Prevalence and Incidence Counts and Rates per Million Population for Selected Countries, 1997

Country	Code ¹	Prevalence		Incidence	
		Counts (n)	Rate ²	Counts (n)	Rate ²
U.S.A.	USA	304,083	1,131	79,102	296
Japan ³	JPN	175,988	1,397	28,870	229
Singapore ³	SIN	1,968	646	480	158
Germany ⁴	GER	55,762	683	12,524	153
Uruguay	URG	2,154	669	435	135
Israel ⁴	ISR	2,265	412	742	135
Belgium	BEL	7,324	720	1,274	125
France ⁴	FRA	36,620	634	7,109	123
Sweden	SWE	5,690	643	1,047	118
Canada	CAN	20,774	690	3,487	116
Italy ⁴	ITA	34,830	690	5,711	113
Chile	CHL	6,501	455	1,523	107
Hong Kong ⁴	HK	3,337	530	640	102
Denmark ⁴	DEN	2,741	527	510	98
Netherlands	NL	8,735	561	1,459	94
New Zealand	NZ	1,895	506	318	85
Brazil ³	BRZ	34,061	214	12,960	81
Australia	AUS	9,845	530	1,468	79
Poland	POL	8,590	223	2,373	62

¹ Other country codes used in this chapter are:

UK (United Kingdom) **SPN** (Spain) and **IRL** (Ireland).

² Patients per million population, no adjustments; ranked by incidence rate

³ Dialysis patients only (approximately 99% of ESRD in Japan)

⁴ Data are for 1996

Source: Reference Tables A.1, A.3, B.1, B.5 for U.S. data.

USRDS 1999

Table XII- 1

should exceed that in Japan. That is not the case. This observation suggests a better survival among Japanese ESRD patients as has been reported in two previous studies (Held 1990; Held 1994). A diverse group of countries has a prevalence rate close to the third highest of Belgium and includes Canada, Italy

Germany, Uruguay, Singapore, Sweden, and France (720-634 per million population). The incidence rates for these countries vary from 158 to 113 per million population. Poland is an example of low prevalence of ESRD reflecting its low treated ESRD incidence rate.

Percent of Prevalent Dialysis Patients Receiving Home Hemodialysis for Selected Countries, 1997

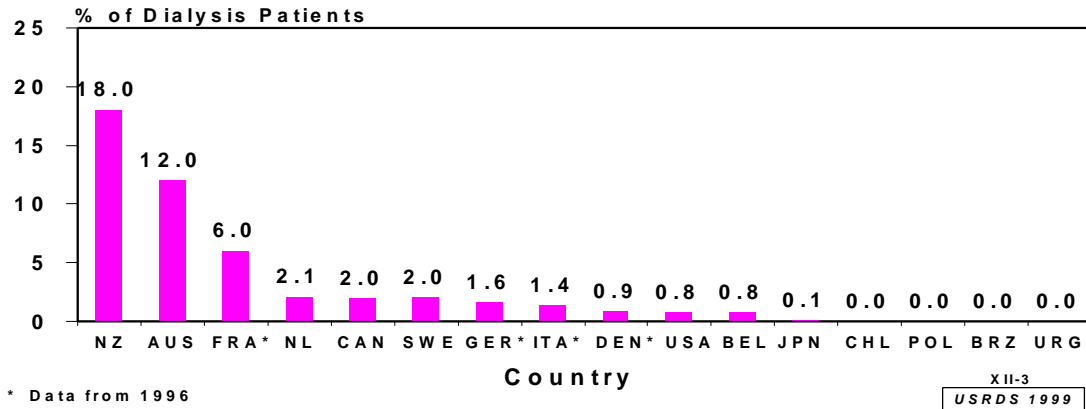


Figure XII-3

Percentage of all prevalent dialysis patients being treated with home hemodialysis in Australia, New Zealand, Canada, Chile, Brazil, Uruguay, Israel, Japan, selected European countries, and in the U.S. on December 31, 1997. (Data from Israel, France, Germany, and Denmark are from 1996.) See Table XII-1 for country codes. Source: Reference Table C.1 for U.S. data.

Dialysis Modalities

The optimal dialytic modality of renal replacement therapy for dialysis patients is the subject of some controversy; while some favor hemodialysis, others are the protagonists of peritoneal dialysis.

Although many consider home hemodialysis the optimal treatment option, its utilization has decreased in recent years. Figure XII-3 shows the utilization of home hemodialysis among dialysis patients in selected countries. New Zealand has a relatively high fraction of patients using home hemodialysis with 18 percent of their dialysis population receiving this form of treatment. The corresponding percent for

Percent of Prevalent Dialysis Patients Receiving CAPD or CCPD for Selected Countries, 1997

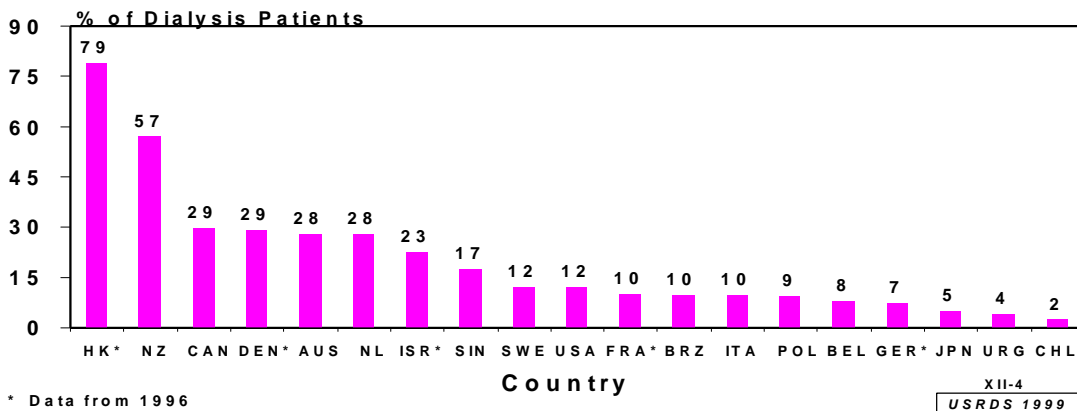


Figure XII-4

Percentage of all prevalent dialysis patients being treated with CAPD or CCPD in Australia, New Zealand, Canada, Japan, Hong Kong, Singapore, Brazil, Chile, Uruguay, Israel, selected European countries, and in the U.S. on December 31, 1997. (Data from France, Germany, Israel, Hong Kong, and Denmark are from 1996.) See Table XII-1 for country codes. Source: Reference Table C.1 for U.S. data.

Trends in Utilization of CAPD/CCPD for Selected Countries, 1991/92 versus 1996/97

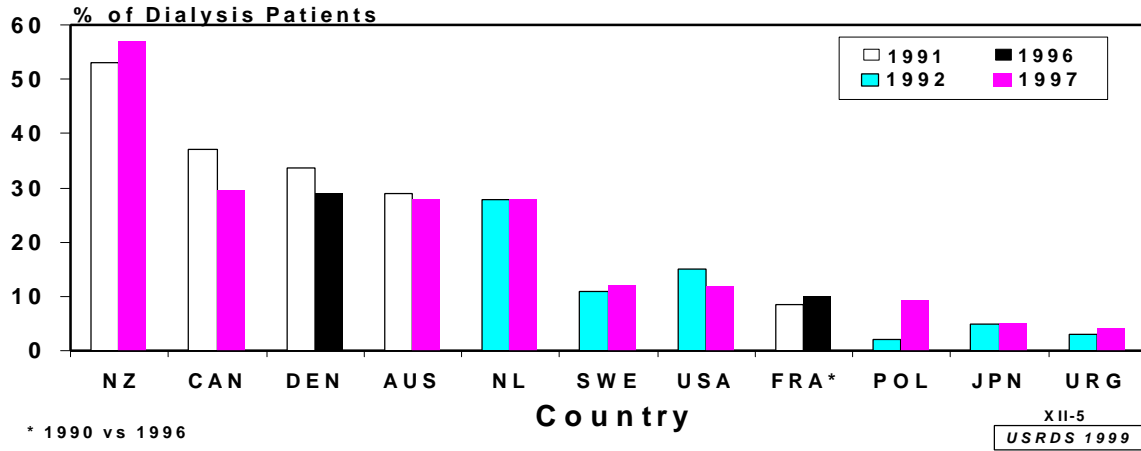


Figure XII-5

Percentage of dialysis patients treated with CAPD or CCPD for Australia, New Zealand, Canada, Japan, Uruguay, selected European countries, and in the U.S. in 1991 or 1992 and 1996 or 1997. (Data from France, are from 1990 and 1996.) See Table XII-1 for country codes. Source: Reference Table C.1 for U.S. data.

Australia and France are 12 and 6 percent respectively.

Most other selected countries utilize this form of renal replacement therapy to a lesser degree ranging

from 2.1 percent to less than 1.0 percent. Home hemodialysis is reported to be associated with a better survival than in-center hemodialysis even when adjusting for some comorbid conditions (Woods). Although it demands that patients be more vigilant

Trends in Utilization of Home Hemodialysis for Selected Countries, 1991/92 versus 1996/97

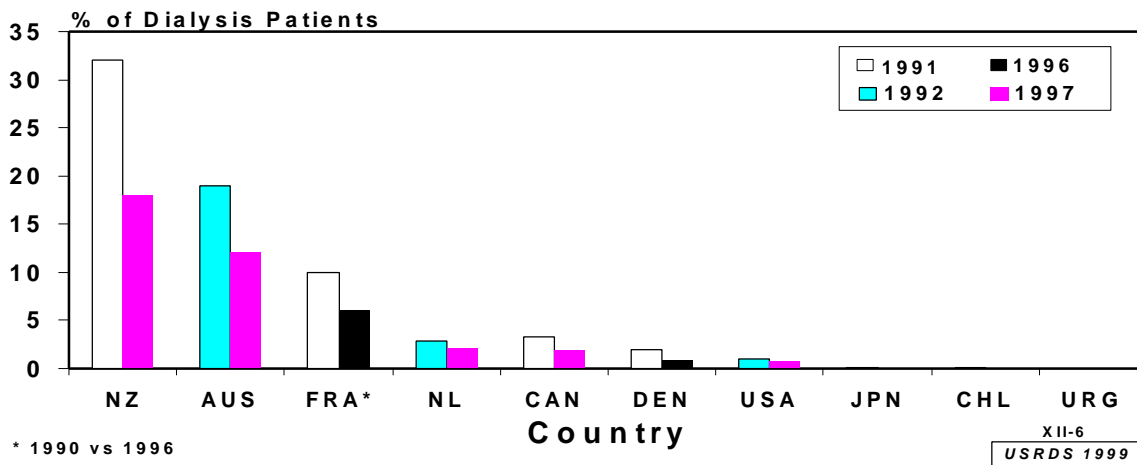


Figure XII-6

Percentage of dialysis patients treated with home hemodialysis for Australia, New Zealand, Canada, Chile, Uruguay, Japan, selected European countries, and in the U.S. in 1991 or 1992 and 1996 or 1997 (Data from France, are from 1990 and 1996.) See Table XII-1 for country codes. Source: Reference Table C.1 for U.S. data.

and take greater responsibility over their treatment, it nevertheless permits greater freedom and offers greater opportunity for rehabilitation.

Peritoneal dialysis has had wide acceptance particularly in Hong Kong, New Zealand, and Canada. Figure XII-4 illustrates the international differences in utilization of peritoneal dialysis as a treatment option as of December 31, 1997. In Hong Kong and New Zealand, peritoneal dialysis remains the predominant mode of therapy among dialysis patients. Although geographic distances to a dialysis center may explain its wide acceptance in New Zealand, non-geographic factors are likely to influence its utilization in Hong Kong. While it remains a major form of renal replacement therapy in some European countries (Denmark, Austria, and Netherlands), its acceptance in other countries, such as Japan, Uruguay, and Chile is much less. National Healthcare policies and geographic factors are likely determinants of its use in various countries.

Trends in the utilization of peritoneal dialysis have shown an overall increase from 1984 to 1994 as reported in the 1997 USRDS Annual Data Report (USRDS 1997). More recently, over the past 8 years, there has been only a modest increase in the fraction of prevalent dialysis patients using peritoneal dialysis

among selected countries (Figure XII-5). Five of the ten selected countries demonstrate an increase in peritoneal dialysis utilization. New Zealand and Poland have had the greatest increases while Canada, Denmark, and the United States showed a modest decline in the fraction of patients using peritoneal dialysis. The increased utilization of peritoneal dialysis as a form of renal replacement therapy in New Zealand was accompanied by a decline in the use of home hemodialysis. This trend is also observed in other countries, as peritoneal dialysis becomes more available and home hemodialysis is less used (Figures XII-5 and XII-6). In Japan, Chile, Uruguay, and the United States less than 1 percent of dialysis patients receive home hemodialysis. The reasons for these differences in practice patterns among countries are not entirely clear. Studies that specifically address these issues are currently in progress (International Dialysis Outcomes and Practice Patterns Study, IDOPPS). The international acceptance of peritoneal dialysis as a form of renal replacement therapy has been fairly stable, which suggests that peritoneal dialysis (with improved dialysis prescription) remains an alternative to hemodialysis.

Transplantation Rates for Selected Countries, 1997

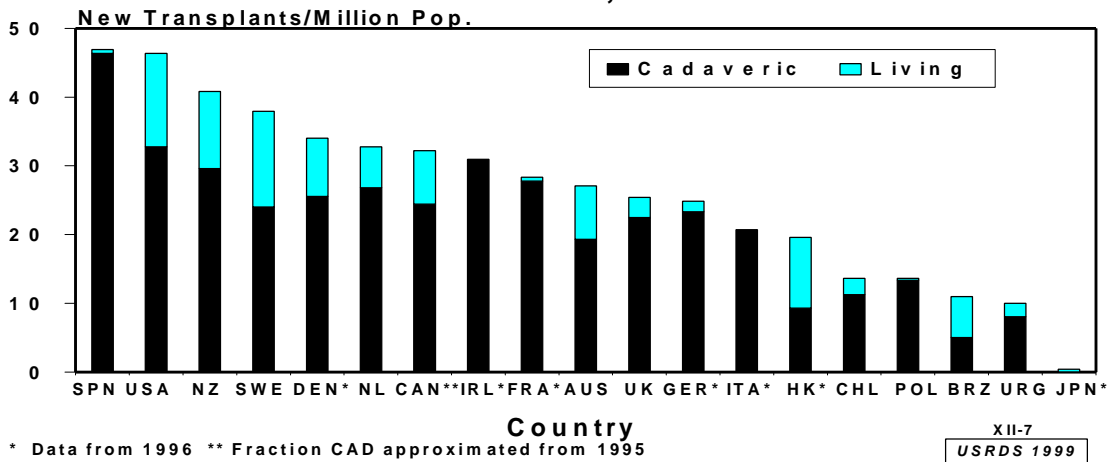


Figure XII-7

Transplantation rates (count of new renal transplants per million total population) in Australia, New Zealand, Canada, selected European countries, Japan, Hong Kong, Chile, Brazil, Uruguay, and in the U.S. during 1997, by donor type (cadaveric or living donor). (Data from Germany, Denmark, Ireland, France, Hong Kong, and Japan are from 1996) See Table XII-1 for country codes. Source: Reference Table F.1 for U.S. data.

Renal Transplantation

Kidney transplantation remains the most successful form of renal replacement therapy worldwide, offering patients the greatest potential to return to a healthy productive life. Despite this, transplant rates vary worldwide and are dependent on cultural, legal, and socioeconomic factors. This report uses each country's the general population as the denominator for transplantation rates to allow better comparisons of the rates among countries that accept different proportions of older patients for ESRD treatment. Although there has been a trend towards transplanting older patients, only a small fraction is currently transplanted. If the count of prevalent ESRD patients were used as the denominator for the transplantation rate, countries that accept higher proportions of older patients would have a relatively lower rate. As of December 31, 1997, transplant activity was greatest in Spain with 47 new transplants per million population (Figure XII-7). The United States, New Zealand, and Sweden had the next highest transplantation rates. In selected South American countries (Brazil, Chile, and Uruguay) and in Poland, transplantation rates were relatively low. Renal transplantation rates were lowest in Japan, which is likely a reflection of religious and cultural

attitudes.

Cadaveric transplantation rates and thus donation rates were highest in Spain, the United States, and Ireland.

Living donor transplantation continues to account for a lesser fraction of the total transplant activity in most of the selected countries. Living donor transplants account for a relatively high fraction in Japan, Hong Kong, Sweden, New Zealand, and the United States. Virtually no living donor transplants are performed in Ireland, Italy, and Poland.

Utilization of Transplantation

The percent of ESRD patients with functioning grafts on December 31, 1997 is shown in Figure XII-8. This percentage is dependent not only on transplant activity over previous years and subsequent graft survival (giving rise to a large numerator) but also on the size of the prevalent dialysis population. Thus in countries where elderly patients make up a sizable proportion of the dialysis population, the percentage of functioning grafts may appear spuriously low. To allow for better international comparisons an analysis using the general population

Percent of Prevalent ESRD Patients with a Functioning Transplant, 1997

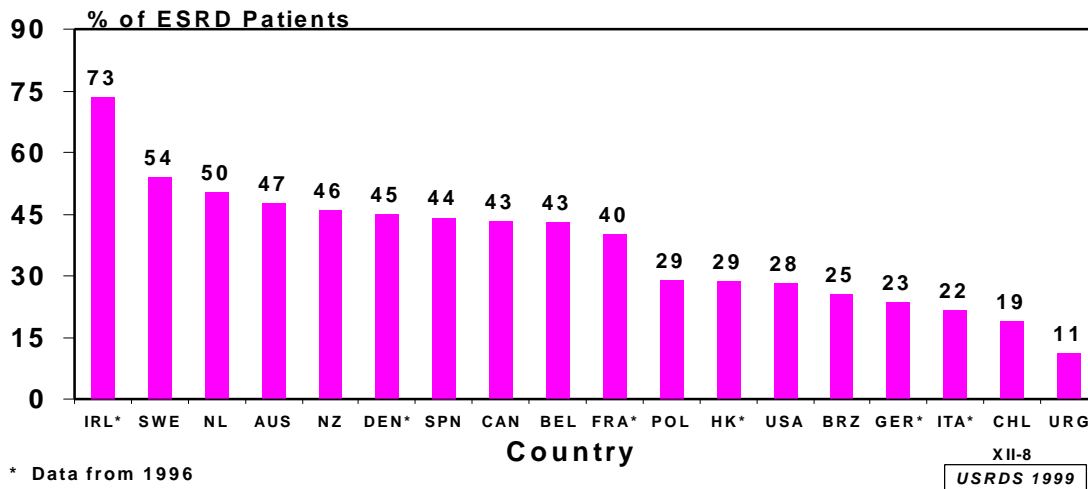


Figure XII-8

Percentage of prevalent ESRD patients with a functioning transplant for Australia, New Zealand, Canada, Chile, Brazil, Uruguay, Hong Kong, selected European countries, and the U.S. for 1997. (Data from Denmark, France, Germany, Hong Kong, Ireland, and Italy are from 1996.) See Table XII-1 for country codes. Source: Reference Table C.1 for U.S. data.

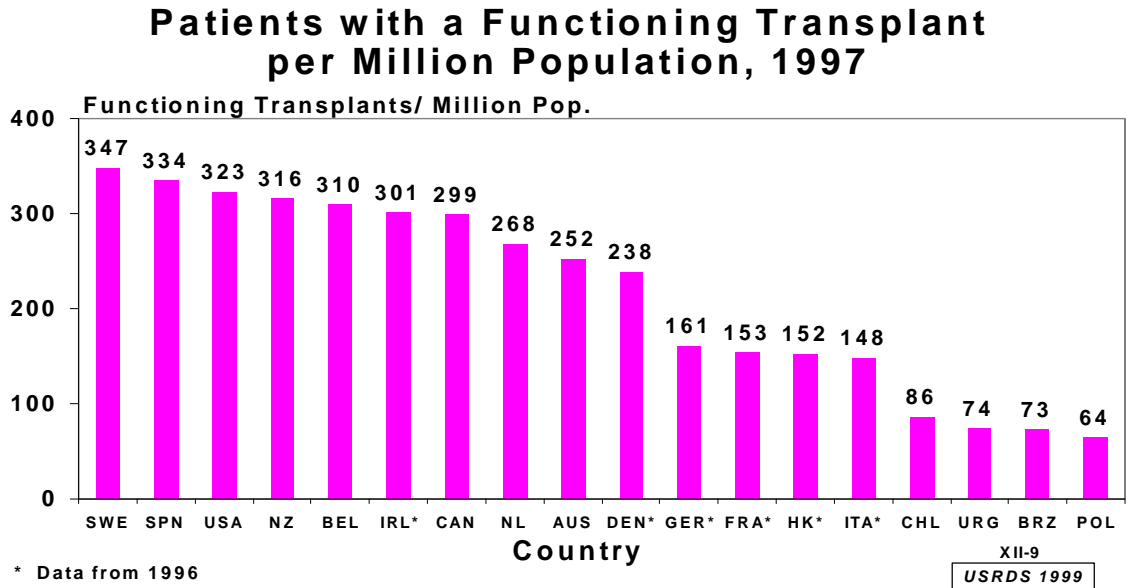


Figure XII-9

Patients with a functioning transplant per million population in Australia, New Zealand, Canada, Chile, Uruguay, Brazil, Hong Kong, selected European countries, and the U.S. for 1997. (Data from Denmark, Germany, France, Hong Kong, Ireland, and Italy are from 1996.) See Table XII-1 for country codes. Source: Reference Tables C.1 and J.1 for U.S. data.

as the denominator is also included (Figure XII-9). The percentage of ESRD patients with a functioning allograft is between 40 and 73 percent amongst most industrialized countries, although in the United States, Germany, and Italy much lower percentages are observed. Ireland has the greatest fraction of ESRD patients with a functioning transplant. There is a noticeable change in the rank order when the general population is used as the denominator (Figure XII-9). Sweden now leads the group followed by Spain and the United States. The prevalence of functioning transplants is between 148 and 310 per million in most other selected countries, although lower prevalence rates are observed in some countries. Lower transplantation rates may account for some of these differences as shown in figure XII-7. In addition an undercount of long term survivors in some countries may also be a contributory factor.

Trends in the Utilization of Renal Transplantation

As renal transplantation offers the best form of renal replacement therapy for patients with ESRD, it is desirable that growth in this area continues worldwide. Figure XII-10 illustrates the changes in transplant rates (number of transplants per million

population) for selected countries between 1992 and 1997. In some, notably Spain, the United States, Canada and Poland, there has been an overall increase in transplantation rates. In Ireland and Australia, the rate of transplant activity has remained stable. However in Japan, where living donor transplantation predominates, the reported transplant activity during 1996 was much lower than during 1992. Such disparity in international transplant rates reflects differences in national efforts at promoting transplantation as well as cultural and socioeconomic factors.

International Survival Comparisons

The goals for health workers caring for patients with ESRD are to improve outcomes, including survival and quality of life. Survival comparisons of ESRD populations among countries are difficult because of the many differences that exist among countries, such as differences in causes of ESRD, acceptance rates to dialysis, levels of comorbidities, and treatment differences. However, it is possible to adjust statistically for measured differences in patient characteristics and comorbid conditions. Such a study was carried out comparing patient survival among

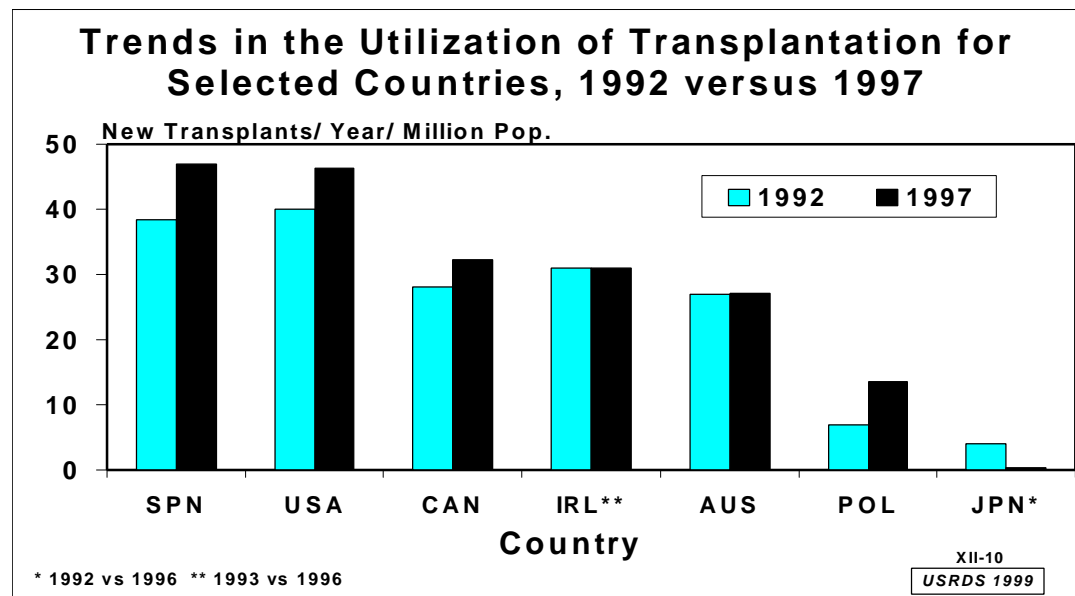


Figure XII-10

New transplants per year per million population for Australia, Canada, Japan, selected European countries, and in the U.S. for 1992 and 1997. (Data from Japan are for 1992 and 1996; data from Ireland are for 1993 and 1996) See Table XII-1 for country codes. Source: Reference Tables F.1 and J.1 for U.S. data.

patients with treated ESRD in the United States and the Lombardy Dialysis and Transplant Registry (Marcelli).

Since large differences exist among countries in the utilization of treatment modalities and in the acceptance of patients, particularly for diabetics and older age groups, it is difficult to interpret observed differences in overall mortality rates (Kjellstrand). Such survival analyses among countries must be approached with caution. Valid comparisons of data in national registries should only be attempted where adequate data collection methods exist and the accuracy of such information gathered can be attested. In addition, reasonable international comparisons should be carried out with an understanding of patient demographics and the proportion represented in the database. To overcome the problem of differences in transplantation rates some studies have focused on the survival comparisons for all ESRD (combining dialysis and transplant) patients (Held 1990), while others have analyzed results for dialysis patients as well as for all ESRD patients (Held 1992).

Future international comparative studies of survival will require a similar multivariate analysis with appropriate adjustment for differences in patient demographics, known risk factors and comorbid

conditions in order to isolate differences in outcomes that can be attributed to differences in treatment. Ideally, treatment differences can be related directly to patient outcomes, both within and across international boundaries, based on consistent data collection procedures. The accuracy of such adjustment is dependent on the quality and the uniformity of the data collected. There is increasing information regarding the data that are required in order to predict mortality among dialysis patients (Wolfe 1995). Future studies of this type will mandate prospective data collection among collaborating registries.

Important insights have already been gained from international comparisons of different health care systems (Held 1990, Nissenson) and health care delivery (Held 1992). A new prospective study of outcomes for hemodialysis patients in five European countries, Japan and the United States will likely provide new insights regarding patient outcomes with adjustment for case-mix and help understand the role of dialysis prescription and other practice patterns. The current trends in ESRD growth worldwide and requirements for improved delivery of renal replacement therapy necessitate an ongoing commitment to outcomes analysis. Such an opportunity is afforded by a meeting of international

registries in conjunction with the International Society of Nephrology Satellite Symposium on 'ESRD Throughout the World' in Uruguay (May 1999). This symposium is likely to provide new data and expand the current knowledge on international work in ESRD. The quantity and quality of ESRD care provided to ESRD patients may be enhanced by future international comparisons.

References

- ANZDATA Report 1998. Australia and New Zealand Dialysis and Transplant Registry. Editor: Disney APS, Adelaide, South Australia. 1999.
- Brazilian Renal Registry (Garcia V: Personal Communication) 1999.
- Canadian Organ Replacement Register (Fenton S: Personal Communication) 1999.
- Chilean Renal Registry (Poblete-Badal H: Personal Communication) 1999.
- Danish National Registry Report on Dialysis and Transplantation in Denmark 1996. The Danish Society of Nephrology, April 1997.
- De Stichting Registratie Nierfunctievervanging Nederland, De Ontwikkeling van het Nierfunctievervangingsprogramma in Nederland 1983-1996. Renine, Rotterdam, 1998.
- European Dialysis and Transplant Association. Report on Management of Renal Failure in Europe, XXV, 1995. *Nephrol Dial Transplant* 1996; 11 (Suppl1): 1-32 and (Briggs JD: Personal Communication).
- Frei U, Schober-Halstenberg HJ. Nierenersatztherapie in Deutschland. Projektgeschäftsstelle QuaSi-Niere. July 1998.
- Held PJ, Akiba T, Stearns NS, Marumo F, Turenne MN, Maeda K, Port FK. Survival of middle-aged dialysis patients in Japan and the U.S. In: Friedman EA, ed. *Death on Dialysis*. Kluwer Academic Publishers Hingham, MA. 1994, pp 13-23.
- Held PJ, Blagg, CR, Liska DW, Port FK, Hakim R, Levin NW. The dose of hemodialysis according to dialysis prescription in Europe and in the United States. *Kidney Int* 1992; 42 (Suppl 38): S16-S21.
- Held PJ, Brunner F, Odaka M, Garcia JR, Port FK, Gaylin DS. 5-year survival for end-stage renal disease patients in the United States, Europe, and Japan, 1982 to 1987. *Am J Kidney Dis* 1990; 15: 451-457.
- Lui, SF. Hong Kong Renal Registry Report 1996. Central Renal Committee. *Nephrology* 1997; 3: 577-581.
- Japanese Society for Dialysis Therapy (Maeda K: Personal Communication) 1999.
- Kjellstrand CM. International comparisons of dialysis survival are meaningless to evaluate differences in dialysis procedures. In: Friedman EA, ed. *Death on Dialysis*. Kluwer Academic Publishers Hingham, MA. 1994. pp 55-68.
- Marcelli D, Stannard D, Conte F, Held PJ, Locatelli F, Port FK. ESRD patient mortality with adjustment for comorbid conditions in Lombardy (Italy) versus the United States. *Kidney Int* 1996; 50: 1013-1018.
- Nissenson AR, Prichard SS, Cheng IKP, Gokal R, Kubota M, Maiorca R, Riella MC, Rottembourg J, Stewart JH. Non-medical factors that impact on ESRD modality selection. *Kidney Int* 1993; 43 (Suppl 1): S1-S8.
- Organizacion Nacional de Transplantes: Memoria de la Actividad de Donacion y Transplante 1997. Ministerio de Sanidad y Consumo.
- Polish Renal Registry (Rutkowski B: Personal Communication) 1999.
- Port FK, Wolfe RA, Mauger EA, Berling DP, Jiang K. Comparison of survival probabilities for dialysis patients versus cadaveric renal transplant recipients. *JAMA* 1993; 270: 1339-1343.
- Port FK. End-stage renal disease: Magnitude of the problem, prognosis of future trends and possible solutions. *Kidney Int* 1995, 48 (Suppl 50): S3-S6.
- Renal Replacement Therapy in France (Canaud, B: Personal Communication) 1998.
- Renal Replacement Therapy in Belgium (Collart F: Personal Communication) 1999.
- Renal Replacement Therapy in Uruguay (Mazzuchi N: Personal Communication) 1999.
- Swedish Renal Registry (Schon: Personal Communication) 1999.

The Irish National Transplant Registry (Conlon P: Personal Communication) 1999.

The Italian Registry of Dialysis and Transplantation (Colosanti G: Personal Communication) 1999.

United Kingdom Transplant Support Service Authority (Short H: Personal Communication) 1999.

United States Renal Data System. USRDS 1998 Annual Data Report, National Institutes of Health, National Institutes of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, April 1998.

Valderrábano F, Jones EH, Mallick NP. Report on the management on renal failure in Europe, XXIV, 1993. *Nephrol Dial Transplant* 10 (suppl 5): 1-25 1995

Webb RL, Port FK, Gaylin DS, Agodoa LYC, Greer J. Recent trends in cadaveric renal transplantation. In: Terasaki P, ed. *Clinical Transplants 1990*. UCLA Tissue Typing Laboratory, Los Angeles, CA. pp 75-87.

Wolfe RA, Mauger E, Held PJ, Golper T, Sarsitis I, Woods JD, Agodoa LYC, Port FK. Patient mix and mortality in chronic hemodialysis. *J Am Soc Nephrol* 1995, 6: 568.

Woo K, Lee GSL: First Report of the Singapore Renal Registry 1997. Singapore. August 1998.

Woods JD. Port FK. Stannard D. Blagg CR. Held PJ. Comparison of mortality with home hemodialysis and center hemodialysis: a national study. *Kidney Int* 49:1464-1470, 1996.