

**Scottish Renal Registry  
Report  
2000-2001**

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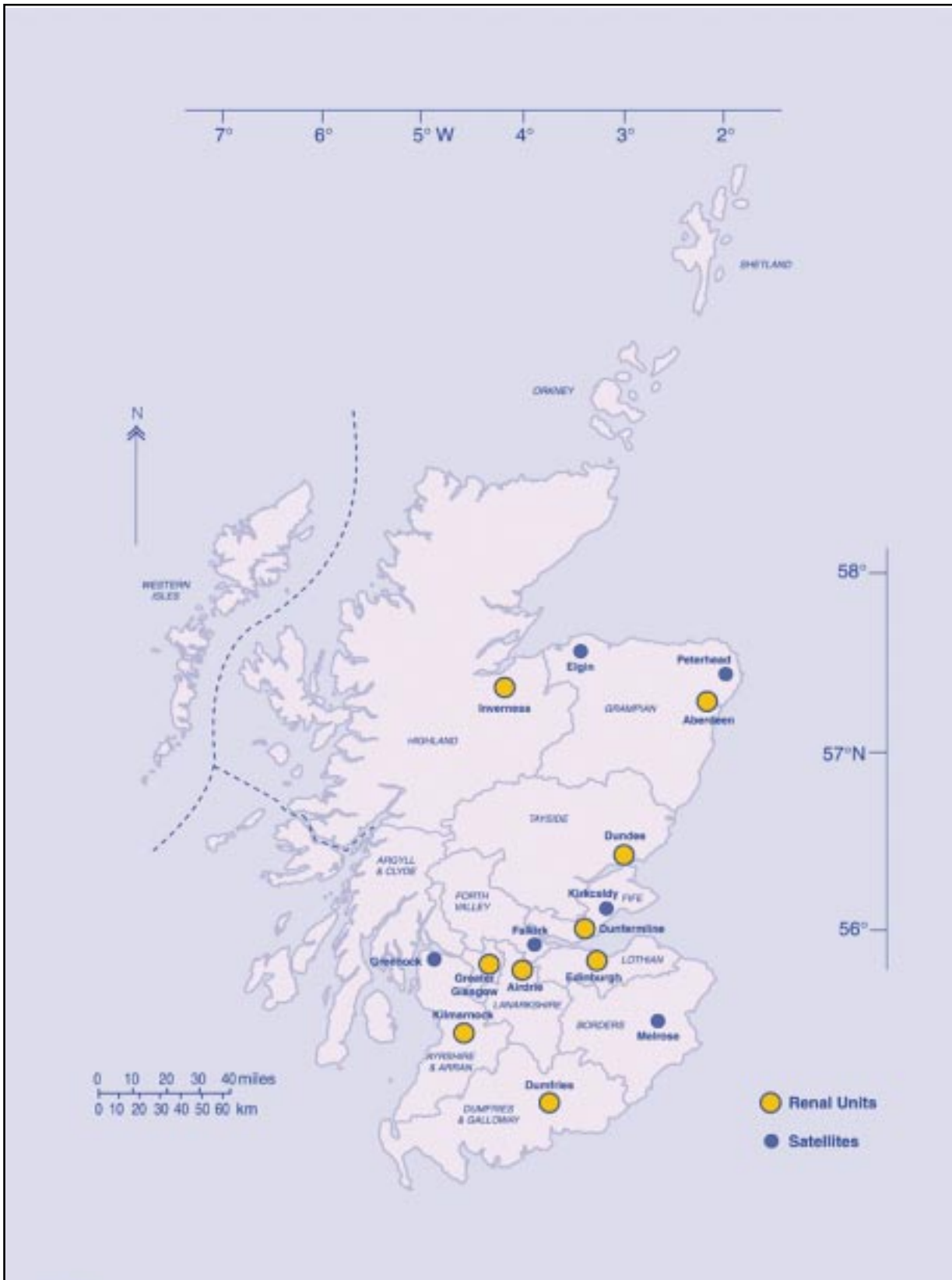
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## Map of Scotland showing renal units and satellite units



## Acknowledgements

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Some data in this report are reproduced with kind permission from the Registrar General for Scotland.

Keith Simpson, Consultant Physician and Chair of the Scottish Renal Registry

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Report Editorial Group

1 September 2003

## EXECUTIVE SUMMARY

The first patient was dialysed for end stage chronic renal haemodialysis disease in Scotland in 1960. Up to 31 December 2001, 8511 patients had been accepted for long-term renal replacement therapy (RRT). The median age for new patients starting RRT for endstage renal disease (ESRD) has risen from 24 in 1964 to 66 in 2001. 3286 patients were receiving renal replacement therapy for end stage renal disease on 31 December 2001. The take on rate for new patients was 110 per million of the population in 2000 and 101 in 2001. In 2001 49% of patients had a functioning kidney transplant, 39% were being treated with haemodialysis (HD) and 12% with peritoneal dialysis (PD).

There are now 10 adult and one paediatric renal units in Scotland with nine satellite or annex units. The renal units at Stobhill Hospital and Glasgow Royal Infirmary have merged. All units contribute fully to the Scottish Renal Registry (SRR) and all patients receiving RRT for ESRD are registered.

Seventy three per cent of patients using HD achieved a urea reduction ratio of >65%. This is better than before but still below the UK Renal Association (UKRA) standard which required all HD patients to achieve a URR >65%. The incidence of PD related peritonitis was stable at 19 months between episodes. This is above the UKRA standard which was <1 episode / 18 patient-months.

Seventy four per cent of patients using HD had a blood haemoglobin concentration  $\geq 10$  g/dL. The treatment of anaemia therefore continues to improve slowly but remains below the UKRA standard which is that >85% of patients should achieve this level.

Information concerning the NHS Board area within which patients reside and the renal unit attended is presented for the first time.

A research project entitled an "Audit of Renal Management in Scotland" (ARMS) is now complete and the results have been published. It examined the epidemiology and demographics of an incident cohort of patients starting RRT for ESRD. A similar research project entitled the "Acute Renal Failure Scotland" (ARFS) study is now underway and will be completed in 2003.

Extensive information about the conduct of the audits and the quality assurance, statistical and validation methods used and much background information is available on the SRR website. A list of publications and a copy of the reports are also available.

## **INTRODUCTION**

This third report from the Scottish Renal Registry (SRR) presents information about the causes, incidence, prevalence, distribution, NHS Board of residence, methods of treatment, renal units providing treatment and outcome of patients receiving renal replacement therapy (RRT) for end stage renal disease (ESRD) between 1960 and 31<sup>st</sup> December 2001 in Scotland. Reports on the adequacy of dialysis, prevalence of anaemia and the incidence of peritoneal dialysis related peritonitis which provide information about the quality of the treatment are given on the website. There is no information about patients with acute renal failure (ARF) or those with chronic renal failure (CRF) before RRT is required.

Information about the organisation of the SRR is given on our website. The Information and Statistics Division (ISD) of the National Health Service Scotland (NHSScotland) assumed overall responsibility and funding for the SRR in April 1999.

### **DATABASE**

The database and computer server have not changed since the 1998 report. We moved our communications from the X-25 network to the newer NHS computer network in 2001.

### **DATA**

The historic epidemiologic data were retrieved from the European Renal Association – European Dialysis and Transplant Association (ERA-EDTA) database and from a variety of sources in each renal unit. In 1999 and 2000, further work was done to improve the quality of the historic data. In particular, postcodes were recorded for patients. From this NHS Boards of residence, social deprivation score and local population statistics can be derived. Information concerning NHS board of residence and renal units attended by patients is given in this report. A core data set has been defined for prospective collection and is reproduced on the SRR website.. This is used for the basic epidemiology report. Other data are collected when required for specific projects.

### **RENAL UNIT ANONYMITY**

When a new audit is introduced, the renal units are identified with a number which is allocated at random. Thereafter renal units are identified by name. Patient confidentiality and anonymity is maintained.

### **QUALITY ASSURANCE**

The SRR undertakes extensive checks on the quality and completeness of the data. Brief details are given on the website.

Data held in a registry are never perfect. The continuing work to improve the quality of existing data inevitably results in slight differences when the same statistic is reported in subsequent years. Rates based on population size may also change slightly if the population estimates are revised. We try to use the most up to date estimates of population size available. The sources of population statistics are given.

### **FUNDING**

The SRR is funded by ISD. Research projects in which the SRR collaborates are separately funded. Sources of funding are given on the website.

### **CONFLICT OF INTEREST**

The SRR chair, executive and report editorial group do not have any conflicting interests.

## SUMMARY OF DATA

### TOTAL PATIENTS.

8511 patients have been registered with the SRR from its inception in 1991 until 31 December 2001 when the data for this report were collated.

Data pertaining to events prior to 1991 were incorporated retrospectively from the ERA-EDTA registry. These data have proved patchy, incomplete and occasionally inaccurate. Data since 1991 have been entered manually or electronically from each of the renal units in Scotland. Recently two of these units, Glasgow Royal Infirmary and Stobhill have merged. Their information has been merged retrospectively and this will be presented under the label GRI in this report. The earliest date a patient is recorded as starting RRT for ESRD in Scotland is October 1960.

### DEATHS.

5014 patients of the 8511 included in this report are known to be dead.

The total number of deaths in 2001 was 422.

### EXCLUSIONS FROM ANALYSES.

21 patients have uncertain status, that is their current location is not known and it is not known if they are alive or dead.

Patients with uncertain status are censored within survival analysis at the date they are lost.

192 patients are recorded as having a renal transplant as their first mode of RRT in Scotland.

36 of these patients had a pre-emptive transplant. The remainder started RRT outwith Scotland and arrived in Scotland with a functioning transplant. At the time of publication, details of their RRT histories outwith Scotland were not available. These 156 patients have been excluded from the incidence figures, but included in prevalence figures. 205 patients were excluded from survival analyses because their first treatment was unknown or outwith Scotland. Patients who recovered independent renal function, who were lost to follow-up and those leaving Scotland (257) were censored in the survival analyses at the date when the Registry received the final laboratory or treatment information. In the survival analysis deaths were not included if the patient had already been censored.

### PATIENTS RECOVERING RENAL FUNCTION.

Patients who recovered function within 90 days of starting RRT and have not yet required to restart RRT were excluded from the analysis.

Patients who recovered but required more than 90 days RRT remain in the data.

For patients who had to restart RRT, after initial recovery within a 90-day treatment period, the date of first starting RRT was considered as beginning at the period of treatment that lasted more than 90 days. The only exception to this is for patients who recover within 90 days of RRT and then restart within 90 days and then their date of starting RRT is taken as the start of the first period of RRT.

### PRIMARY RENAL DIAGNOSES

A diagnosis code for the primary renal disease (PRD) has been chosen by the nephrologists responsible for the care of the patient from the list published by the ERA-EDTA.

To simplify analysis of the data these diagnoses have been grouped into five categories: glomerulonephritis, interstitial nephritis, diabetic nephropathy, multi-system disorders and unknown diagnosis.

It is often not possible to make a precise diagnosis for patients presenting with ESRD because the subtle signs of the original disease may have been obscured. Most end stage kidneys look the same. Attributing the cause of renal failure to PRD does not tell us anything about the presence or absence of comorbid illnesses. For example, a patient with vascular disease or diabetes mellitus may have a different cause for their renal failure.

The full code list and subdivisions are shown in Appendix 1

Some patients have data missing from the registry. The majority of these missing data are historic and pertain to patients retrospectively registered from the ERA-EDTA registry. The clinical notes for 21 of these patients have now been destroyed.

**MISSING DATA**

Missing basic data are summarised below.

**Table 1 Missing Data Items**

| Data Item               | Total<br>Number<br>missing | Number missing<br>from patients<br>alive on<br>31 December2001 |
|-------------------------|----------------------------|--|
| Mode of first RRT       | 13                         | 12   |
| Primary Renal Diagnosis | 52                         | 19   |
| Post Code               |                            | 4  |

**PRESENTATION OF THE DATA**

Throughout the report numeric data are shown either on the charts or in a separate table. In many charts the data are shown in five year bands. In order to present all the available data, the first time band represents seven years. The statistical methods used for the report are described in the web site.

To allow international comparison, we have adopted the age bands used by the ERA-EDTA registry.

**ABBREVIATIONS**

Throughout this report for brevity and ease of reading some abbreviations are used. These are listed in full in [Appendix 2](#)

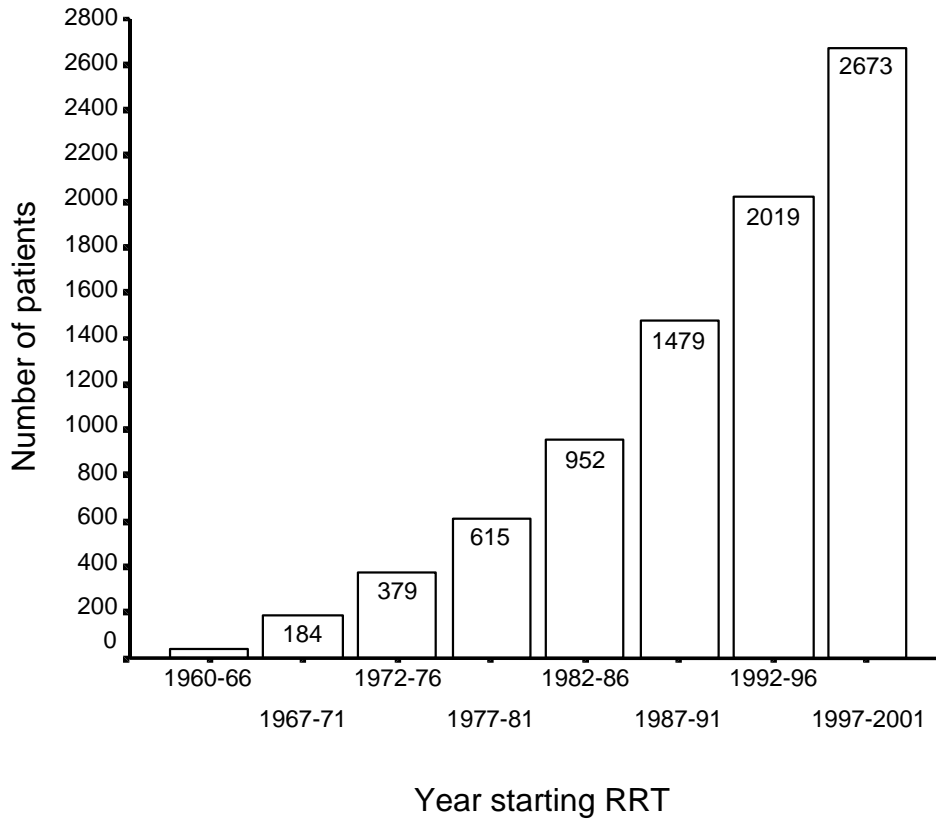
# A INCIDENCE

## A1 INCIDENCE OF NEW PATIENTS STARTING RRT

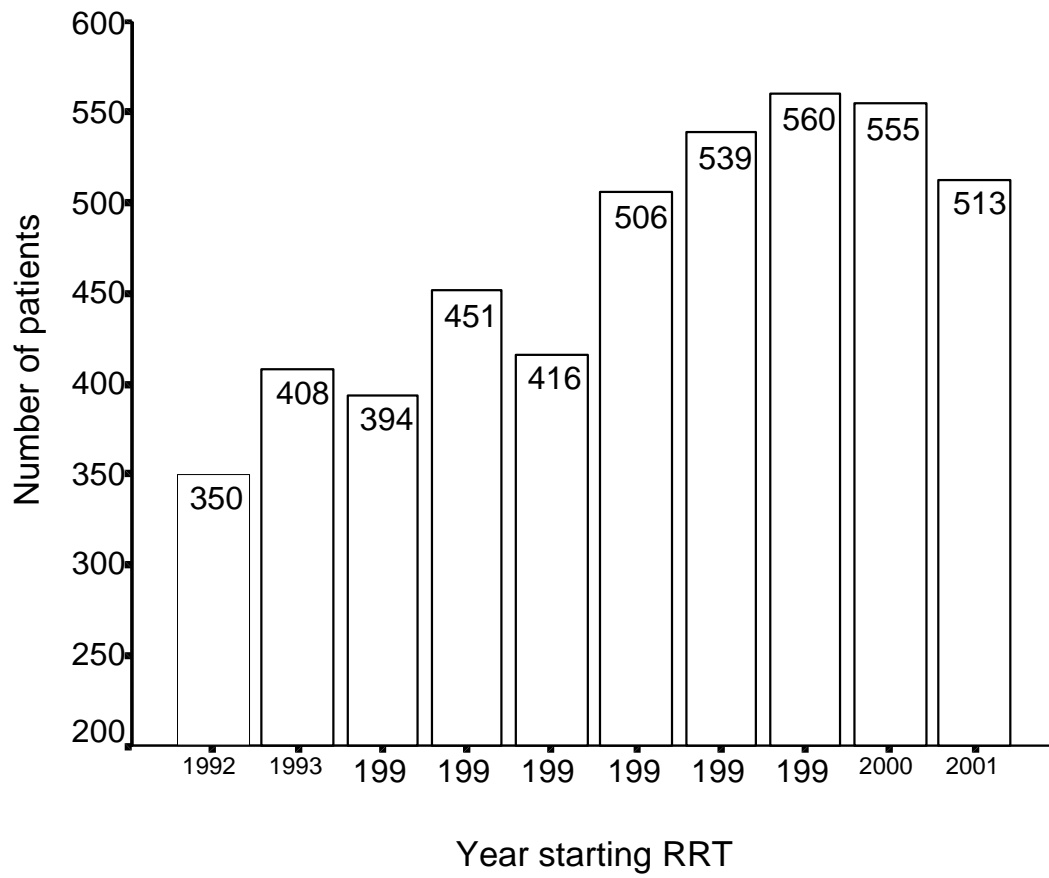
41 Patients started RRT between 1960 and 1966.

The proportion of males to females starting RRT for ESRD has remained at 60% to 40%.

### A1.1 Incidence of new patients starting RRT 1960-2001

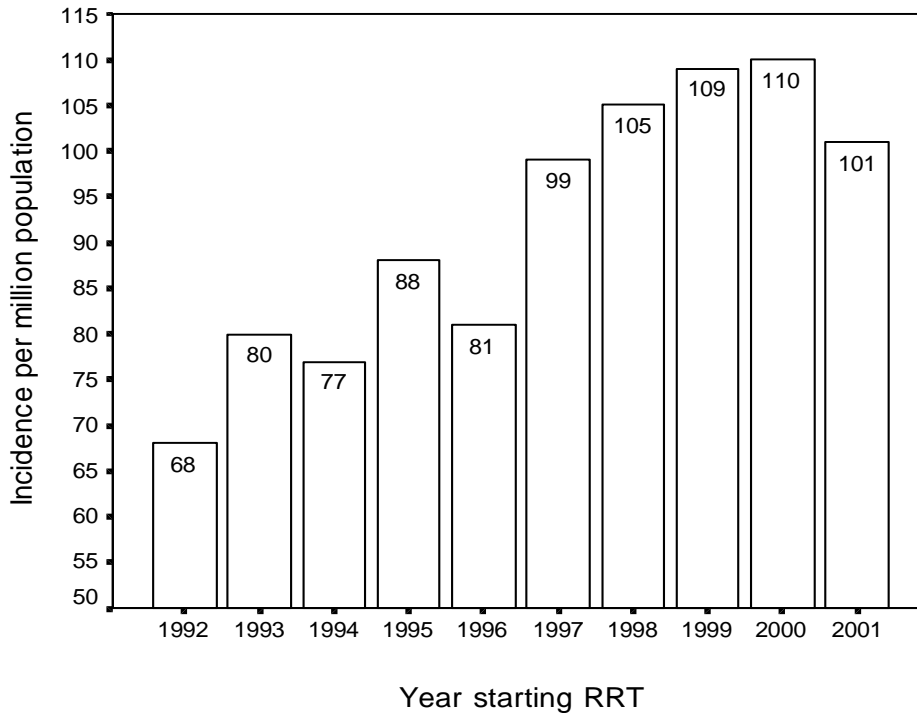


A1.2 Incidence of new patients starting RRT 1992-2001



**A1.3 Annual incidence per million population of new patients starting RRT 1992-2001**

Population figures are from the Registrar General for Scotland. They are population estimates for the 30 June of each year. The incidence of patients starting RRT per million of the population continues to rise.



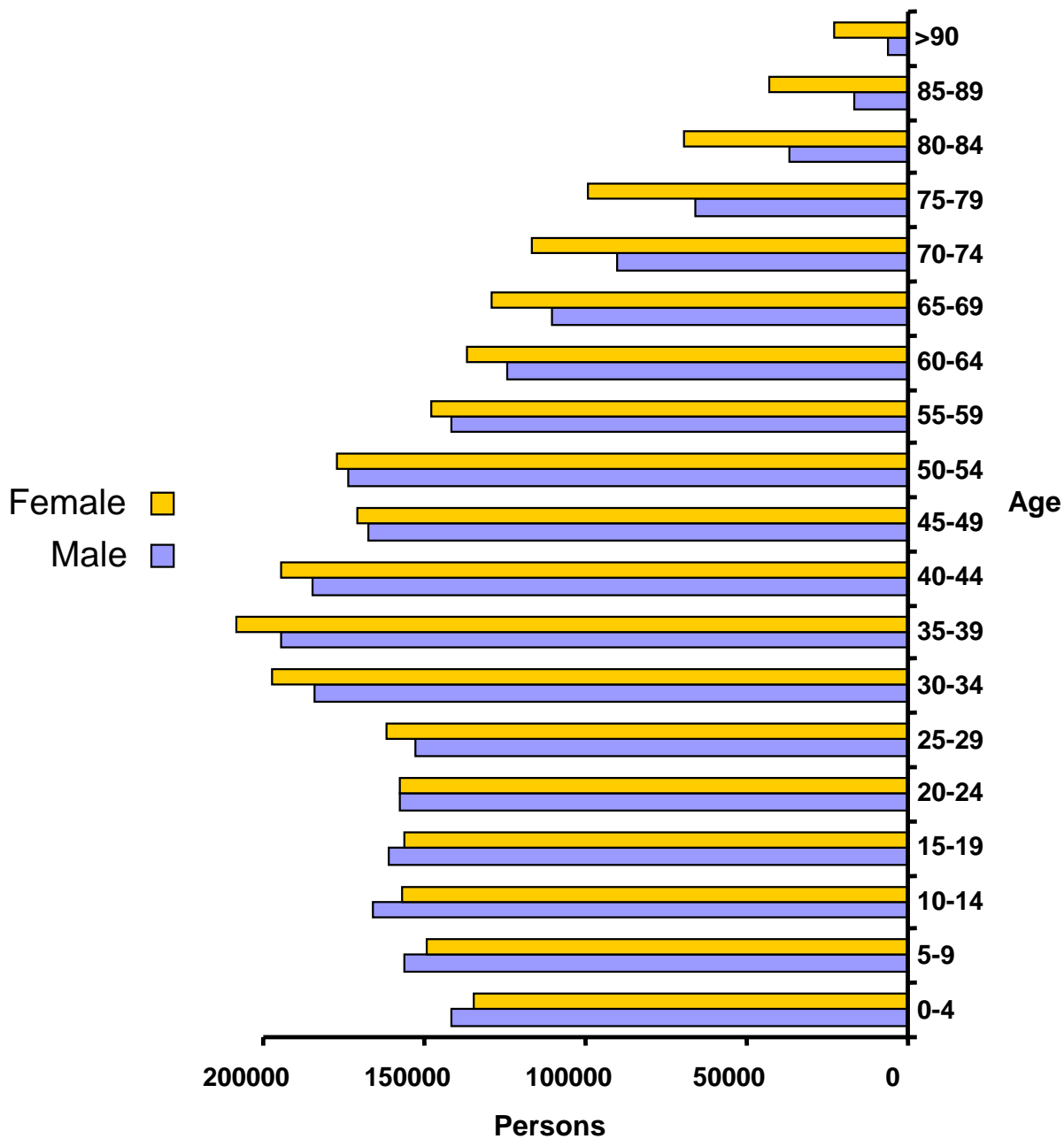
**A1.4 Annual incidence per million population of new patients starting RRT 1992-2001**

| Year | Number starting RRT | Population of Scotland | Incidence per million |
|------|---------------------|------------------------|-----------------------|
| 1992 | 350                 | 5 111 200              | 68                    |
| 1993 | 408                 | 5 120 200              | 80                    |
| 1994 | 394                 | 5 132 400              | 77                    |
| 1995 | 451                 | 5 136 600              | 88                    |
| 1996 | 416                 | 5 128 000              | 81                    |
| 1997 | 506                 | 5 122 500              | 99                    |
| 1998 | 539                 | 5 120 000              | 105                   |
| 1999 | 560                 | 5 119 200              | 109                   |
| 2000 | 555                 | 5 058 200 *            | 110                   |
| 2001 | 513                 | 5 064 200 *            | 101                   |

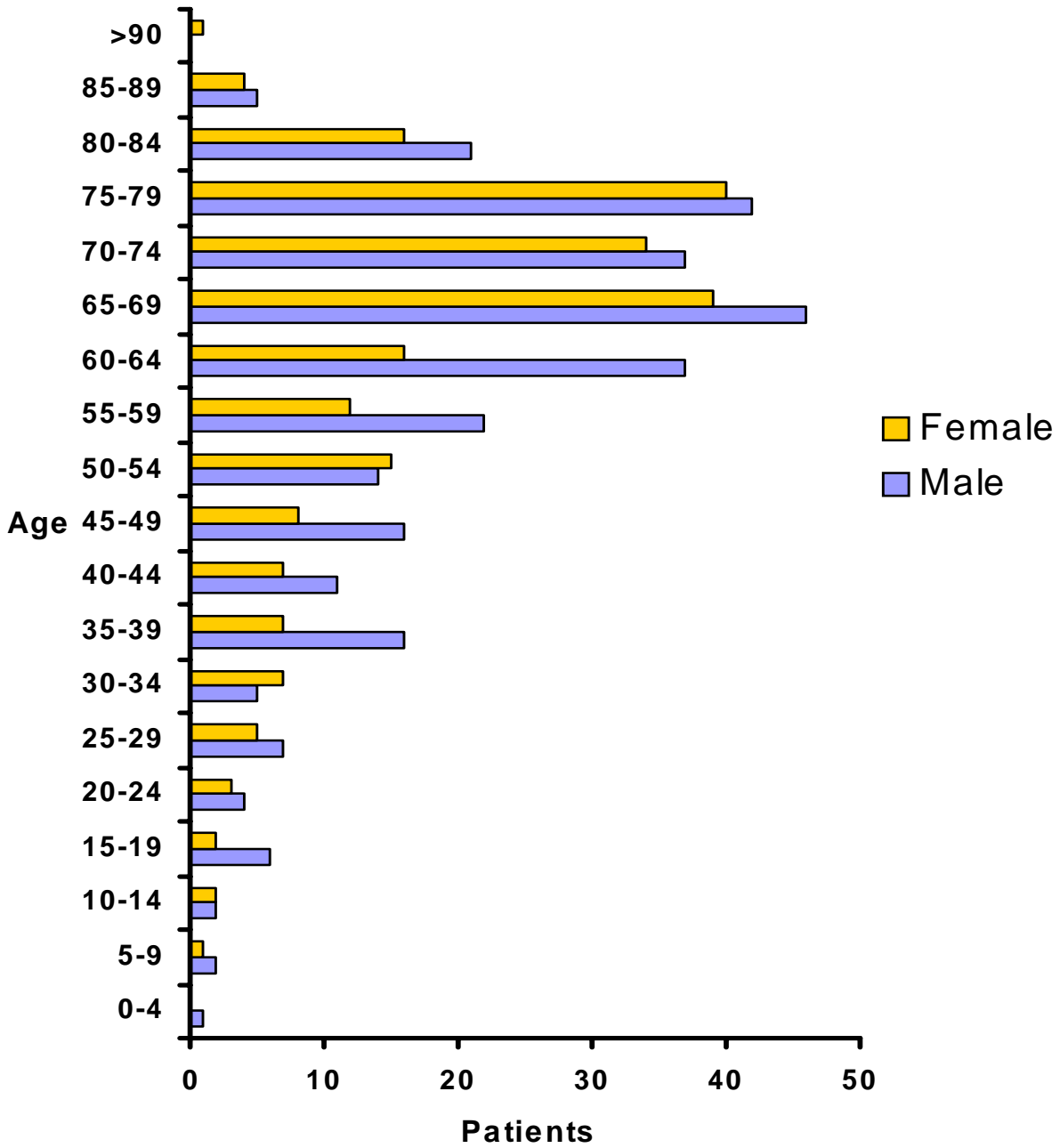
\* Mid-2001 Scottish Population and revised mid-2000 estimate from the 2001 Census.

A2 GENERAL POPULATION AND INCIDENT RRT POPULATION 2001

A2.1 Estimated Population of Scotland 2001 (Registrar General for Scotland)



A2.2 Incident RRT population of Scotland 2001



### A2.3 Incident RRT population of Scotland 2001

| Age group    | Male       | Female     | Total      |
|--------------|------------|------------|------------|
| >90          | 0          | 1          | 1          |
| 85-89        | 5          | 4          | 9          |
| 80-84        | 21         | 16         | 37         |
| 75-79        | 42         | 40         | 82         |
| 70-74        | 37         | 34         | 71         |
| 65-69        | 46         | 39         | 85         |
| 60-64        | 37         | 16         | 53         |
| 55-59        | 22         | 12         | 34         |
| 50-54        | 14         | 15         | 29         |
| 45-49        | 16         | 8          | 24         |
| 40-44        | 11         | 7          | 18         |
| 35-39        | 16         | 7          | 23         |
| 30-34        | 5          | 7          | 12         |
| 25-29        | 7          | 5          | 12         |
| 20-24        | 4          | 3          | 7          |
| 15-19        | 6          | 2          | 8          |
| 10-14        | 2          | 2          | 4          |
| 5-9          | 2          | 1          | 3          |
| 0-4          | 1          | 0          | 1          |
| <b>Total</b> | <b>294</b> | <b>219</b> | <b>513</b> |

### A2.4 Age specific incidence and prevalence of RRT patients in 2001

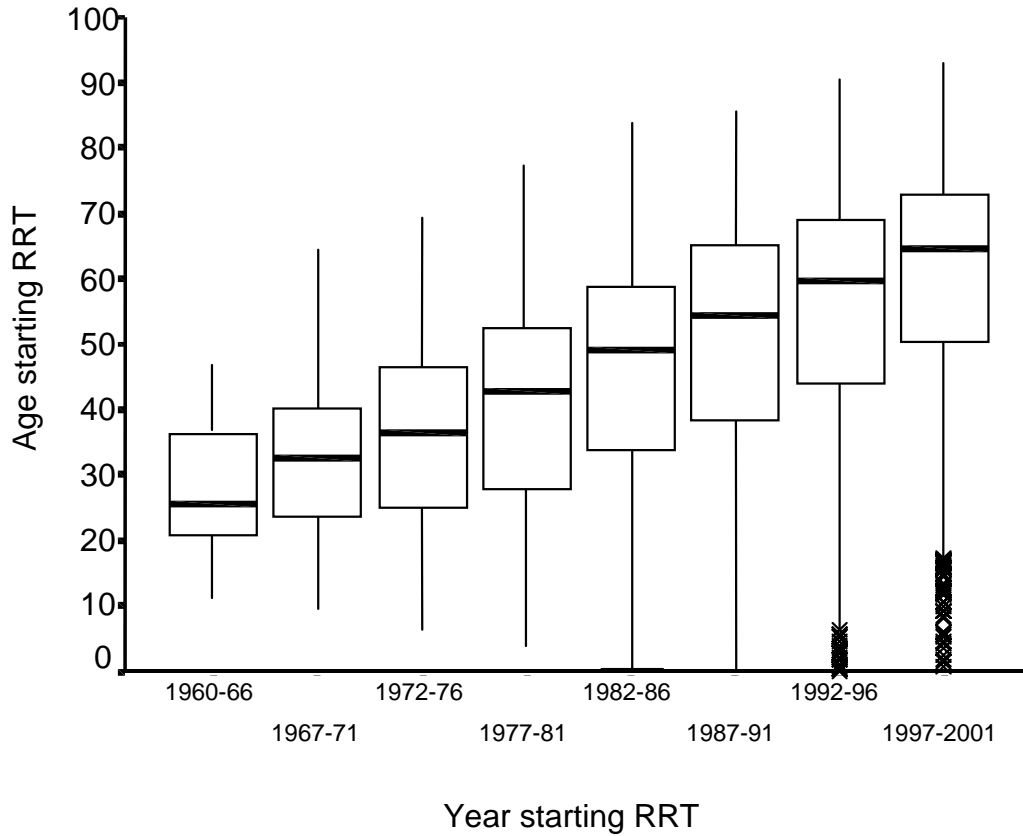
The table shows the age specific incidence and prevalence of patients receiving RRT per million population in 2001.

| Age group (years) | Estimated population 2001 | Number starting RRT 2001 | Incidence per million population of each age | All patients receiving RRT on 30/6/2001 | Prevalence per million population of each age |
|-------------------|---------------------------|--------------------------|--|---|---|
| ≥ 75              | 360 539                   | 129                      | 358  | 296                                     | 821   |
| 65-74             | 446 642                   | 156                      | 349  | 594                                     | 1330  |
| 45-64             | 1 240 780                 | 140                      | 113  | 1259                                    | 1015  |
| 20-44             | 1 793 637                 | 72                       | 40   | 998                                     | 556   |
| <20               | 1 222 602                 | 16                       | 13   | 93                                      | 76  |

**A3 MEDIAN AGE OF PATIENTS WHEN STARTING RRT**

The following graphs show median age (thick black line), inter-quartile range (box) and the last value falling within 1.5 times the inter-quartile range (whiskers). Values lying outwith 1.5 times the inter-quartile range are shown as 'x'. The outliers at the lower end of a range represent children.

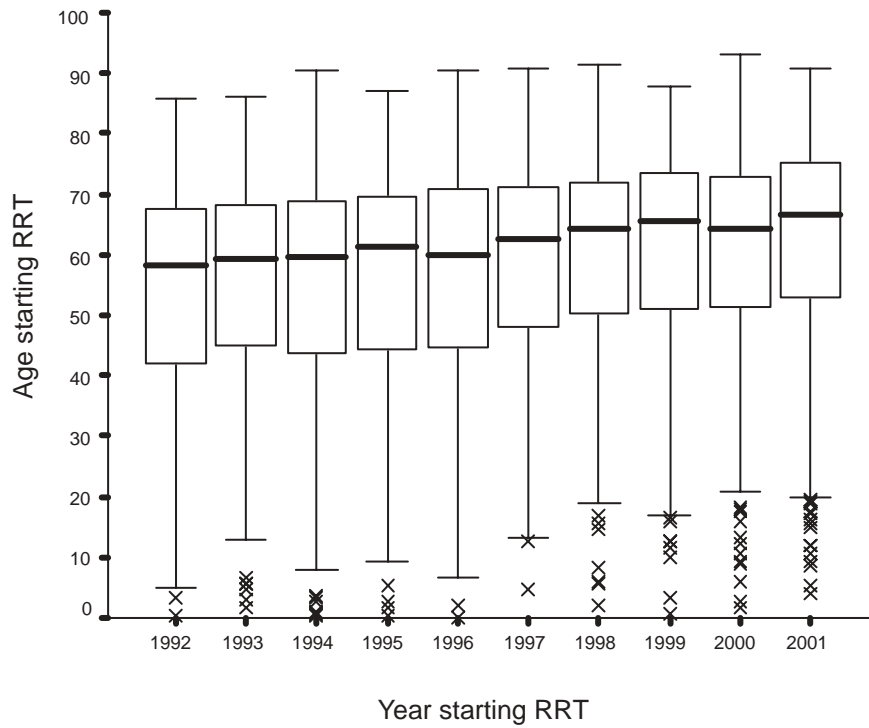
**A3.1 Median age of patients when starting RRT 1960-2001**



**A3.2 Median age of patients when starting RRT 1960-2001**

|            | 1960-1966 | 1967-1971 | 1972-1976 | 1977-1981 | 1982-1986 | 1987-1991 | 1992-1996 | 1997-2001 |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Median age | 25.6      | 32.7      | 36.6      | 42.7      | 49.0      | 54.5      | 59.7      | 64.7      |

**A3.3 Median age of patients starting RRT 1992-2001**



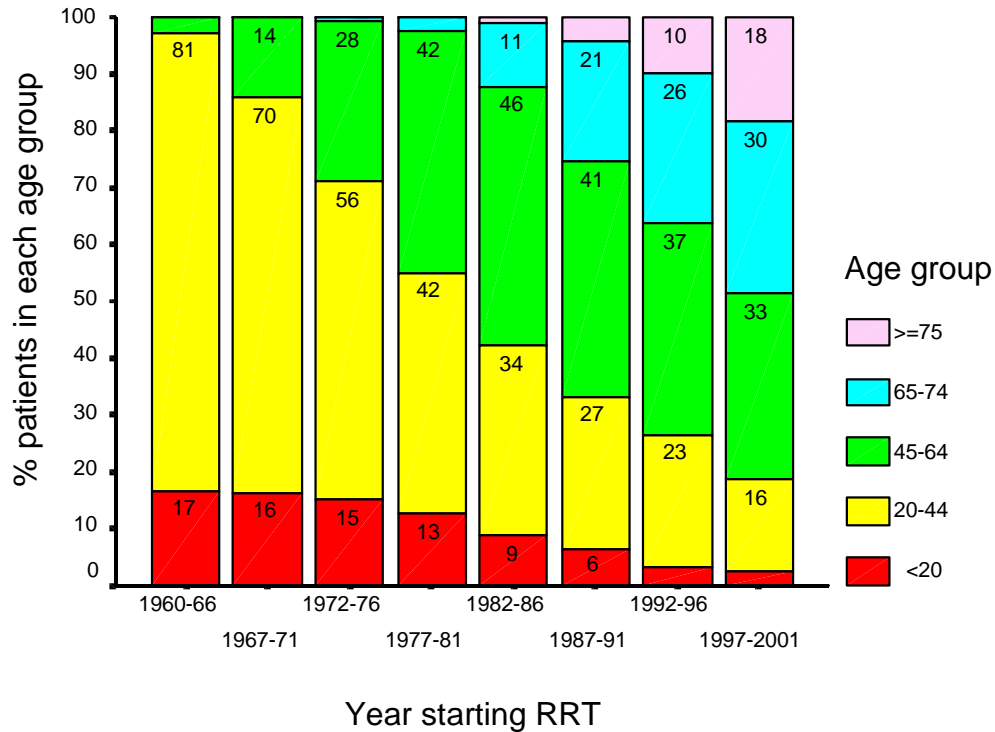
**A3.4 Median age of patients starting RRT 1992-2001**

|            | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|------------|------|------|------|------|------|------|------|------|------|------|
| Median age | 58.2 | 59.3 | 59.6 | 61.1 | 59.9 | 62.5 | 64.1 | 65.7 | 64.4 | 66.4 |

**A4 AGE DISTRIBUTION OF PATIENTS WHEN STARTING RRT**

The total numbers of patients are the same as shown in graphs A1.1 and A1.2.

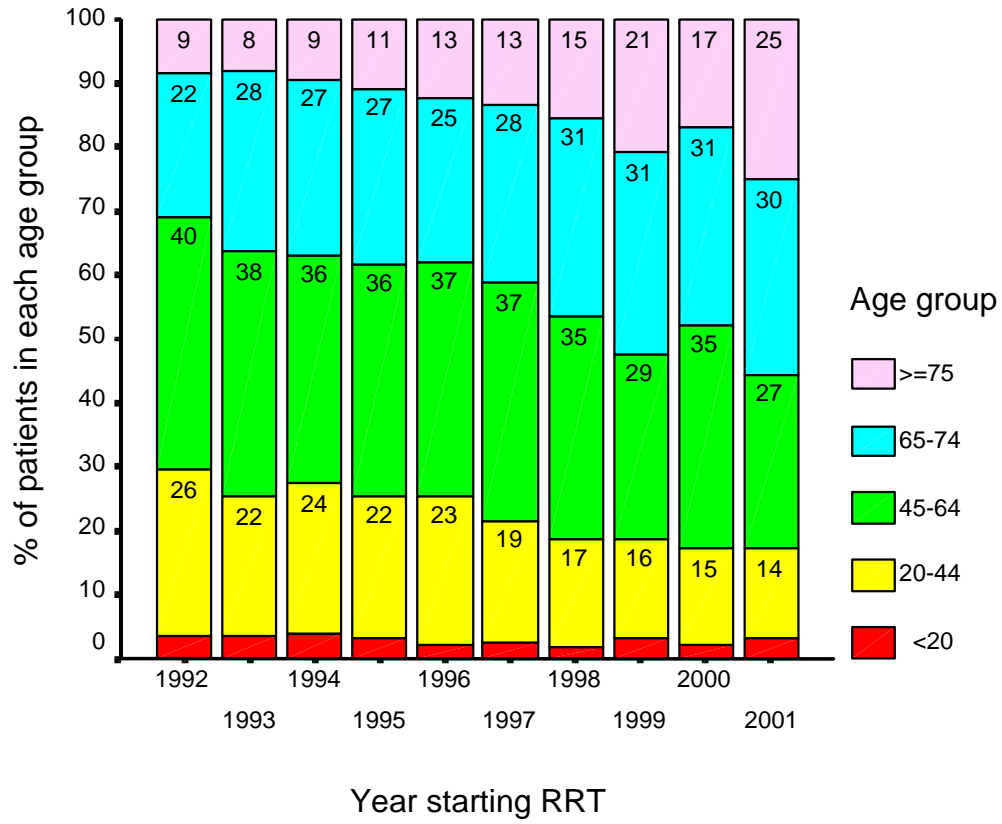
**A4.1 Age distribution of patients when starting RRT 1960-2001**



**A4.2 Percentage age distribution of patients when starting RRT 1960-2001**

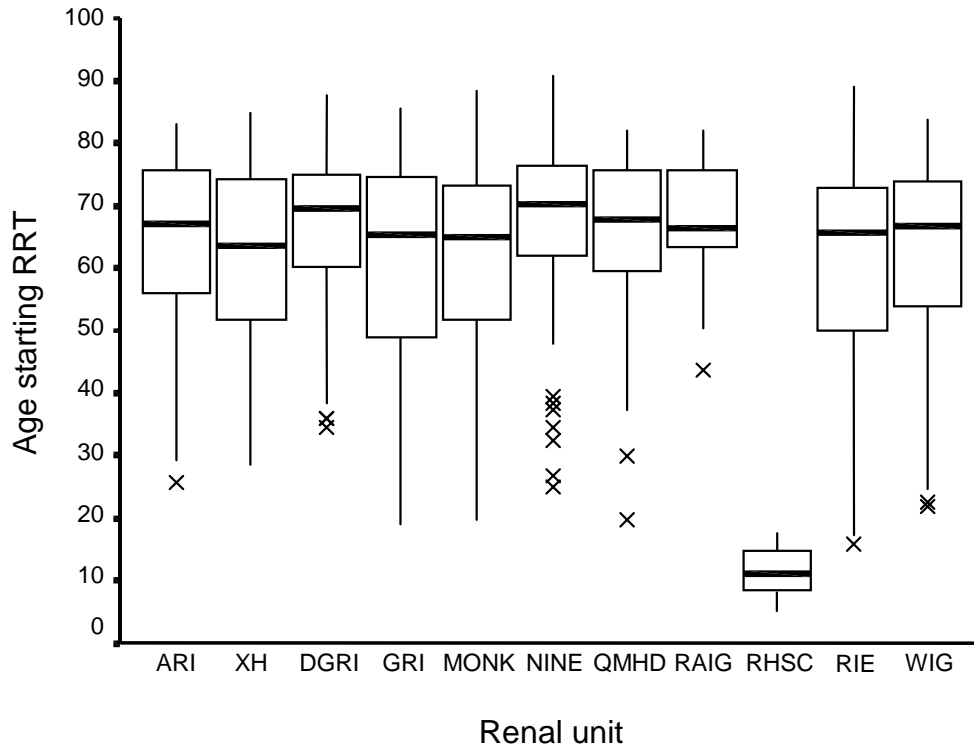
| Year starting RRT | <20 | 20-44 | 45-64 | 65-74 | ≥ 75 |
|-------------------|-----|-------|-------|-------|------|
| 1960-1966         | 17  | 81    | 3     | 0     | 0    |
| 1967-1971         | 16  | 70    | 14    | 0     | 0    |
| 1972-1976         | 15  | 56    | 28    | 1     | 0    |
| 1977-1981         | 13  | 42    | 42    | 2     | 0    |
| 1982-1986         | 9   | 34    | 46    | 11    | <1   |
| 1987-1991         | 6   | 27    | 41    | 21    | 4    |
| 1992-1996         | 3   | 23    | 37    | 26    | 10   |
| 1997-2001         | 2   | 16    | 33    | 30    | 18   |

A4.3 Age distribution of patients when starting RRT 1992-2001



**A4.4 Median age of patients starting RRT by renal unit 2001**

There was no significant difference between the median ages of new patients starting RRT at the 10 adult renal units (Kruskal Wallis p=0.7).



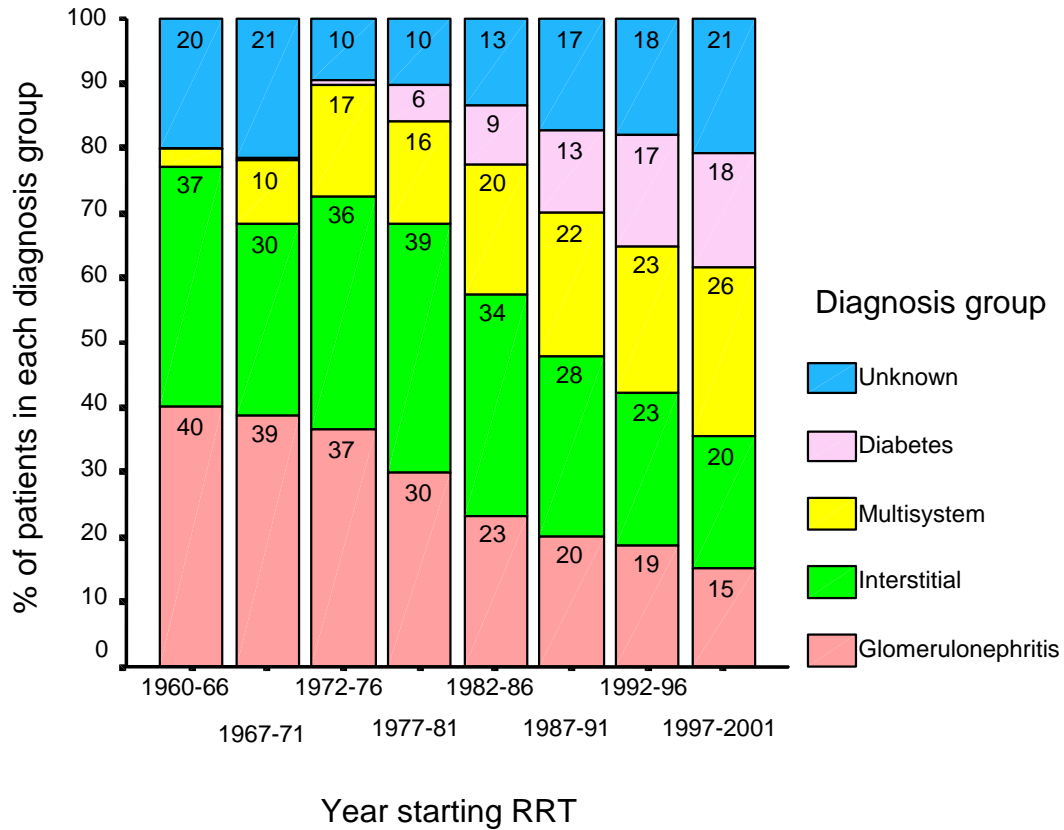
**A4.5 Median age of patients starting RRT by renal unit 2001**

|            | ARI  | XH   | DGRI | GRI  | MONK | NINE | QMHD | RAIG | RHSC | RIE  | WIG  |
|------------|------|------|------|------|------|------|------|------|------|------|------|
| Median age | 67.2 | 63.7 | 69.4 | 65.2 | 65.0 | 70.3 | 67.9 | 66.4 | 11.2 | 65.6 | 66.6 |

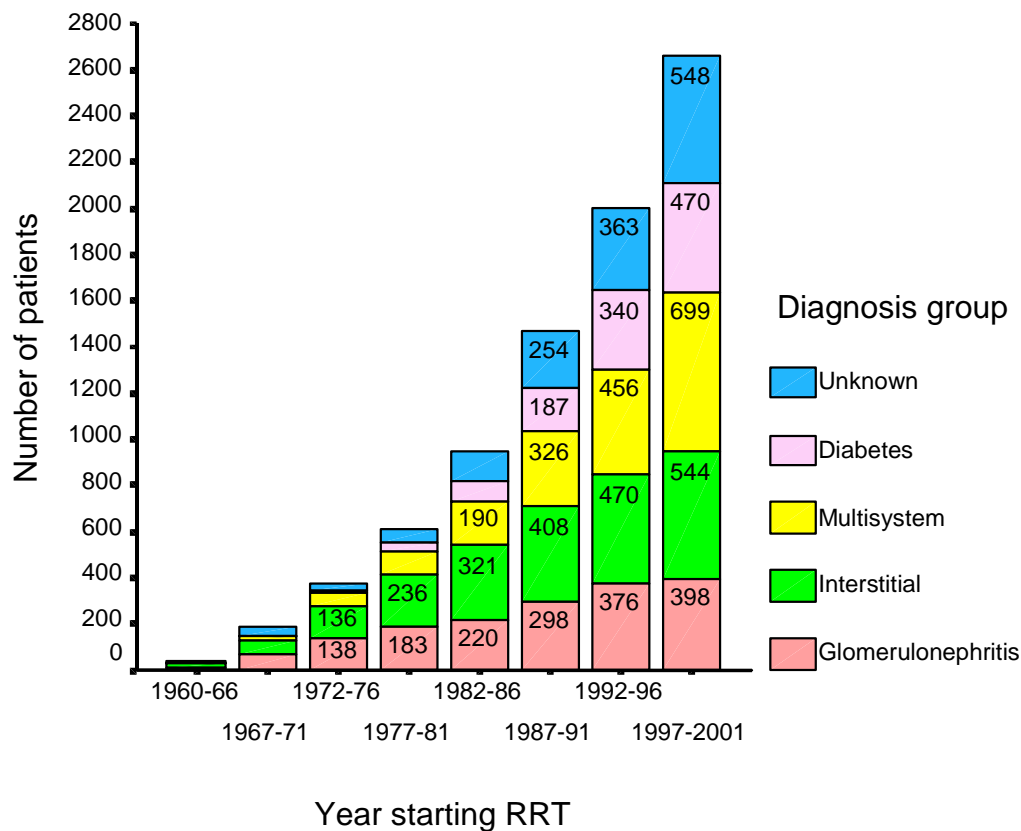
**A5 PRIMARY RENAL DIAGNOSIS OF PATIENTS STARTING RRT**

Graphs A 5.1 and A 5.2 represent the same data displayed as proportion of patients and absolute numbers. Diabetic nephropathy is the largest single named PRD in patients starting RRT. ERA-EDTA PRD codes and groupings are reproduced in Appendix 1.

**A5.1 Percentage of patients in each PRD group 1960-2001**



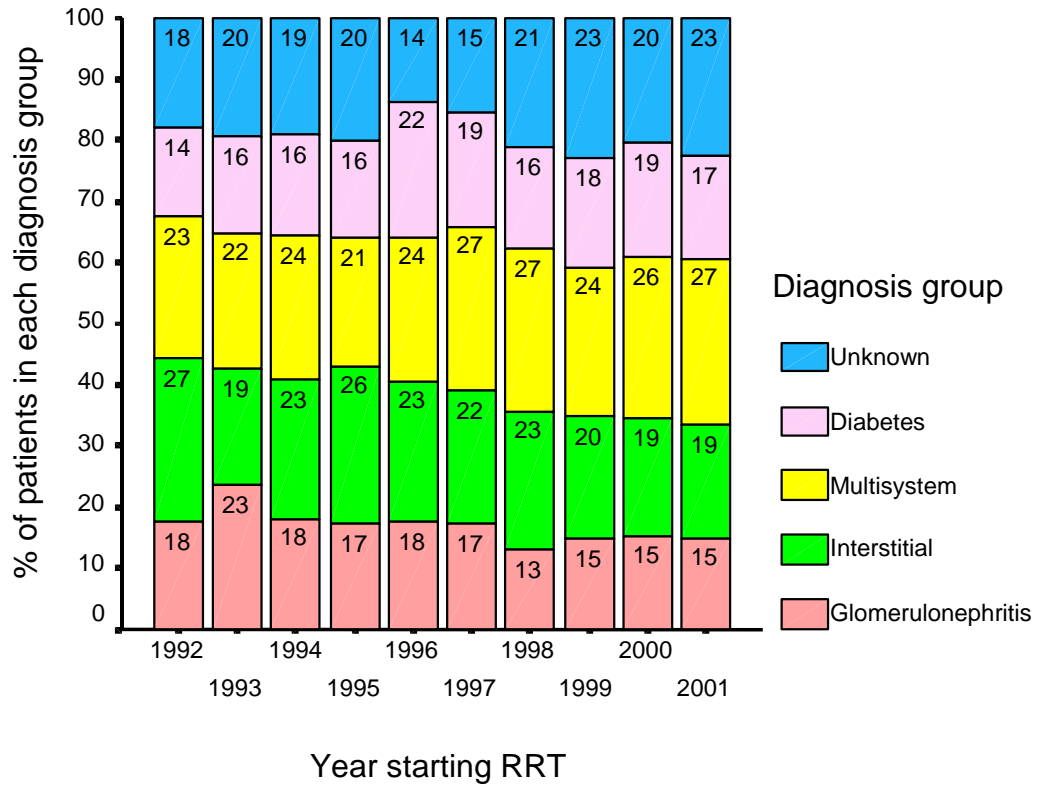
**A5.2 Number of patients in each diagnosis group starting RRT 1960-2001**



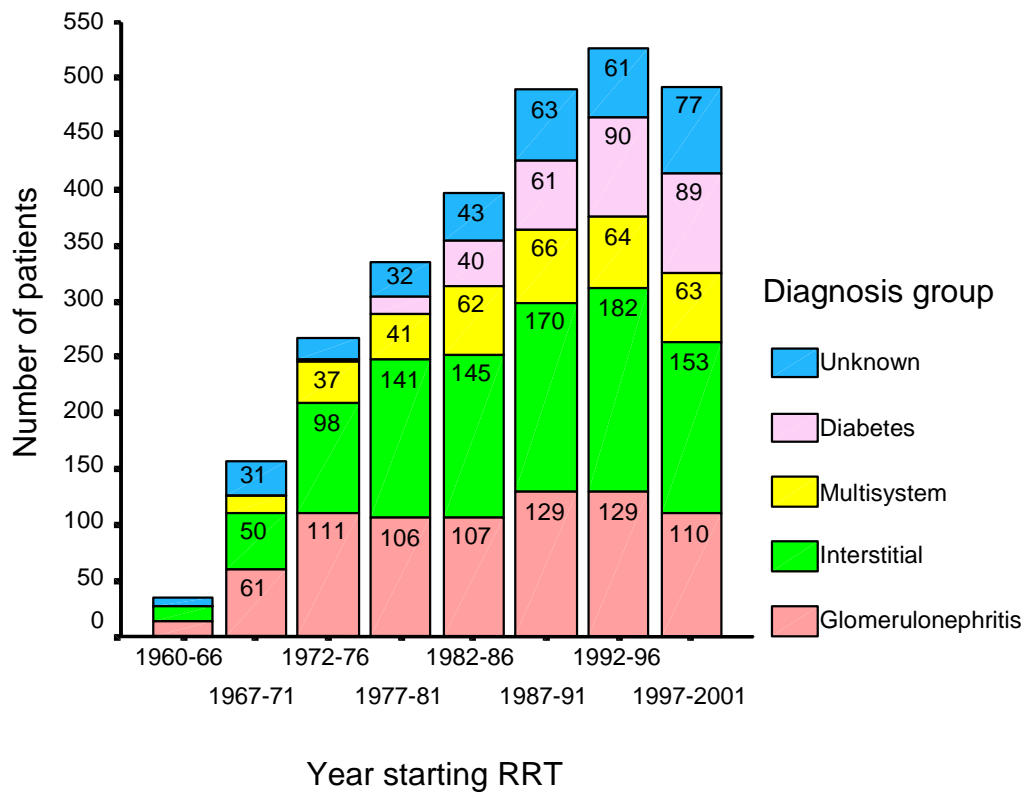
**A5.3 Number of patients in each diagnosis group starting RRT 1960-2001**

| Year starting RRT | Glomerulonephritis | Interstitial | Multi-system | Diabetes | Unknown | Missing PRD | Total |
|-------------------|--------------------|--------------|--------------|----------|---------|-------------|-------|
| 1960-1966         | 14                 | 13           | 1            | 0        | 7       | 1           | 36    |
| 1967-1971         | 71                 | 54           | 18           | 1        | 39      | 1           | 184   |
| 1972-1976         | 138                | 136          | 64           | 3        | 36      | 2           | 379   |
| 1977-1981         | 183                | 236          | 96           | 35       | 62      | 3           | 615   |
| 1982-1986         | 220                | 321          | 190          | 86       | 125     | 10          | 952   |
| 1987-1991         | 298                | 408          | 326          | 187      | 254     | 6           | 1479  |
| 1992-1996         | 376                | 470          | 456          | 340      | 363     | 14          | 2019  |
| 1997-2001         | 398                | 544          | 699          | 470      | 548     | 14          | 2673  |

A5.4 Percentage of patients in each diagnosis group starting RRT 1992-2001



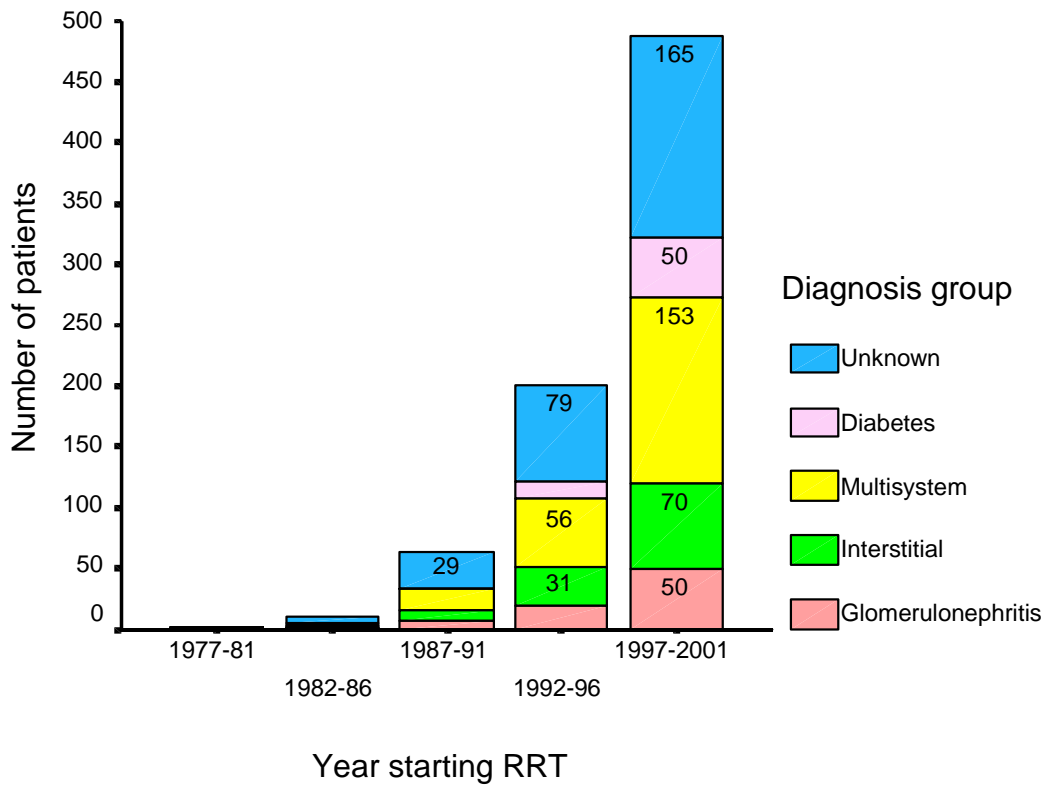
**A5.5 Primary renal diagnosis of patients aged less than 45 years starting RRT 1960-2001**



**A5.6 Primary renal diagnosis of patients aged less than 45 years starting RRT 1960-2001**

| Year starting RRT | Glomerulonephritis | Interstitial | Multi-system | Diabetes | Unknown | Missing PRD | Total |
|-------------------|--------------------|--------------|--------------|----------|---------|-------------|-------|
| 1960-1966         | 14                 | 13           | 1            | 0        | 6       | 1           | 35    |
| 1967-1971         | 61                 | 50           | 14           | 1        | 31      | 1           | 158   |
| 1972-1976         | 111                | 98           | 37           | 1        | 20      | 2           | 269   |
| 1977-1981         | 106                | 141          | 41           | 16       | 32      | 2           | 338   |
| 1982-1986         | 107                | 145          | 62           | 40       | 43      | 5           | 402   |
| 1987-1991         | 129                | 170          | 66           | 61       | 63      | 1           | 490   |
| 1992-1996         | 129                | 182          | 64           | 90       | 61      | 9           | 535   |
| 1997-2001         | 110                | 153          | 63           | 89       | 77      | 7           | 499   |

**A5.7 Primary renal diagnosis of patients aged 75 years and older starting RRT 1977-2001**



**A5.8 Primary renal diagnosis of patients aged 75 years and older starting RRT 1977-2001**

| Year starting RRT | Glomerulonephritis | Interstitial | Multi-system | Diabetes | Unknown | Missing PRD | Total |
|-------------------|--------------------|--------------|--------------|----------|---------|-------------|-------|
| 1977-1981         | 0                  | 1            | 0            | 0        | 0       | 0           | 1     |
| 1982-1986         | 1                  | 1            | 2            | 1        | 5       | 0           | 10    |
| 1987-1991         | 7                  | 9            | 17           | 1        | 29      | 1           | 64    |
| 1992-1996         | 20                 | 31           | 56           | 15       | 79      | 0           | 201   |
| 1997-2001         | 50                 | 70           | 153          | 50       | 165     | 2           | 490   |

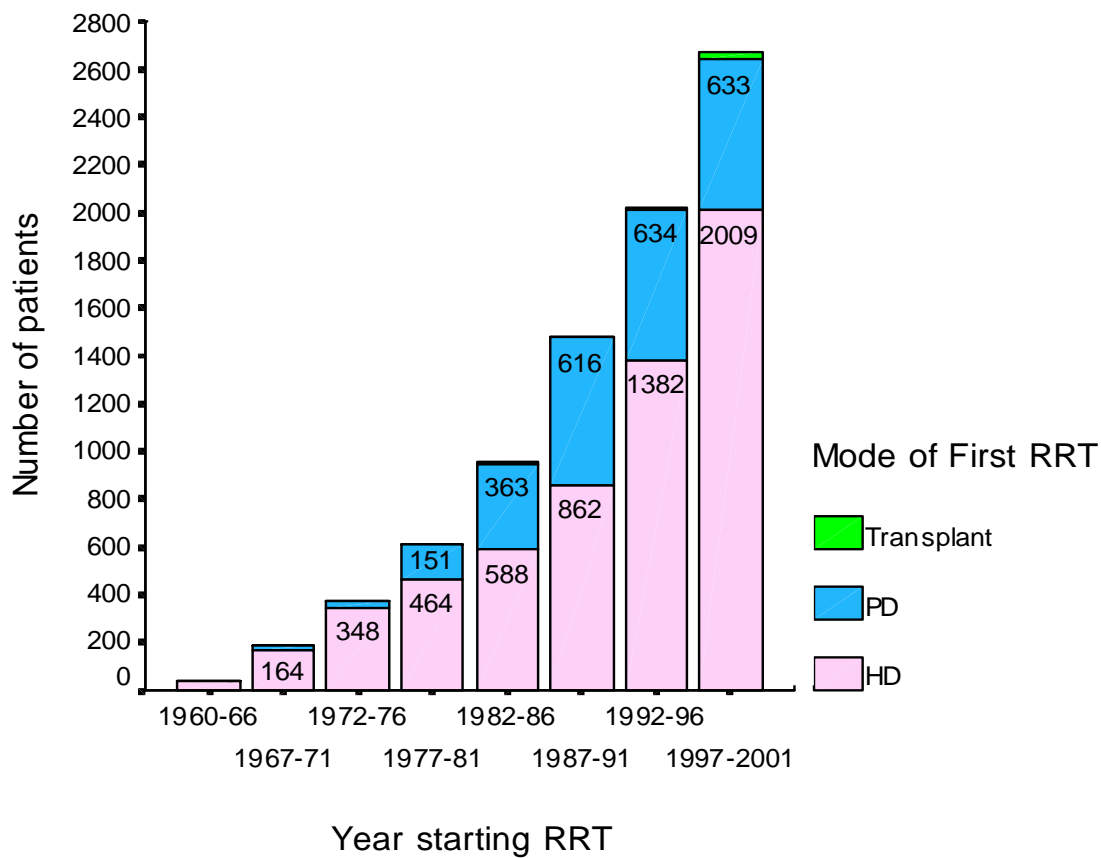
## A6 MODALITY OF RRT

There are three principal types of RRT:

Haemodialysis (HD) is normally performed in a hospital but can be undertaken in a patient's home. Peritoneal dialysis (PD) is normally performed by the patient in their home using the technique of continuous ambulatory peritoneal dialysis (CAPD); the dialysate exchanges can be performed semi automatically by a machine in the variant known as automated peritoneal dialysis (APD). Renal transplants are normally donated from a cadaver, but occasionally by a living person.

In total 36 patients have received a pre-emptive transplant, the first was in 1982. Hospital HD remains the most common first mode of RRT. Peritoneal dialysis was introduced in 1968; the use of PD both as the first mode of RRT and amongst prevalent patients has levelled off. Patients recorded as having used intermittent peritoneal dialysis (IPD) are shown together with patients who have been treated with APD.

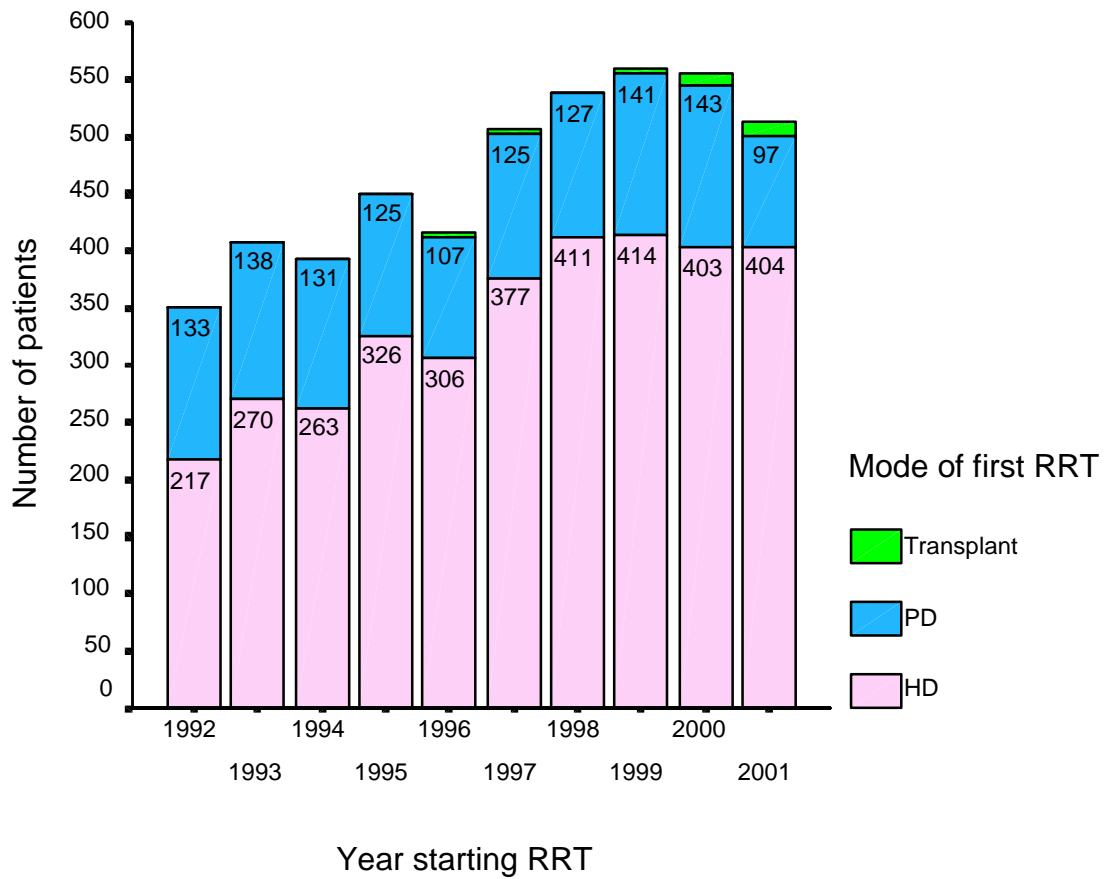
### A6.1 Mode of first RRT 1960-2001



### A6.2 Mode of first RRT 1960-2001

| Year starting RRT | HD   | PD  | Transplant | Total |
|-------------------|------|-----|------------|-------|
| 1960-1966         | 35   | 1   | 0          | 36    |
| 1967-1971         | 164  | 20  | 0          | 184   |
| 1972-1976         | 348  | 31  | 0          | 379   |
| 1977-1981         | 464  | 151 | 0          | 615   |
| 1982-1986         | 588  | 363 | 1          | 952   |
| 1987-1991         | 862  | 616 | 1          | 1479  |
| 1992-1996         | 1382 | 634 | 3          | 2019  |
| 1997-2001         | 2009 | 633 | 31         | 2673  |

**A6.3 Mode of first RRT 1992-2001**



**A6.4 Mode of first RRT 1992-2001**

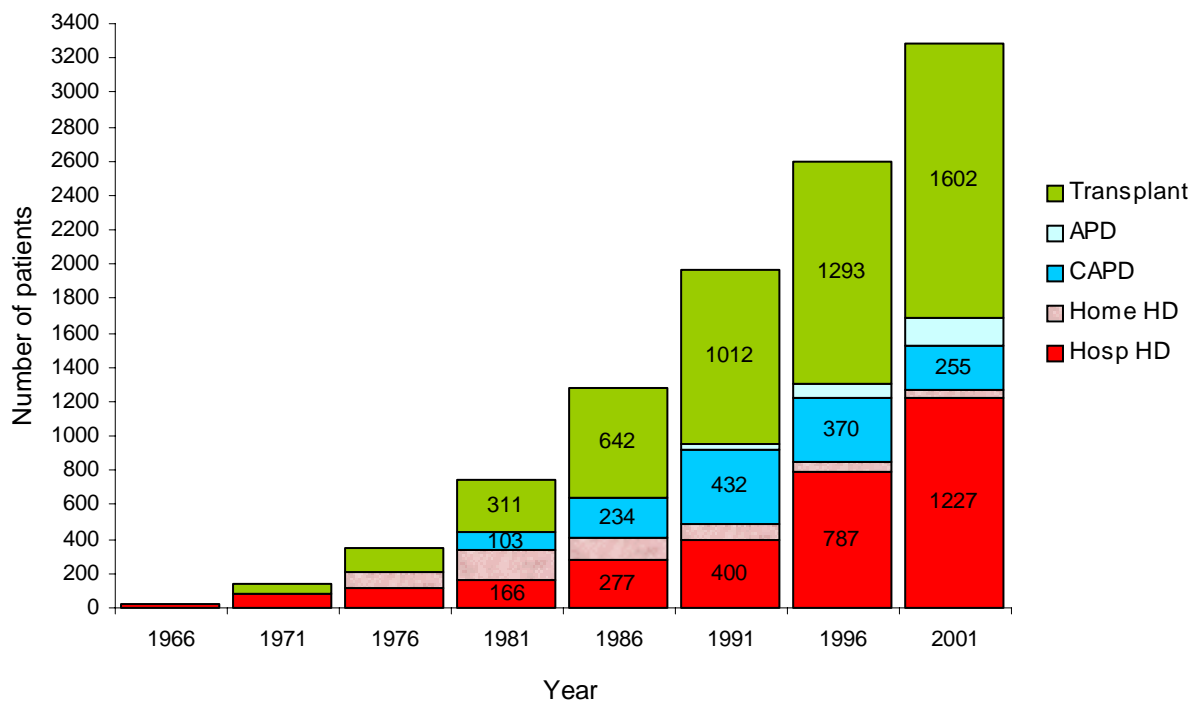
| Year starting RRT | HD  | PD  | Transplant | Total |
|-------------------|-----|-----|------------|-------|
| 1992              | 217 | 133 | 0          | 350   |
| 1993              | 270 | 138 | 0          | 408   |
| 1994              | 263 | 131 | 0          | 394   |
| 1995              | 326 | 125 | 0          | 451   |
| 1996              | 306 | 107 | 3          | 416   |
| 1997              | 377 | 125 | 4          | 506   |
| 1998              | 411 | 127 | 1          | 539   |
| 1999              | 414 | 141 | 5          | 560   |
| 2000              | 403 | 143 | 9          | 555   |
| 2001              | 404 | 97  | 12         | 513   |

## B PREVALENCE

### B1 PATIENTS RECEIVING RRT IN SCOTLAND ACCORDING TO MODALITY OF TREATMENT ON 31ST DECEMBER

Patients have been included only if the renal unit at which they have been treated in Scotland is known. The number of patients with renal transplants and using hospital HD continues to increase.

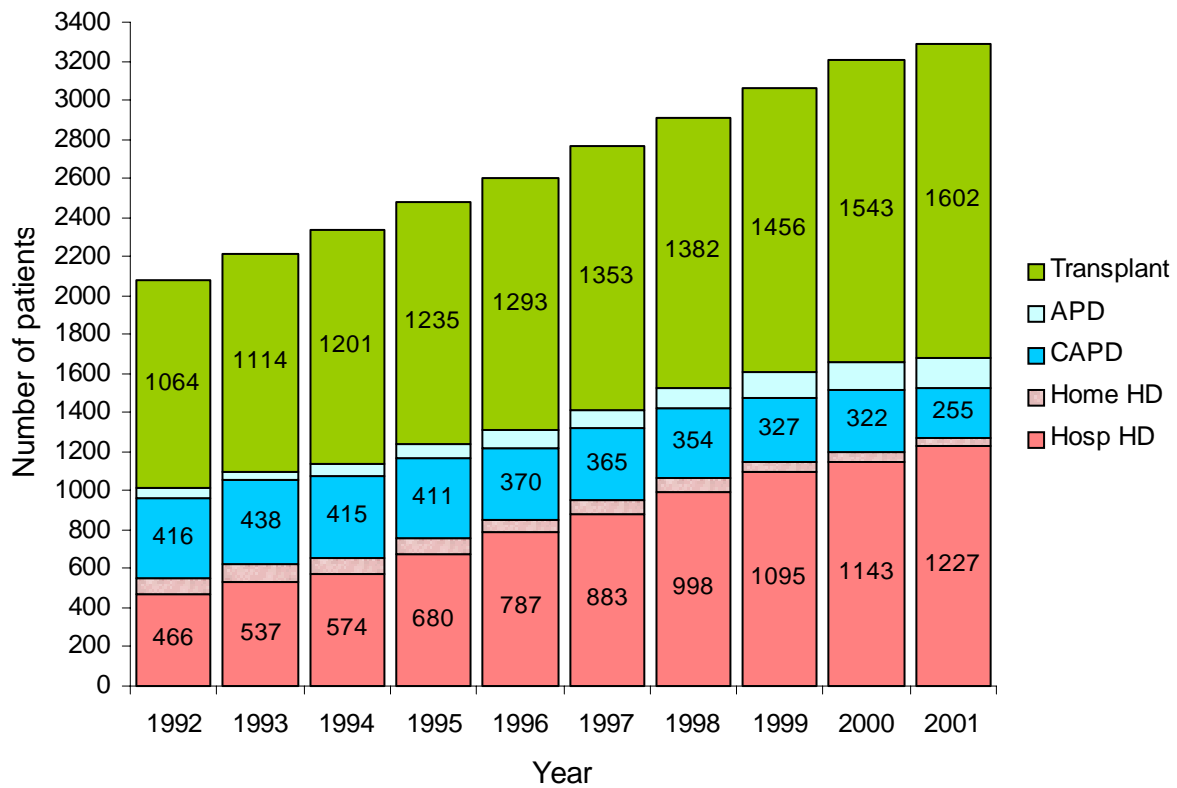
#### B1.1 Prevalent patients every fifth year between 1966-2001



#### B1.2 Prevalent patients every fifth year between 1966-2001

| Year | Hospital HD | Home HD | CAPD | APD | Transplant | Total |
|------|-------------|---------|------|-----|------------|-------|
| 1966 | 22          | 0       | 0    | 0   | 6          | 28    |
| 1971 | 77          | 7       | 0    | 3   | 55         | 142   |
| 1976 | 115         | 96      | 0    | 3   | 137        | 351   |
| 1981 | 166         | 169     | 103  | 1   | 311        | 469   |
| 1986 | 277         | 133     | 234  | 0   | 642        | 1286  |
| 1991 | 400         | 89      | 432  | 31  | 1012       | 1964  |
| 1996 | 787         | 65      | 370  | 84  | 1293       | 2599  |
| 2001 | 1227        | 45      | 255  | 157 | 1602       | 3286  |

**B1.3 Prevalent patients every year between 1992-2001**



**B1.4 Prevalent patients every year between 1992-2001**

| Year | Hospital HD | Home HD | CAPD | APD | Transplant | Total |
|------|-------------|---------|------|-----|------------|-------|
| 1992 | 466         | 85      | 416  | 49  | 1064       | 2080  |
| 1993 | 537         | 84      | 438  | 41  | 1114       | 2214  |
| 1994 | 574         | 83      | 415  | 62  | 1201       | 2335  |
| 1995 | 680         | 79      | 411  | 73  | 1235       | 2478  |
| 1996 | 787         | 65      | 370  | 84  | 1293       | 2599  |
| 1997 | 883         | 68      | 365  | 98  | 1353       | 2767  |
| 1998 | 998         | 68      | 354  | 109 | 1382       | 2911  |
| 1999 | 1095        | 56      | 327  | 126 | 1456       | 3060  |
| 2000 | 1143        | 52      | 322  | 145 | 1543       | 3205  |
| 2001 | 1227        | 45      | 255  | 157 | 1602       | 3286  |

**B2 PREVALENT PATIENTS AT EACH RENAL UNIT**

The total number of patients treated at each renal unit differs considerably.

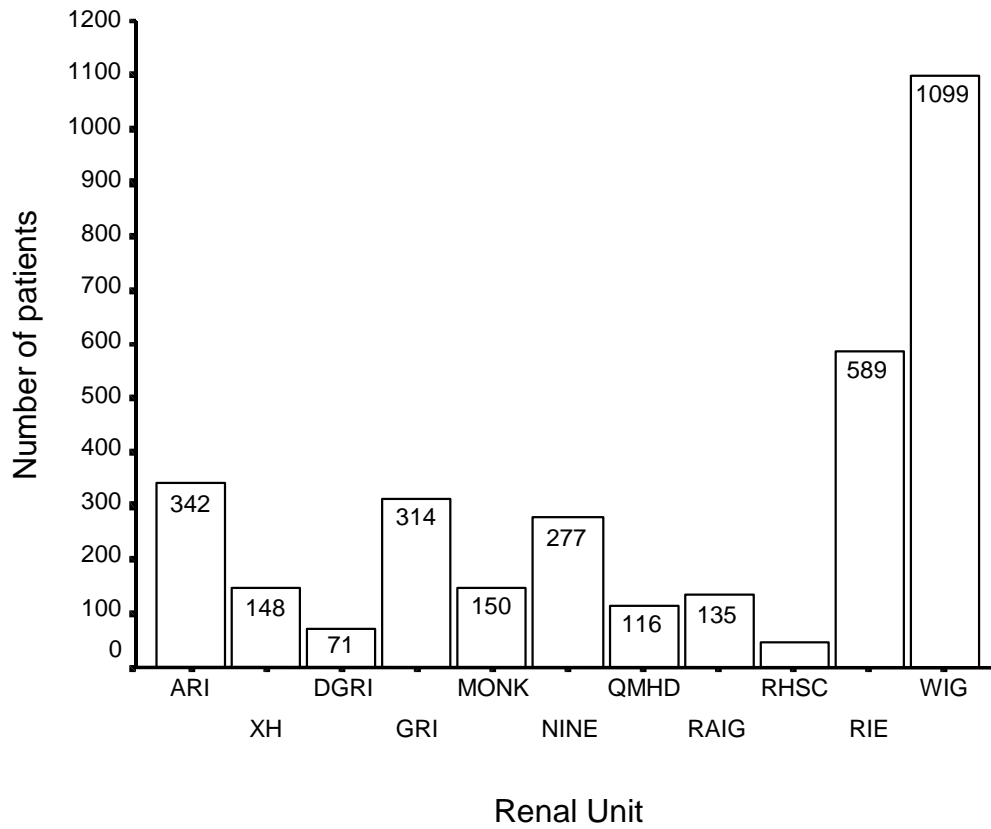
To make even very simple comparisons it is important to have some background information about local and national working practices. This is given in the table below. Transplants are performed at three renal units in Scotland: Aberdeen Royal Infirmary (ARI), Royal Infirmary Edinburgh (RIE) and Western Infirmary Glasgow (WIG). Multi organ transplants may be performed in the RIE and Glasgow Royal Infirmary (GRI). Patients with a functioning renal transplant are followed up as noted below. Patients recorded as having used IPD are shown together with patients who have been treated with APD.

**RENAL UNIT**

|   |  |
|---|--|
| <b>Raigmore Hospital</b>                | Many patients live in geographically isolated areas and for this reason PD is often favoured.  |
| <b>Royal Infirmary of Edinburgh</b>     | Performs both kidney transplants and follow-up of patients previously dialysed at Queen Margaret Hospital Dunfermline.<br><br>Performs kidney transplants but not follow-up of patients previously dialysed at Ninewells Hospital Dundee.<br><br>Performs combined pancreas and kidney transplants   |
| <b>Glasgow Royal Infirmary</b>          | Treats all Home HD patients from Glasgow Royal Infirmary, and the Western Infirmary Glasgow. The home HD service is run from the GRI satellite unit at Stobhill hospital.<br><br>The Scottish cardio pulmonary transplant unit is at the GRI. Combined heart and kidney transplants can be performed there. Patients are followed up initially at the GRI. |
| <b>Western Infirmary Glasgow</b>        | Performs transplants and subsequent follow-up of patients previously dialysed at GRI, and Monklands Hospital.<br><br>Performs transplants but not follow-up or share follow-up of patients previously dialysed at Dumfries and Galloway Royal Infirmary and Crosshouse Hospital.   |
| <b>Royal Hospital for Sick Children</b> | Whilst all patients treated at the Royal Hospital for Sick Children Glasgow (RHSC) are children, some children are treated by other renal units and are included in the figures of the unit they attend.   |

The high proportion of younger patients at some units (Graph B2.2 and B2.5) is at least in part because they offer transplant follow-up.

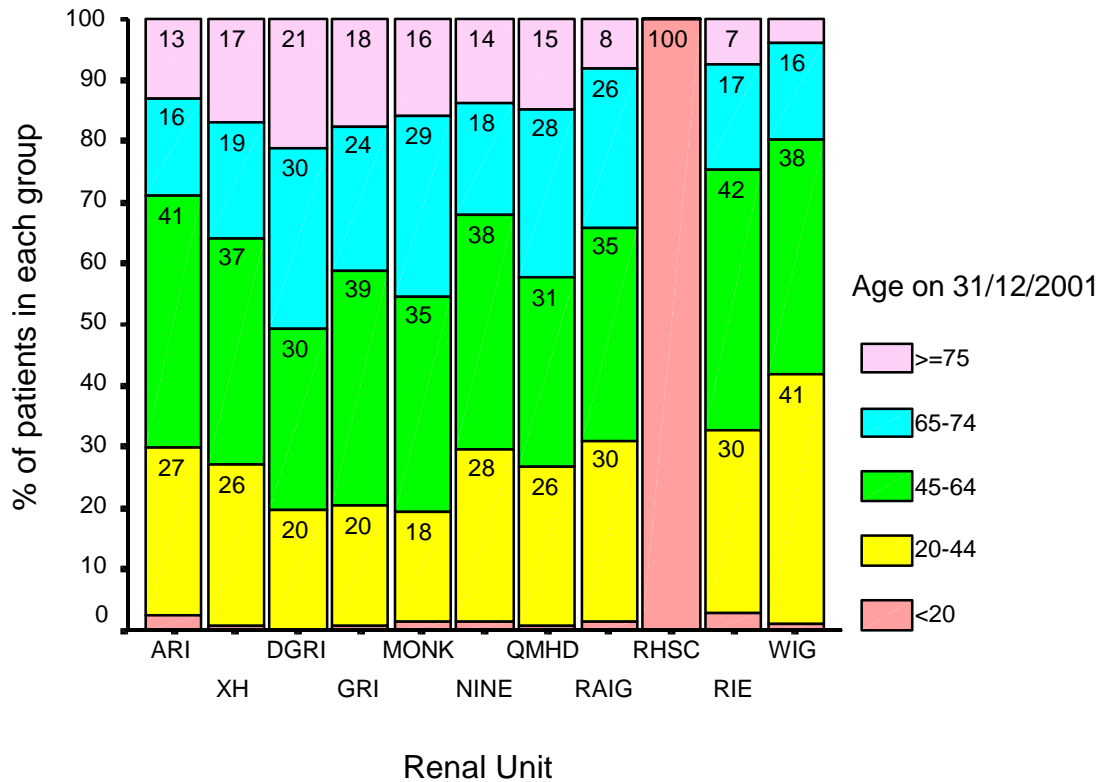
**B2.1 Numbers of patients receiving RRT on 31st December 2001**



3286 patients were receiving RRT on 31 December 2001

Of these, 45 patients were receiving treatment in RHSC.

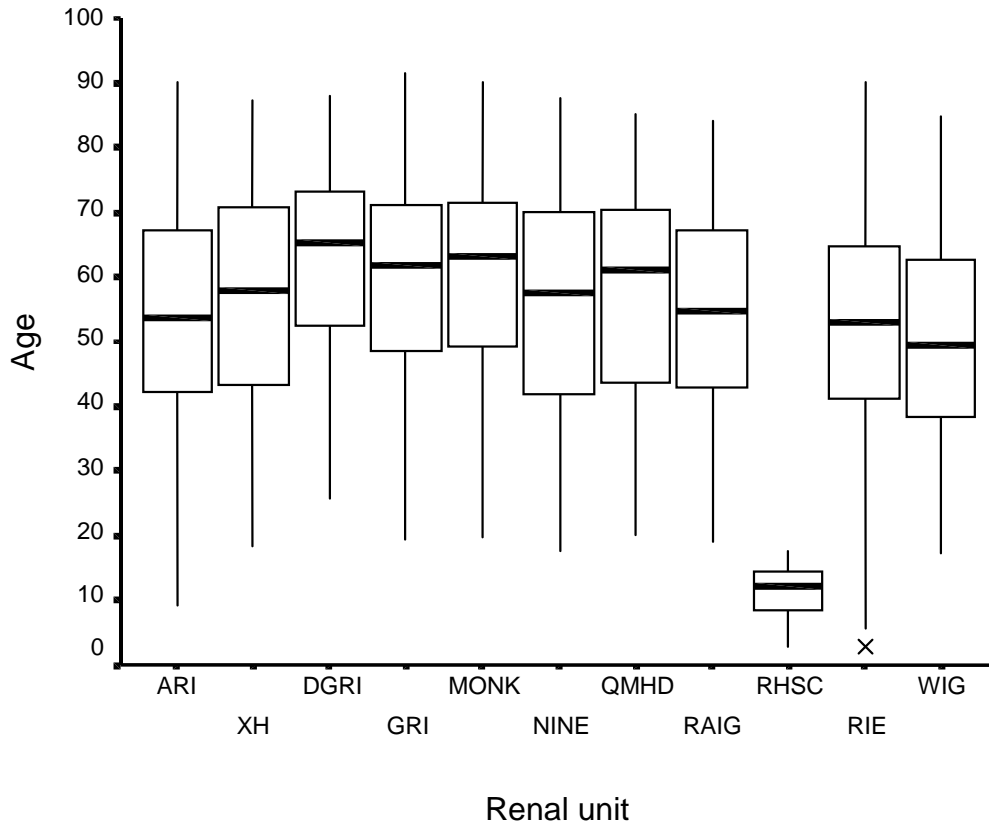
**B2.2 Percentage of patients in each age group receiving RRT at each renal unit on 31st December 2001**



**B2.3 Number of patients receiving RRT at each renal unit on 31st December 2001**

| AGE               | ARI        | XH         | DGRI      | GRI        | MONK       | NINE       | QMHD       | RAIG       | RHSC      | RIE        | WIG         | TOTAL       |
|-------------------|------------|------------|-----------|------------|------------|------------|------------|------------|-----------|------------|-------------|-------------|
| $\geq 75$         | 44         | 25         | 15        | 55         | 24         | 38         | 17         | 11         | 0         | 44         | 44          | <b>317</b>  |
| 65-74             | 55         | 28         | 21        | 74         | 44         | 51         | 32         | 35         | 0         | 102        | 172         | <b>614</b>  |
| 45-64             | 141        | 55         | 21        | 121        | 53         | 106        | 36         | 47         | 0         | 250        | 423         | <b>1253</b> |
| 20-44             | 94         | 39         | 14        | 62         | 27         | 78         | 30         | 40         | 0         | 176        | 449         | <b>1009</b> |
| <math>< 20</math> | 8          | 1          | 0         | 2          | 2          | 4          | 1          | 2          | 45        | 17         | 11          | <b>93</b>   |
| <b>Total</b>      | <b>342</b> | <b>148</b> | <b>71</b> | <b>314</b> | <b>150</b> | <b>277</b> | <b>116</b> | <b>135</b> | <b>45</b> | <b>589</b> | <b>1099</b> | <b>3286</b> |

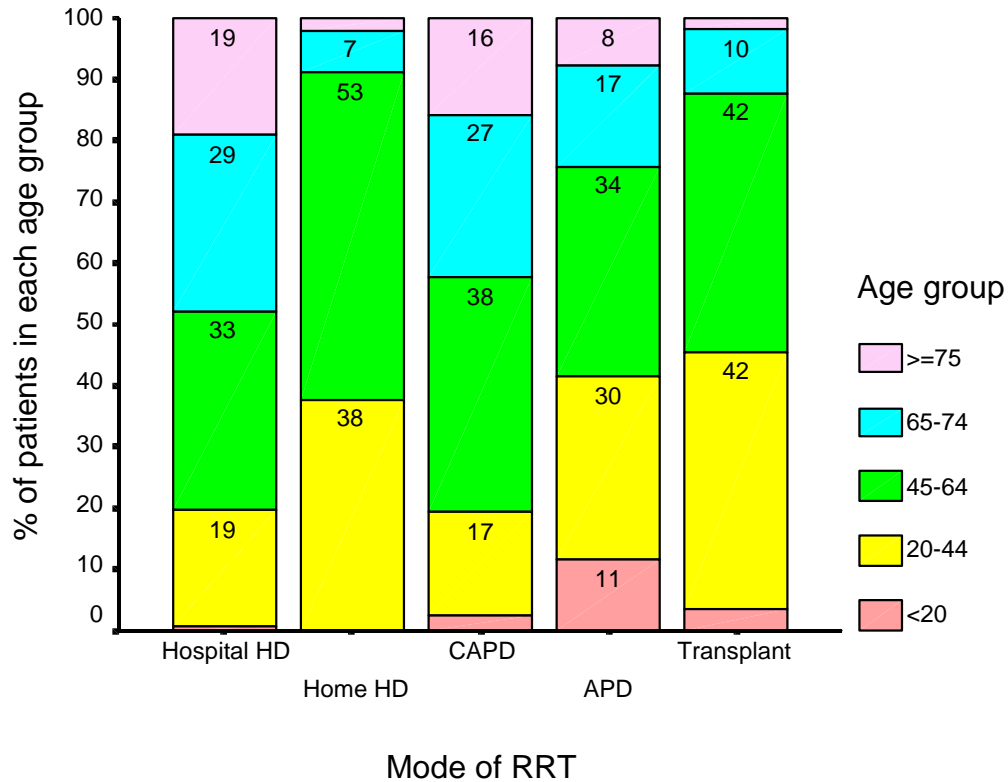
**B2.4 Median age of prevalent patients at each renal unit on 31st December 2001**



**B2.5 Median age of prevalent patients at each renal unit on 31st December 2001**

|            | ARI  | XH   | DGRI | GRI  | MONK | NINE | QMHD | RAIG | RHSC | RIE  | WIG  |
|------------|------|------|------|------|------|------|------|------|------|------|------|
| Median age | 53.7 | 58.0 | 65.2 | 61.8 | 63.3 | 57.4 | 61.1 | 54.8 | 12.0 | 52.8 | 49.6 |

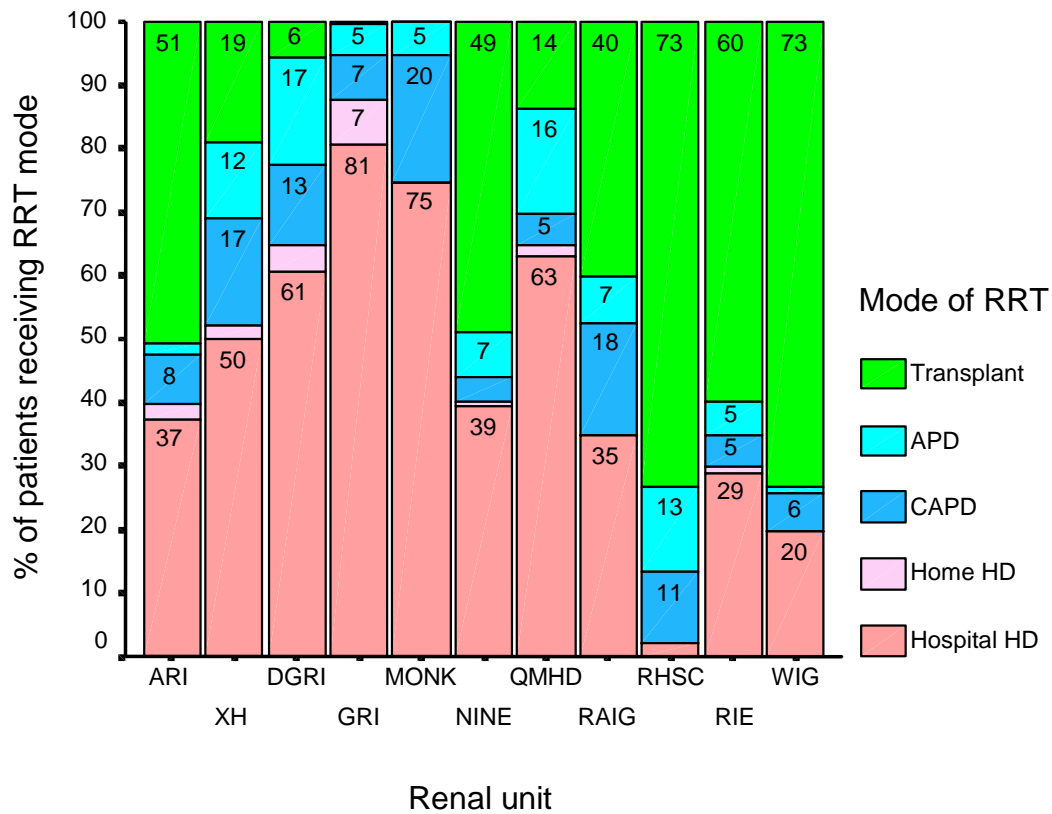
**B2.6 Mode of RRT and renal unit providing treatment on 31st December 2001**



**B2.7 Number of patients, median age and age range on each mode of RRT on 31st December 2001**

|             | <20 | 20-44 | 45-64 | 65-74 | ≥75 | Median†Age | Age†Range |
|-------------|-----|-------|-------|-------|-----|------------|-----------|
| Transplant  | 59  | 671   | 677   | 166   | 29  | 47.0       | 5.4-81.7  |
| APD         | 18  | 47    | 54    | 26    | 12  | 51.8       | 2.9-88.2  |
| CAPD        | 6   | 43    | 98    | 68    | 40  | 61.4       | 6.2-90.1  |
| Home HD     | 0   | 17    | 24    | 3     | 1   | 51.2       | 21.3-77.6 |
| Hospital HD | 10  | 231   | 400   | 351   | 235 | 64.2       | 12.2-91.5 |

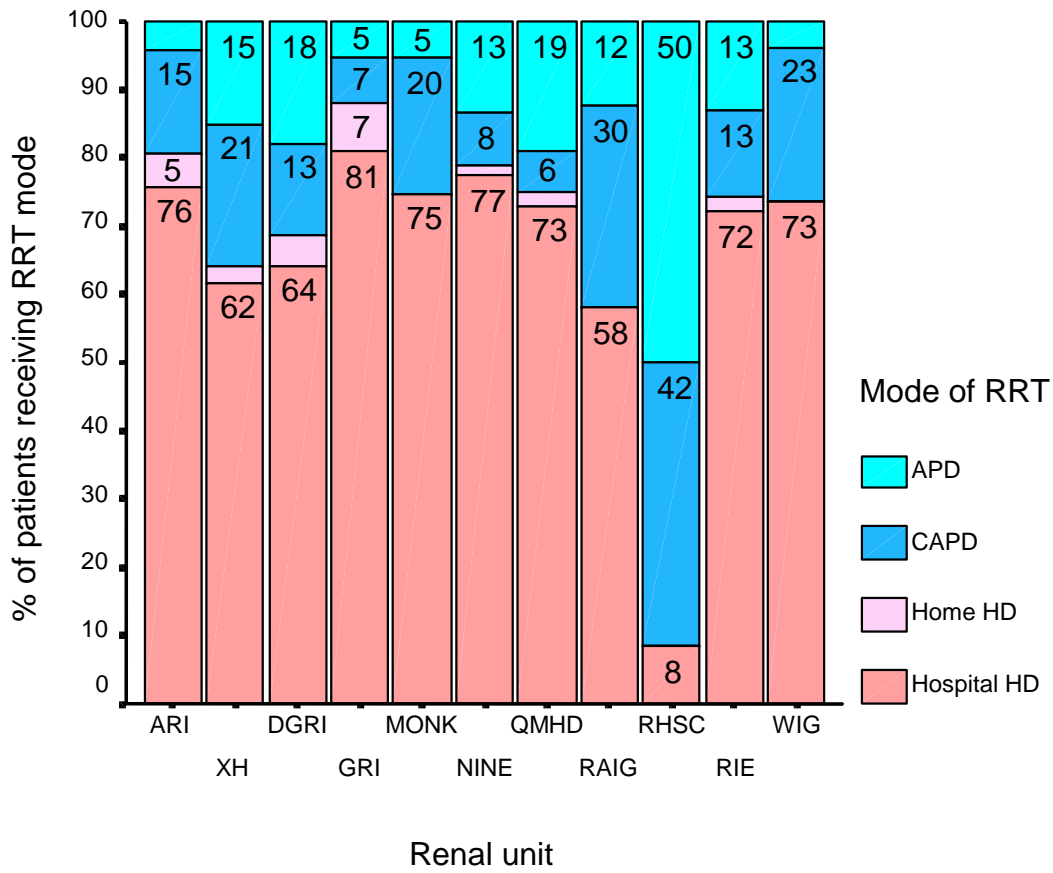
**B2.8 Mode of RRT and renal unit providing treatment on 31st December 2001**



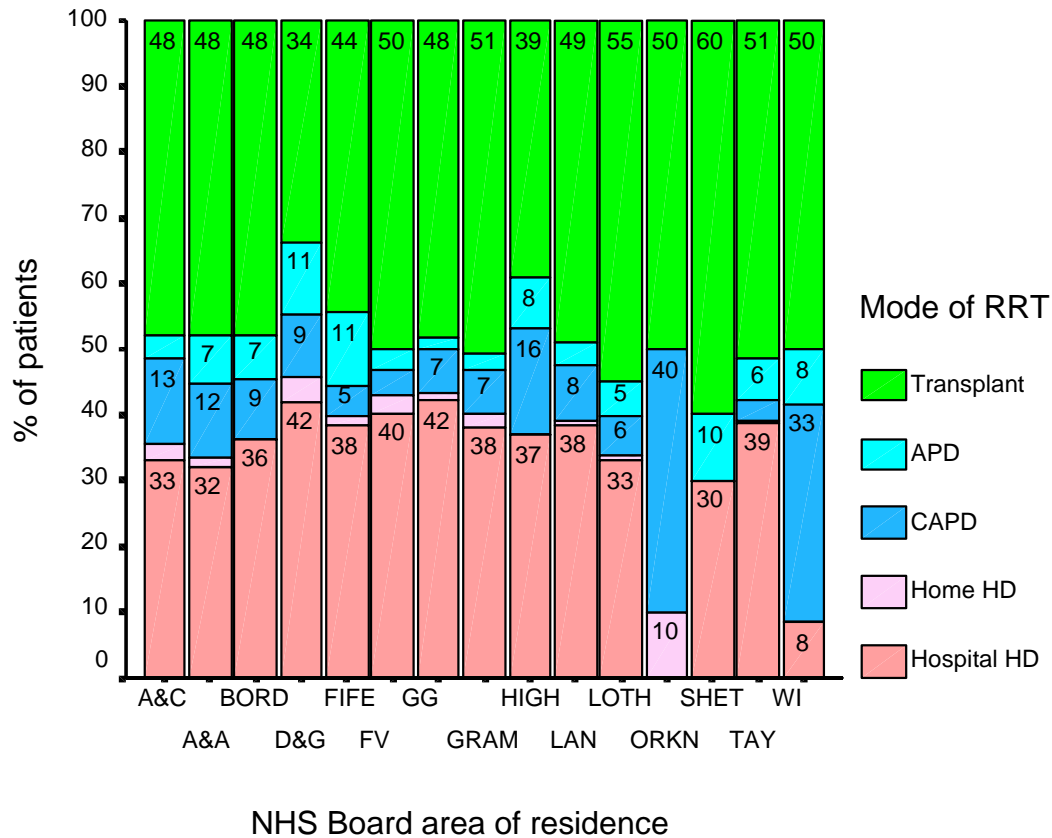
**B2.9 Number of patients and renal unit providing treatment on each mode of RRT on 31st December 2001**

|             | ARI | XH | DGRI | GRI | MONK | NINE | QMHD | RAIG | RHSC | RIE | WIG |
|-------------|-----|----|------|-----|------|------|------|------|------|-----|-----|
| Transplant  | 173 | 28 | 4    | 1   | 0    | 136  | 16   | 54   | 33   | 352 | 805 |
| APD         | 7   | 18 | 12   | 16  | 8    | 19   | 19   | 10   | 6    | 31  | 11  |
| CAPD        | 26  | 25 | 9    | 22  | 30   | 11   | 6    | 24   | 5    | 30  | 67  |
| Home†HD     | 8   | 3  | 3    | 22  | 0    | 2    | 2    | 0    | 0    | 5   | 0   |
| Hospital†HD | 128 | 74 | 43   | 253 | 112  | 109  | 73   | 47   | 1    | 171 | 216 |

**B2.10 Mode of RRT and renal unit providing treatment on 31st December 2001 (excluding transplant)**



**B2.11 Mode of RRT on 31st December 2001 and NHS board area of patient residence**



**B2.12 Mode of RRT on 31st December 2001 and NHS Board area of patient residence**

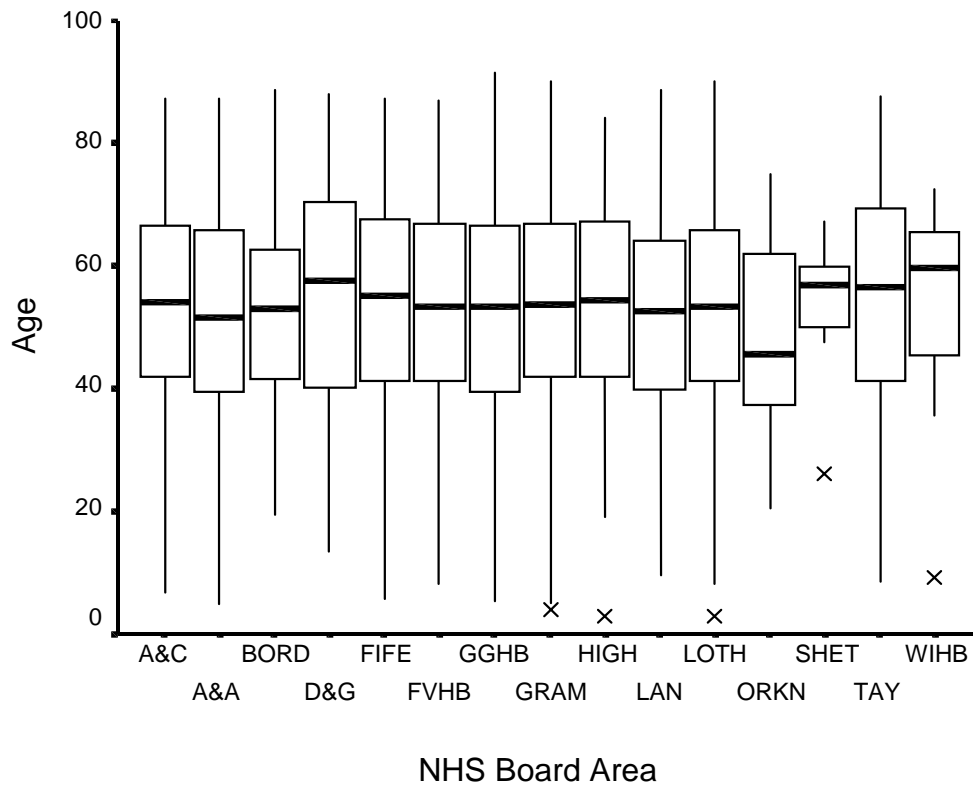
| NHS Board    | Transplant  | APD        | CAPD       | Home HD   | Hospital HD | Total       |
|--------------|-------------|------------|------------|-----------|-------------|-------------|
| A&A          | 115         | 18         | 28         | 3         | 78          | 242         |
| A&C          | 134         | 10         | 37         | 7         | 93          | 281         |
| BORD         | 21          | 3          | 4          | 0         | 16          | 44          |
| D&G          | 36          | 12         | 10         | 4         | 45          | 107         |
| FIFE         | 93          | 23         | 10         | 3         | 80          | 209         |
| FV           | 77          | 5          | 6          | 4         | 62          | 154         |
| GG           | 317         | 11         | 42         | 8         | 275         | 653         |
| GRAM         | 167         | 8          | 22         | 7         | 126         | 330         |
| HIGH         | 51          | 10         | 23         | 0         | 48          | 132         |
| LAN          | 185         | 13         | 31         | 3         | 144         | 376         |
| LOTH         | 252         | 25         | 27         | 4         | 152         | 460         |
| ORK          | 5           | 0          | 4          | 1         | 0           | 10          |
| SHET         | 6           | 1          | 0          | 0         | 3           | 10          |
| TAY          | 135         | 17         | 7          | 1         | 102         | 262         |
| WI           | 6           | 1          | 4          | 0         | 1           | 12          |
| Missing      | 4           | -          | -          | -         | -           | 4           |
| <b>Total</b> | <b>1604</b> | <b>157</b> | <b>255</b> | <b>45</b> | <b>1225</b> | <b>3286</b> |

**B2.13 NHS Board area of residence and renal unit providing treatment 31st December 2001**

Patients often receive treatment outside their NHS board area. The reasons for this include transplant follow-up at a transplant centre, traditional patterns of referral that were established before local renal units were opened or to accommodate patient preference. This is sometimes based on family, employment or educational commitments.

|              | ARI        | XH         | DGRI      | GRI        | MONK       | NINE       | QMHD       | RAIG       | RHSC      | RIE        | WIG         | Total       |
|--------------|------------|------------|-----------|------------|------------|------------|------------|------------|-----------|------------|-------------|-------------|
| A&A          | -          | 147        | -         | 2          | -          | -          | -          | -          | 5         | 1          | 87          | <b>242</b>  |
| A&C          | -          | -          | -         | 23         | -          | -          | -          | -          | 5         | -          | 253         | <b>281</b>  |
| BORD         | -          | -          | -         | -          | -          | -          | -          | -          | -         | 44         | -           | <b>44</b>   |
| D&G          | -          | -          | 71        | -          | -          | -          | -          | -          | 1         | 3          | 32          | <b>107</b>  |
| FIFE         | -          | -          | -         | -          | -          | 32         | 112        | -          | 1         | 63         | 1           | <b>209</b>  |
| FV           | -          | -          | -         | 64         | -          | -          | 1          | -          | 1         | 9          | 79          | <b>154</b>  |
| GG           | -          | -          | -         | 189        | 2          | -          | -          | -          | 10        | 1          | 452         | <b>654</b>  |
| GRAMP        | 315        | -          | -         | -          | -          | 1          | -          | 6          | 4         | 3          | 1           | <b>330</b>  |
| HIGH         | 5          | -          | -         | 1          | -          | -          | -          | 122        | 1         | -          | 2           | <b>131</b>  |
| LAN          | -          | -          | -         | 34         | 147        | -          | -          | 1          | 10        | 3          | 180         | <b>375</b>  |
| LOTH         | -          | -          | -         | -          | -          | 1          | -          | -          | 2         | 452        | 5           | <b>460</b>  |
| ORK          | 10         | -          | -         | -          | -          | -          | -          | -          | -         | -          | -           | <b>10</b>   |
| SHET         | 10         | -          | -         | -          | -          | -          | -          | -          | -         | -          | -           | <b>10</b>   |
| TAY          | 2          | 1          | -         | -          | -          | 243        | 3          | -          | 4         | 8          | 2           | <b>263</b>  |
| WI           | -          | -          | -         | 1          | -          | -          | -          | 5          | 1         | 1          | 4           | <b>12</b>   |
| Missing      | -          | -          | -         | -          | 1          | -          | -          | 1          | -         | 1          | 1           | <b>4</b>    |
| <b>Total</b> | <b>342</b> | <b>148</b> | <b>71</b> | <b>314</b> | <b>150</b> | <b>277</b> | <b>116</b> | <b>135</b> | <b>45</b> | <b>589</b> | <b>1099</b> | <b>3286</b> |

**B2.14 Patients' age on 31st December 2001 and their NHS Board area of residence**



**B2.15 Patients' median age on 31st December 2001 and their NHS Board area of residence**

| NHS Board | Median Age | Age Range   |
|-----------|------------|-------------|
| A&A       | 51.5       | 7.1 - 87.3  |
| A&C       | 53.9       | 6.6 - 87.3  |
| BORD      | 52.9       | 19.2 - 88.9 |
| D&G       | 57.6       | 13.3 - 88.2 |
| FIFE      | 55.2       | 5.6 - 87.2  |
| FV        | 53.2       | 8.0 - 87.0  |
| GG        | 53.2       | 5.4 - 91.5  |
| GRAMP     | 53.6       | 3.9 - 90.2  |
| HIGH      | 54.4       | 3.0 - 84.0  |
| LAN       | 52.6       | 9.6 - 88.9  |
| LOTH      | 53.3       | 2.9 - 90.1  |
| ORK       | 45.6       | 20.5 - 75.2 |
| SHET      | 56.7       | 25.9 - 67.3 |
| TAY       | 56.4       | 8.3 - 87.6  |
| WI        | 59.6       | 9.3 - 72.5  |

## B2.16 Prevalence of patients receiving RRT on 31st December 2001 by NHS Board area of residence

The NHS board boundaries and the locations of renal units and satellites are shown on the map in the front of this report. The number of patients and the population in some NHS board areas are low. The derived figures are therefore subject to variation year by year.

| NHS Board | Population in 2000* | RRT population 2001 | Prevalence per 100 000 population |
|-----------|---------------------|---------------------|-----------------------------------|
| A&A       | 373 400             | 242                 | 65                                |
| A&C       | 423 500             | 281                 | 67                                |
| BORD      | 106 900             | 44                  | 41                                |
| D&G       | 145 800             | 107                 | 73                                |
| FIFE      | 350 400             | 209                 | 60                                |
| FV        | 278 000             | 154                 | 55                                |
| GG        | 904 400             | 653                 | 72                                |
| GRAMP     | 523 400             | 330                 | 63                                |
| HIGH      | 208 600             | 132                 | 62                                |
| LAN       | 562 000             | 376                 | 67                                |
| LOTH      | 783 600             | 460                 | 59                                |
| ORK       | 19 480              | 10                  | 51                                |
| SHET      | 22 440              | 10                  | 45                                |
| TAY       | 385 500             | 262                 | 68                                |
| WEST I    | 27 180              | 12                  | 44                                |
| Missing   | -                   | 4                   | -                                 |

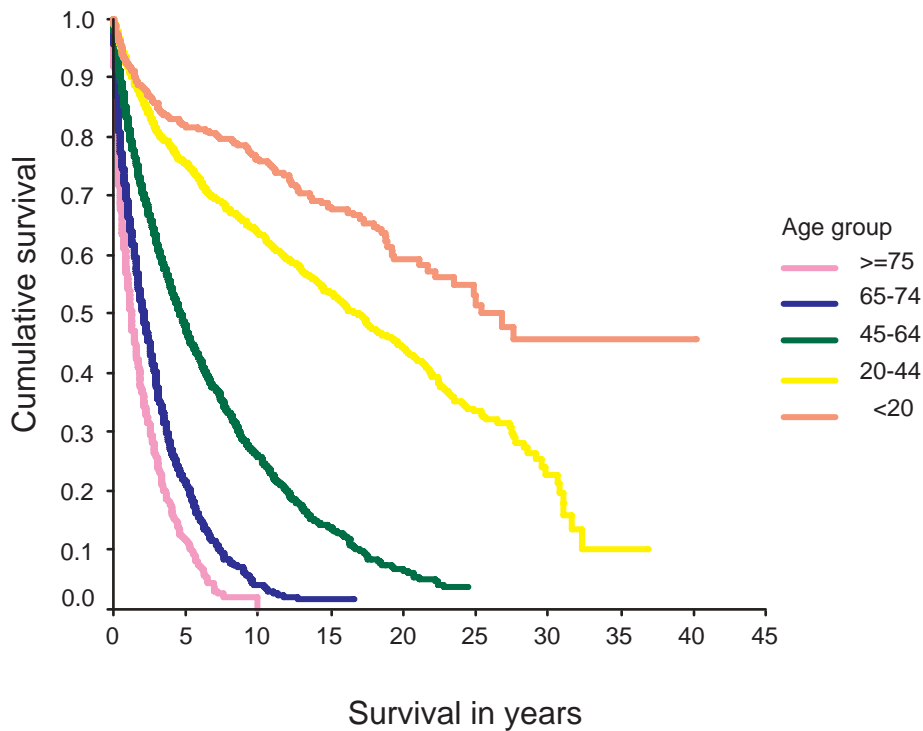
\* Population figures from the office of the Registrar General mid-year estimates 2000.

## C SURVIVAL

### C1 SURVIVAL ANALYSES

The log rank test for comparison of the survival curves had a p-value <0.0001 indicating a significant difference in survival between these age groups (at the start of RRT). Median survival decreased with increasing age at the time of starting RRT.

#### C1.1 Survival by age when starting RRT



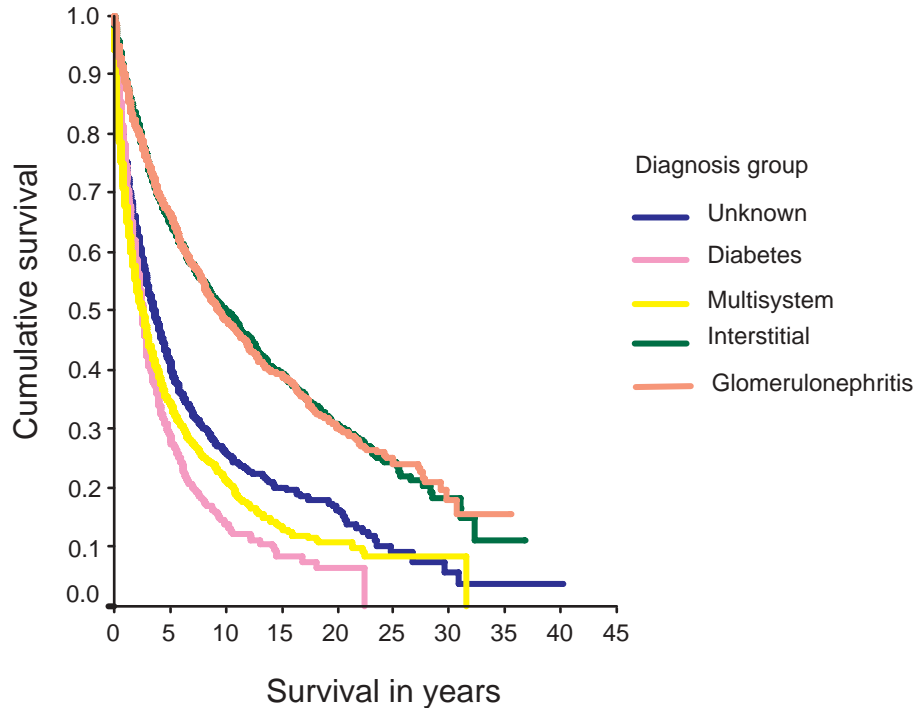
#### C1.2 Survival of all patients by age when starting RRT

Only patients with complete data are eligible for survival analysis. The total number of patients in this section will therefore be slightly less than the totals reported in the incidence and prevalence sections. In the youngest age group too few had died to give an interval for median survival.

| Age Group       | Number Starting RRT | Number dead by 31/12/2001 | Median survival (years) | 95% CI for median survival |            |
|-----------------|---------------------|---------------------------|-------------------------|----------------------------|------------|
| ≥ 75 years      | 766                 | 558                       | 1.2                     | 1.1                        | 1.4        |
| 65-74 years     | 1780                | 1297                      | 2.1                     | 1.9                        | 2.3        |
| 45-64 years     | 3057                | 2011                      | 4.6                     | 4.3                        | 4.9        |
| 20-44 years     | 2230                | 901                       | 16.9                    | 15.4                       | 18.4       |
| <20 years       | 473                 | 144                       | 26.8                    | †                          | †          |
| <b>All ages</b> | <b>8306</b>         | <b>4911</b>               | <b>4.9</b>              | <b>4.7</b>                 | <b>5.2</b> |

### C1.3 Survival of all patients by primary renal diagnosis group

A wide range of expected survival is evident between the different renal diagnoses groups.



### C1.4 Survival of all patients by primary renal diagnosis group

The log rank test for comparison of survival curves had a p-value <0.0001, indicating a significant difference in survival between the 5 diagnosis groups. On average patients with glomerulonephritis or interstitial nephritis survived longer than those in the other diagnosis groups.

| Diagnostic Group     | Number Starting RRT | Number dead by 31/12/2001 | Median survival (years) | 95%†CI†for†median survival |            |
|----------------------|---------------------|---------------------------|-------------------------|----------------------------|------------|
| Unknown              | 1430                | 895                       | 3.5                     | 3.1                        | 3.9        |
| Diabetes             | 1122                | 782                       | 2.5                     | 2.3                        | 2.7        |
| Multisystem          | 1843                | 1264                      | 2.5                     | 2.2                        | 2.8        |
| Interstitial         | 2169                | 1084                      | 10.0                    | 8.9                        | 11.1       |
| Glomerulonephritis   | 1691                | 853                       | 9.3                     | 8.3                        | 10.4       |
| <b>All diagnoses</b> | <b>8255</b>         | <b>4878</b>               | <b>4.9</b>              | <b>4.7</b>                 | <b>5.2</b> |

### C1.5 Survival by age and diagnosis group

The table shows the independent effect on survival of age and diagnosis. The general pattern seen in graphs C1.1 and C1.3 is reflected in each of the age groups separately.

The lack of significant difference in survival between diagnosis groups in patients aged over 75 might be due to the smaller number of patients involved, or it might be a real effect therefore these figures should be interpreted with caution.

| Age Group       | Diagnosis Group      | Number Starting RRT | Number dead by 31/12/2001 | Median survival (years) | 95% CI for median survival | Log Rank   | p value |
|-----------------|----------------------|---------------------|---------------------------|-------------------------|----------------------------|------------|---------|
| ≥75†years       | Unknown              | 278                 | 218                       | 1.2                     | 0.9                        | 1.4        | 0.056†  |
|                 | Diabetes             | 67                  | 48                        | 1.1                     | 0.6                        | 1.5        |         |
|                 | Multisystem          | 228                 | 160                       | 1.0                     | 0.6                        | 1.4        |         |
|                 | Interstitial         | 112                 | 74                        | 1.9                     | 1.3                        | 2.5        |         |
|                 | Glomerulonephritis   | 78                  | 56                        | 1.3                     | 0.9                        | 1.7        |         |
| 65-74†years     | Unknown              | 394                 | 273                       | 2.5                     | 2.1                        | 2.9        | <0.0001 |
|                 | Diabetes             | 247                 | 184                       | 1.6                     | 1.4                        | 1.8        |         |
|                 | Multisystem          | 577                 | 436                       | 1.4                     | 1.2                        | 1.7        |         |
|                 | Interstitial         | 318                 | 231                       | 2.9                     | 2.4                        | 3.3        |         |
|                 | Glomerulonephritis   | 236                 | 166                       | 3.0                     | 2.4                        | 3.6        |         |
| 45-64†years     | Unknown              | 426                 | 282                       | 4.7                     | 4.2                        | 5.3        | <0.0001 |
|                 | Diabetes             | 510                 | 383                       | 2.5                     | 2.2                        | 2.8        |         |
|                 | Multisystem          | 694                 | 501                       | 3.0                     | 2.5                        | 3.5        |         |
|                 | Interstitial         | 798                 | 471                       | 7.3                     | 6.7                        | 8.0        |         |
|                 | Glomerulonephritis   | 617                 | 363                       | 6.8                     | 5.9                        | 7.7        |         |
| 20-44†years     | Unknown              | 257                 | 102                       | 17.3                    | 10.7                       | 23.9       | <0.0001 |
|                 | Diabetes             | 296                 | 165                       | 5.8                     | 4.4                        | 7.1        |         |
|                 | Multisystem          | 286                 | 150                       | 9.3                     | 7.3                        | 11.3       |         |
|                 | Interstitial         | 730                 | 243                       | 21.9                    | 19.9                       | 23.9       |         |
|                 | Glomerulonephritis   | 658                 | 238                       | 20.0                    | 17.6                       | 22.4       |         |
| <20†years       | Unknown              | 75                  | 20                        | 26.8                    | 14.1                       | 39.5       | <0.0001 |
|                 | Diabetes             | 2                   | 2                         | -                       | -                          | -          |         |
|                 | Multisystem          | 58                  | 17                        | -                       | -                          | -          |         |
|                 | Interstitial         | 211                 | 65                        | 25.4                    | -                          | -          |         |
|                 | Glomerulonephritis   | 102                 | 30                        | 27.6                    | -                          | -          |         |
| <b>All†ages</b> | <b>All†diagnoses</b> | <b>8255</b>         | <b>4878</b>               | <b>5.0</b>              | <b>4.7</b>                 | <b>5.2</b> |         |

**C1.6 Life expectancy for the general Scottish population 2000**

Life expectancy for the general population of Scotland in 2000 by sex, at the exact age given are shown. This allows comparison with patients receiving RRT. Life expectancy for patients receiving RRT is much less than the general population. The excess mortality in renal patients may partly be attributed to comorbid illnesses. These are sometimes caused by the renal failure but are often coincident and may indeed cause the renal failure.

| Age | Life expectancy males | Life expectancy females |
|-----|-----------------------|-------------------------|
| 85  | 4.9                   | 5.8                     |
| 75  | 8.8                   | 10.8                    |
| 65  | 14.6                  | 17.7                    |
| 45  | 30.7                  | 35.0                    |

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## C2 SURVIVAL OF PATIENTS AGED 50-64 WHEN STARTING RRT OVER TIME

We aimed to determine whether survival has improved for patients starting RRT in more recent years.

The data were divided into groups according to year of starting RRT. These year groups have obviously been followed-up for different periods therefore a standard Kaplan-Meier analysis would give a misleading estimate of survival. The most recent data relating to patients starting RRT between 1995-1999 were excluded to ensure a minimum of 5 years of follow-up was available for analysis. We are aware that this reduces the power for finding a significant improvement in survival for patients who started RRT recently.

Logistic regression was used to see whether the probability of dying within 5 years of starting RRT, in patients aged 50-64 years, with a diagnosis of glomerulonephritis has changed over time. Odds ratios were calculated for death by 5 years.

### C2.1 Odds ratio of death by 5 years of RRT for patients aged 45-64 with a diagnosis of Glomerulonephritis

An initial group of 617 patients who had a PRD of glomerulonephritis and were of age 45-64 years when starting treatment were identified for analyses. However, 156 of this number started treatment between 1997 and 2001 and were excluded to ensure a minimum of 5 years of follow-up RRT. A further 10 patients had either recovered, moved outwith Scotland or had been lost to follow-up within 5 years and were therefore ineligible. Of the remaining 451 people, 174 died within 5 years of beginning RRT.

Only the odds ratios for earliest time interval are significantly different to a ratio of 1.0. Note that the number of patients starting in this time interval is not large. However a similar analysis looking for a linear trend over time suggested that for each year more recently that RRT was started there was a 4% reduction (95% CI 1% to 7%) in the odds of death within 5 years of starting RRT.

| Date of starting RRT | Patients | Dead by 5 years of RRT | Odds ratio of death | 95% CI ratio of odds of death |      | p value |
|----------------------|----------|------------------------|---------------------|-------------------------------|------|---------|
| 1992-1997            | 152      | 51                     | 1.00                | reference                     |      |         |
| 1987-1991            | 109      | 36                     | 0.98                | 0.58                          | 1.65 | 0.93††  |
| 1982-1986            | 80       | 35                     | 1.54                | 0.88                          | 2.68 | 0.13††  |
| 1977-1981            | 74       | 31                     | 1.43                | 0.81                          | 2.53 | 0.22††  |
| 1964-1976            | 36       | 21                     | 2.77                | 1.32                          | 5.83 | 0.007   |

This analysis was repeated for patients of the same age when starting RRT but with a diagnosis of diabetic nephropathy. Such patients have only been treated in appreciable numbers for the last 18 years.

## C2.2 Odds ratio of death by 5 years of RRT for patients aged 45-64 with a diagnosis of Diabetic nephropathy

510 patients had a PRD of diabetic nephropathy and were of age 45 - 64 years when starting treatment. This group included 196 people who had not received 5 years of RRT and 27 patients who started RRT before 1984. All of these are excluded from the analyses. Of the remainder, 226 died within 5 years of RRT start.

None of the odds ratios are significantly different to 1.0.

For patients aged 45-64 when starting RRT, with diabetic nephropathy, the probability of dying within 5 years was essentially the same regardless of when RRT was started.

| Date of starting RRT | Patients | Dead by 5 years of RRT | Odds ratio of death | 95% CI ratio of odds of death |      | p value |
|----------------------|----------|------------------------|---------------------|-------------------------------|------|---------|
| 1995-1996            | 76       | 61                     | 1.00                | reference                     |      |         |
| 1993-1994            | 55       | 42                     | 0.79                | 0.34                          | 1.84 | 0.59    |
| 1991-1992            | 46       | 38                     | 1.17                | 0.45                          | 3.02 | 0.75    |
| 1989-1990            | 40       | 29                     | 0.65                | 0.26                          | 1.59 | 0.34    |
| 1984-1988            | 70       | 56                     | 0.98                | 0.44                          | 2.22 | 0.97    |

The 5 year survival of patients aged 50 – 64 years when starting RRT with diabetic nephropathy has not increased over the last 30 years although the number of patients starting RRT in the 1960s was very small.

## C2.3 Percentage of patients surviving to key time points by year of start of treatment 1997- 2001

Patients with insufficient follow-up and those who recovered or who were lost to follow-up within the relevant period have been excluded. Those patients starting RRT in 2001 do not have 1 year of follow-up and those starting RRT in 2000 do not have 2 years of follow-up.

There are no trends in the proportion of patients surviving at any or these time points when compared across the different years of starting RRT.

| Date of starting RRT | % surviving 90 days | % surviving 1 year | % surviving 1 year + | % surviving 2 years | % surviving 2 years + 90 days |
|----------------------|---------------------|--------------------|----------------------|---------------------|-------------------------------|
| 1997                 | 88.5                | 74.3               | 71.8                 | 63.4                | 60.6                          |
| 1998                 | 86.0                | 75.1               | 71.3                 | 60.5                | 58.4                          |
| 1999                 | 86.2                | 74.9               | 70.8                 | 61.3                | 60.6                          |
| 2000                 | 91.0                | 76.1               | 71.6                 | -                   | -                             |
| 2001                 | 88.5                | -                  | -                    | -                   | -                             |

## C2.4 Comparison of survival at the different renal units using Cox regression

This is the first time we have reported patient survival according to the renal unit at which the patient first received RRT. In line with our standard practice for new audit reports, renal unit anonymity is maintained.

For a comparison of survival by renal unit of starting RRT, patients were only included in the analysis if a PRD was recorded and they started RRT between 1992 and 2001 inclusive. The other exclusions for the earlier survival analyses also applied.

The results presented in the table below are hazard ratios for death and 95% confidence intervals in the different renal units relative to Unit A which is the reference unit. Unit A, is in the middle of the spread of units in terms of length of survival. These are presented both without adjustment and then with adjustment for the effects of age (in four categories), PRD and sex. A hazard ratio of 1.00 is given for the reference group within each of the variables. The hazard is the instantaneous risk of death and the hazard ratio is a comparison of the hazards between two groups.

The unadjusted results may be considered as a very crude examination of survival. The figure after adjustment improves the utility of this analysis and emphasises the importance of adjustment. Further adjustment will be necessary in the future to account for other confounding factors such as comorbidity the modes of RRT used.

The unadjusted hazard ratios appear to be significantly higher in units B, C, G and I and significantly lower in unit K than in unit A. The hazard ratios suggest that the risks of death are 23% higher in B, 43% higher in C, 37% higher in G and 35% higher in I than in A. However these unadjusted hazard ratios can be misleading because patient characteristics have not been taken into account.

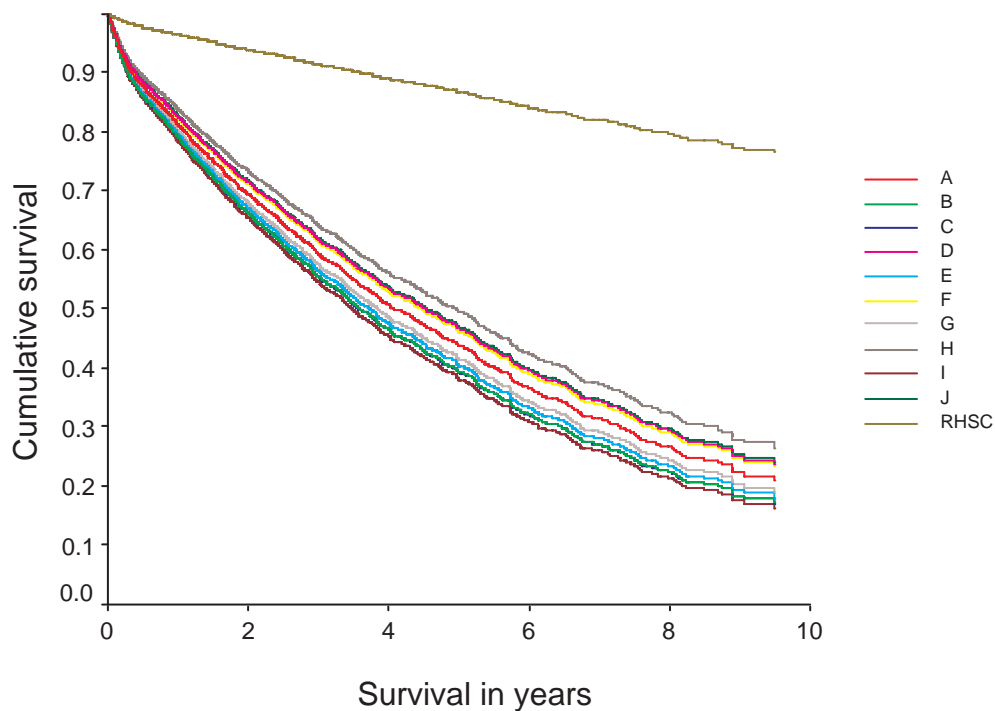
The next three columns show that age and diagnosis were highly influential and independently significant. Males were no more or less likely to die than females. As expected the risks of death were higher in older age groups with the risks being 3 times, 6 times and 10 times higher for patients starting RRT at the age of 45-64, 65-74 and 75 years or older relative to those starting RRT at less than 45 years of age. Patients with multisystem disease, diabetic nephropathy or unknown diagnosis had risks of death elevated by a factor of between 1.6 and 2.5 relative to patients with GN. Patients with an interstitial nephropathy were not significantly different to GN patients.

The renal unit term is significant in the model after adjusting for the other characteristics,  $p=0.003$ . This means that there are statistically significant differences in survival time between the units after adjusting for obviously important demographic and diagnosis factors but without adjusting for possible differences in comorbidity or mode of RRT. This difference is maintained even if the atypical paediatric (RHSC) is excluded. After adjustment for other patient characteristics, the units with elevated risks of death relative to unit A were B (1.13), C (1.13), and I (1.16). Units D, F, H, J and particularly the RHSC have reduced risks of death relative to unit A. Since none of the 95% confidence intervals excludes 1, it would appear that no renal unit has a risk of death which is significantly different to unit A. While there were significant differences in survival between the units, these were not so great that the extreme units were significantly different to this reference unit in the middle of the range. However, if a renal unit at one of the extremes in terms of survival had been selected as the reference, then many of the hazard ratios would have excluded 1 and the same differences would appear to be much more striking.

**C2.5 Hazard ratios and 95% confidence intervals for death in the different units relative to unit A**

|                            | Unadjusted   |           | Adjusted     |            |
|----------------------------|--------------|-----------|--------------|------------|
|                            | Hazard ratio | 95% CI    | Hazard ratio | 95% CI     |
| <b>Age at start of RRT</b> |              |           |              |            |
| ≤44 yrs (reference)        |              |           | 1.00         |            |
| 45-64 yrs                  |              |           | 3.34         | 2.83 3.94  |
| 65-74 yrs                  |              |           | 6.49         | 5.49 7.67  |
| ≥75 yrs                    |              |           | 9.77         | 8.16 11.71 |
| <b>PRD</b>                 |              |           |              |            |
| GN (reference)             |              |           | 1.00         |            |
| Interstitial               |              |           | 0.98         | 0.84 1.16  |
| Multisystem                |              |           | 2.04         | 1.77 2.36  |
| Diabetes                   |              |           | 2.45         | 2.10 2.84  |
| Unknown                    |              |           | 1.57         | 1.34 1.82  |
| <b>Sex</b>                 |              |           |              |            |
| Female (reference)         |              |           | 1.00         |            |
| Male                       |              |           | 0.96         | 0.88 1.04  |
| <b>Renal unit</b>          |              |           |              |            |
| Unit A (reference)         | 1.00         |           | 1.00         |            |
| Unit B                     | 1.23         | 1.02 1.49 | 1.13         | 0.93 1.36  |
| Unit C                     | 1.43         | 1.11 1.84 | 1.13         | 0.88 1.45  |
| Unit D                     | 0.95         | 0.79 1.15 | 0.92         | 0.76 1.12  |
| Unit E                     | 1.05         | 0.83 1.33 | 1.09         | 0.87 1.38  |
| Unit F                     | 0.94         | 0.70 1.24 | 0.93         | 0.70 1.24  |
| Unit G                     | 1.37         | 1.12 1.68 | 1.06         | 0.87 1.30  |
| Unit H                     | 0.89         | 0.72 1.11 | 0.85         | 0.68 1.06  |
| Unit I                     | 1.35         | 1.04 1.76 | 1.16         | 0.89 1.52  |
| Unit J                     | 0.96         | 0.79 1.17 | 0.92         | 0.75 1.12  |
| RHSC                       | 0.05         | 0.01 0.34 | 0.17         | 0.02 1.23  |

**C2.6 Survival by renal unit providing first RRT.**



**APPENDIX 1****ERA-EDTA PRIMARY RENAL DIAGNOSIS CODES AND GROUPINGS****GROUP 1: PRIMARY GLOMERULONEPHRITIS**

- 10 Glomerulonephritis; histologically NOT examined
- 11 Focal segmental glomerulosclerosis with nephrotic syndrome in children
- 12 IgA nephropathy (proven by immunofluorescence, not 85)
- 13 Dense deposit disease; membranoproliferative GN; type II (proven by immunofluorescence and/or electron microscopy)
- 14 Membranous nephropathy
- 15 Membranoproliferative GN; type I (proven by immunofluorescence and/or electron microscopy - not code 84 or 89)
- 16 Crescentic (extra-capillary) glomerulonephritis (type I, II, III)
- 17 Focal segmental glomerulosclerosis with nephrotic syndrome in adults
- 19 Glomerulonephritis; histologically examined, not given above

**GROUP 2: INTERSTITIAL NEPHROPATHIES**

- 20 Pyelonephritis cause not specified
- 21 Pyelonephritis associated with neurogenic bladder
- 22 Pyelonephritis due to congenital obstructive uropathy with/without vesico-ureteric reflux
- 23 Pyelonephritis due to acquired obstructive uropathy
- 24 Pyelonephritis due to vesico-ureteric reflux without obstruction
- 25 Pyelonephritis due to urolithiasis
- 29 Pyelonephritis due to other cause
- 30 Interstitial nephritis (not pyelonephritis) due to other cause, or unspecified (not mentioned below)
- 31 Interstitial nephropathy due to analgesic drugs
- 32 Interstitial nephropathy due to cis-platinum
- 33 Interstitial nephropathy due to cyclosporin A
- 34 Lead induced interstitial nephropathy
- 39 Drug induced interstitial nephropathy not mentioned above
- 40 Cystic kidney disease - type unspecified
- 41 Polycystic kidneys; adult type (dominant)
- 42 Polycystic kidneys; infantile (recessive)
- 43 Medullary cystic disease; including nephronophthisis
- 49 Cystic kidney disease - other specified type
- 50 Hereditary/Familial nephropathy - type unspecified
- 51 Hereditary nephritis with nerve deafness (Alport's Syndrome)
- 52 Cystinosis
- 53 Primary oxalosis
- 54 Fabry's disease
- 59 Hereditary nephropathy - other specified type

- 61 Oligomeganephronic hypoplasia
- 63 Congenital renal dysplasia with/without urinary tract malformation
- 66 Syndrome of agenesis of abdominal muscles (Prune Belly)
- 92 Gout nephropathy (urate)
- 93 Nephrocalcinosis and hypercalcaemic nephropathy

**GROUP 3: MULTISYSTEM DISEASES**

- 70 Renal vascular disease - type unspecified
- 71 Renal vascular disease due to malignant hypertension (No PRD)
- 72 Renal vascular disease due to hypertension (No PRD)
- 73 Renal vascular disease due to polyarteritis
- 74 Wegeners Granulomatosis
- 75 Ischaemic renal disease / cholesterol embolisation
- 76 Glomerulonephritis related to liver cirrhosis
- 78 Cryoglobulinaemic glomerulonephritis
- 79 Renal vascular disease - due to other cause (not given above and not code 84-88)
- 82 Myelomatosis/light chain deposit disease
- 83 Amyloid
- 84 Lupus erythematosus
- 85 Henoch-Schonlein purpura
- 86 Goodpasture's Syndrome
- 87 Systemic sclerosis (scleroderma)
- 88 Haemolytic uraemic Syndrome (including Moschcowitz Syndrome)
- 89 Multi-system disease - other (not mentioned above)
- 90 Tubular necrosis (irreversible) or cortical necrosis (different from 88)
- 91 Tuberculosis
- 94 Balkan nephropathy
- 95 Kidney tumour
- 96 Traumatic or surgical loss of kidney

**GROUP 4: – DIABETES**

- 80 Diabetic glomerulosclerosis or diabetic nephropathy

**GROUP 5: - NOT KNOWN AND OTHER**

- 00 Chronic renal failure; aetiology uncertain/unknown/unavailable
- 60 Renal hypoplasia (congenital) - type unspecified
- 99 Other identified renal disorders

**APPENDIX 2****ABBREVIATIONS USED IN THE TEXT**

| <b>Abbreviation</b> | <b>Definition</b>  |
|---------------------|--|
| APD                 | Automated Peritoneal Dialysis - Previously called Continuous Cyclic Peritoneal Dialysis (CCPD) |
| ARF                 | Acute Renal Failure  |
| ARI                 | Aberdeen Royal Infirmary   |
| ARMS                | Audit of Renal Management in Scotland (a prospective cohort research study)                    |
| CAPD                | Continuous Ambulatory Peritoneal Dialysis  |
| CRAG                | Clinical Resource and Audit Group  |
| CRF                 | Chronic Renal Failure  |
| DGRI                | Dumfries and Galloway Royal Infirmary  |
| ERA-EDTA            | European Renal Association-European Dialysis and Transplant Association                        |
| ESRD                | End Stage Renal Disease  |
| GRI                 | Glasgow Royal Infirmary  |
| HD                  | Haemodialysis  |
| IPD                 | Intermittent Peritoneal Dialysis   |
| ISD                 | Information and Statistics Division (of the NHSScotland)                                       |
| MONK                | Monklands Hospital, Lanarkshire  |
| NHS                 | National Health Service  |
| NHSScotland         | National Health Service in Scotland  |
| NINE                | Ninewells Hospital, Dundee   |
| PD                  | Peritoneal Dialysis  |
| PRD                 | Primary Renal Diagnosis  |
| QA                  | Quality Assurance  |
| QMHD                | Queen Margaret's Hospital, Dunfermline   |
| RAIG                | Raigmore Hospital, Inverness   |
| RHSC                | Royal Hospital for Sick Children Glasgow   |
| RIE                 | Royal Infirmary of Edinburgh   |
| RRT                 | Renal Replacement Therapy  |
| SRA                 | Scottish Renal Association   |
| SRR                 | Scottish Renal Registry  |
| WIG                 | Western Infirmary Glasgow  |
| UK                  | United Kingdom   |
| UKTSSA              | United Kingdom Transplant Support Service Authority  |
| URR                 | Urea Reduction Ratio   |
| XH                  | Crosshouse Hospital, Kilmarnock  |

**NHS Boards**

|       |                     |
|-------|---------------------|
| A&A   | Ayr & Arran         |
| A&C   | Argyll & Clyde      |
| BORD  | Borders             |
| D&G   | Dumfries & Galloway |
| FIFE  | Fife                |
| FV    | Forth Valley        |
| GG    | Greater Glasgow     |
| GRAMP | Grampian            |
| HIGH  | Highland            |
| LAN   | Lanarkshire         |
| LOTH  | Lothian             |
| ORK   | Orkney              |
| SHET  | Shetland            |
| TAY   | Tayside             |
| WI    | Western Isles       |