Chapter 16: Referral to Nephrology Services of Patients Starting Renal Replacement Therapy in England & Wales

Summary

- Date of referral to a nephrologist is still poorly recorded by many renal units.
- 30% of patients are referred less than 3 months before starting RRT, and 20% less than a month prior to start of RRT. This is consistent with other published data from the UK and elsewhere.
- The late referral group tend to be older than others, but gender, ethnicity and social deprivation were not significant factors influencing the referral timing.
- 13% of the late referral group had a primary diagnosis of diabetic nephropathy, and 23% of all patients with diabetic nephropathy were referred late.
- 83% of the late referral group started on haemodialysis compared with 62% of those referred earlier as their first mode of RRT. ($p = 0.0044$)
- There was no difference in estimated GFR (MDRD) between the early and late referral group. The estimated GFR at the start of RRT in the UK is the same as that quoted in a 21 centre European study (6.7 mls/min v 6.6 mls/min respectively).
- The late referral group has poorer 1 year after 90 days survival than others (81.5% v 88.5% respectively, $p<0.0001$), even after adjusting for age and the lower haemoglobin levels in this group.

Introduction

Within the UK there has been no previous analysis comparing the differences in timing of referral between renal units. The previous published studies from the UK have all used varying definitions of the late referral period, from less than 1 month to less than 4 months.[1–6] Consequently it is difficult to directly compare these studies and 'late referral' of patients appears to vary from 25% to 47% of patients starting RRT.

Roderick *et al.*[3] analysed the reasons for late referrals and found that nearly 50% of the late referrals were potentially avoidable, with 80% of this group having previously had evidence of progressive renal damage. Similarly in the study by Ellis *et al.*[6] nearly 50% of the late referrals were known to have had renal disease for more than 8 weeks prior to referral.

These studies also showed that late referred patients were in a poorer clinical state at the start of RRT, more likely to require emergency dialysis, have a longer median hospitalisation period and have a higher rate of mortality compared to those referred early. A recent study also showed that late referral of elderly patients may influence the nephrologist's decision in considering the appropriateness of RRT, therapy being offered less frequently.[7]

This analysis of data from England and Wales compares the differences between early and late referral groups by demographics (age, gender and ethnicity), primary diagnosis, modality of first RRT, social deprivation (Townsend score) and survival. Differences between renal units were also analysed.

Patient Cohort

The UK Renal Registry collects the 'date first seen by dialysing nephrologist' for incident patients. To improve the data, for 2001 and 2002, centres which had returned more than 50% of the item 'date first seen' (DFS) for their incident patients were identified. These units were then contacted to obtain the missing data wherever possible. Only the centres with more than 75% completed data were included in the analysis.

Additional data were also obtained from the Manchester based study of Implementation of Renal Standards (SIRS). This study involves Manchester Royal Infirmary, Hope Hospital, and Royal Preston Hospital who also collect this data item and have kindly provided the Registry with their data to be included in the analysis. The SIRS group have prospectively collected their data from April 2000 onwards, although this analysis includes only the SIRS data for the complete years 2001 and 2002. The Royal Preston Hospital is already part of the UK Renal Registry.

Table 16.1 lists the centres that send this data item to the Registry.

Number of patients

Of the 13221 new patients who started RRT in centres registered with UKRR or the SIRS study between 1997 and 2002, 36% (4790 patients) commenced at the centres included in this analysis. 93% of these (4478 patients) had their 'date first seen by nephrologists' recorded in the database. The number of patients included from each centre is as shown in Table 16.1.

Results

Analysis for bias from missing data

The demographic details of the two patient groups (with and without a date first seen) were compared (age, gender and primary diagnosis). The results are shown in Table 16.2. There were no significant differences between the two groups for age and gender. There was a higher percentage of missing primary diagnoses in the group of patients with no recorded date of referral, which probably reflects the incomplete data entry for these patients.

Referral pattern

In published studies, definitions of late referral vary from 1 to 6 months. This analysis has defined late referral as being seen by a dialysing nephrologist less than 3 months before starting RRT. In Table 16.3, the time from referral to RRT was further divided into 3–6 months, 6–12 months and more than a year prior to start of RRT.

Late referral occurred in 30% of patients commencing RRT and 66% of these patients

Table 16.1. Renal units included in the analysis with the number of patients included in the analysis and % completed data

	1997		1998		1999		2000		2001		2002	
	Pts No	%*	Pts No	%*	Pts No	%*	Pts No	%*	Pts No	%*	Pts No	%*
Notts	107	97	120	96	117	97	106	98	118	100	82	98
Sheff	108	98	124	100	126	99	132	99	141	97	147	99
StJms	64	77	57	83	64	79	78	88	87	100	79	100
Mid	76	83							82	100	112	100
Leic			143	81	130	81	134	76	176	99	149	99
Bristl					114	98	142	97	148	99	112	92
Extr									97	100	78	98
York									31	84	64	98
Ports									138	100	137	99
Hope									76	91	72	88
Prstn									106	94	78	77
MRI									102	86		
NewC											103	100
Bangr											21	78
Total	355	90	444	90	551	91	592	91	1302	97	1234	95

*Percentage completed data

presented within 1 month of starting RRT. To enable comparison with other published data, the data were re-analysed by four separate monthly intervals. Using 4 months as the definition of late referral, 33% were late referrals. (Table 16.4)

For 2002, the percentage of late referrals varied significantly between units (p = <0.001) and ranged from 24% to 56% (Figure 16.1). These differences in late referral could not be explained by the variation between units in demographic profile, primary diagnosis, ethnicity or social deprivation scores.

Trend over last 5 years

As there were fewer centres included in the analysis of the earlier years (Table 16.1), it was not valid to directly compare data between the different years. To identify any change in late referral patterns with time, the 4 centres with high percentages of completed data from 1998–2002 (Nottingham, Sheffield, Leicester and St James, Leeds) were included in a separate analysis (Table 16.5). There has been no significant change in the percentages of late referrals at these centres over these 5 years (p = 0.78).

Table 16.2. Comparison between patients with and without date first seen

	Patients with Date first seen	Patients without a Date first seen
Age (median)	64	62
Male (%)	61	61
Diagnosis		
Diabetes	17.6	17.6
Reno-vascular disease	13.2	11.5
Glomerulonephritis	13.5	9.3
Pyelonephritis	8.8	9.3
Polyc	7.3	4.8
Uncert	20.4	18.9
OtherH	7.2	5.1
OtherL	7.6	9.0
Missing	4.3	14.4

Age, Gender and Primary Diagnosis

Table 16.6 shows the demographic data for the Early Referrals (ER) and Late Referrals (LR) groups.

The late referrals have an older median age of 67 years at the start of RRT compared to that of 62 in the early referrals (p < 0.0001). There was no difference in the gender distribution (61% male) between the two groups (p = 0.76). Diabetic nephropathy was the main primary diagnosis in the early referral group (19.5%), but disappointingly also accounted for 13.3% of the late referral group (p < 0.0001). When analysed separately, 24% of the Type I and 22% of the Type II diabetics who started RRT during these period were referred late.

Ethnicity

For the analysis of the effect of ethnicity on late referral (Table 16.7), only centres with >70% completeness of ethnicity data were included (11 out of 14 centres). Therefore for the study period, there were 3681 of 4098 patients with both referral date and ethnicity data who were included in this analysis.

Table 16.3. Time to referral by year 1997-2002

	< 3 months		3–6 months		6–12months		> 12 months	
Year	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
1997	124	35	26	7	50	7	155	44
1998	114	26	49	11	49	11	230	52
1999	157	29	45	8	45	8	284	52
2000	176	30	44	7	44	7	307	52
2001	385	30	101	8	101	8	656	50
2002	399	32	100	8	100	8	582	47
Total	1355	30	365	8	544	12	2214	49

Table 16.4. Referral distribution between 0–4 months for 1997–2002

Days	< 1 month		1–2 months		2–3 months		3–4 months	
	No	%	No	%	No	%	No	%
	913	20	270	6	172	4	137	3

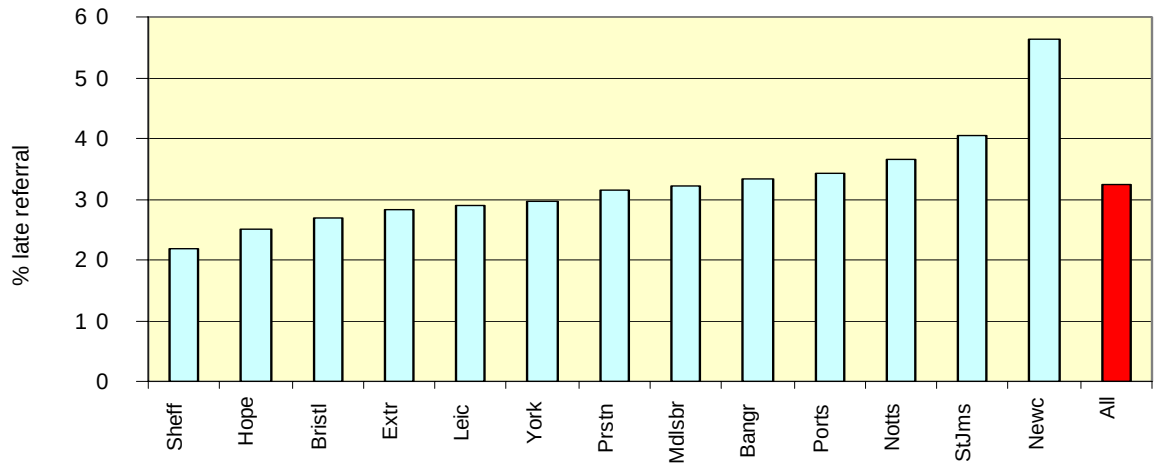

Figure 16.1. Late referral by centre for 2002

Table 16.5. Late referral trend in 4 centres

	< 3 months		3–6 months		6–12months		> 12 months	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
1998	113	26	49	11	51	12	230	52
1999	126	29	37	9	57	13	217	50
2000	132	29	36	8	51	11	230	51
2001	134	26	38	7	66	13	275	54
2002	127	30	34	8	38	9	222	53
Total	632	28	194	9	263	12	1174	52

Table 16.6. Comparison between late and referrals groups

	ER	LR
Median Age at RRT (years)	62	67
Male (%)	61	61
Diagnosis (%)		
Diabetes Mellitus	19.5	13.3
Reno-vascular disease	12.9	14.0
Glomerulonephritis	15.3	9.4
Pyelonephritis	9.8	6.6
Polycystic Kidney Disease	9.4	2.3
OtherH	4.9	12.6
OtherL	6.3	10.6
Uncertain	18.9	24.0
Missing	3.0	7.4

For these centres, 90% of incident patients were white, 7% were Indo-Asian and 2% were African-Caribbean. There was no significant difference in late referral in the ethnic minorities when compared with those of white ethnicity.

Although only 21% of the Indo-Asians were referred late compared with 29% of the white population, this difference is probably due to the higher percentage of Indo-Asians with diabetes (31% v 16% respectively), who would be expected to be referred earlier. In the African-Caribbean population 34% were referred late and diabetic nephropathy accounted for 33% of those starting RRT.

Table 16.7 Ethnicity and referral

	ER	LR	Total
White	70.8 (2359	29.2 (973)	3332
Indo-Asian	78.8 (186)	21.2 (50)	236
African Caribbean	65.8 (50)	34.2 (26)	76
Chinese	70.6 (12)	29.4 (5)	17
Other	65.0 (13)	35.0 (7)	20
Total	71.2 (2620)	28.8 (1061)	3681

Social Deprivation

The Townsend index was used as the scoring system for social deprivation, which was derived from the patient's postcode. The Townsend index is a composite measure of deprivation based on total unemployment rate, no car households, overcrowded households and not owner-occupier households based on the electoral ward as at the 2001 Census. The higher the Townsend index, the greater the deprivation. For this analysis, the UK general population was divided into quintiles of deprivation (1 lowest, 5 highest).

There was no significant trend relating late referral to social deprivation (Chi squared p = 0.23); see Table 16.8.

Table 16.8 Social deprivation and referral by Townsend quintiles

Deprivation Score	ER % (N)	LR % (N)	Total
1	70.9 (579)	29.1 (238)	817
2	70.9 (545)	29.1 (224)	769
3	71.9 (577)	28.1 (226)	803
4	68.5 (703)	31.5 (323)	1026
5	67.6 (719)	32.4 (344)	1063
Total	69.7 (3123)	30.3 (1355)	4478

Table 16.9. Modality choice at day 0 and day 90

	ER day 0 (day 90)	LR day 0 (day 90)
HD	62.2% (58.4%)	83.2% (74.9%)
PD	35.9% (38.8%)	16.4% (24.3%)
Transplant	2.0% (2.7%)	

Modality of Renal Replacement Therapy

Table 16.9 demonstrates that patients who were referred late were less likely to start on peritoneal dialysis than those who were referred early (16.4% v 35.9% p = <0.0001). These late referred patients were also more likely to have changed modality from HD to PD by day 90 than those referred early (Table 16.10).

From Figure 16.2 it can be seen that patients from more deprived backgrounds in the early referral group are more likely to go on haemodialysis. There is a linear trend (r^2 = 0.96) with deprivation (Cochran-Armitage trend test, p < 0.0001). There is no relationship between modality and deprivation in the late referral group.

For both referral groups, patients who started RRT on PD are younger than those starting with HD. In the late referral group, the median age is 68 v 59 years for HD and PD respectively (p < 0.0001). In the early referral group, the median age is 65 v 59 years respectively (p < 0.0001).

Haemoglobin and estimated GFR by referral

For these analyses, only measurements within 14 days prior to starting RRT were used. There was no significant difference of the median of the estimated GFR (abbreviated MDRD formula) between late referral and early referral groups at the start of RRT (6.63 ml/min v 6.72 ml/min; p = 0.2786). Both HD and PD groups started RRT at a similar estimated GFR (eGFR).

As would be expected (Table 16.11), the

Table 16.10 Modality by deprivation and referral

Deprivation Score	ER % on HD	LR % on HD
1	57.5	78.2
2	59.1	85.3
3	60.8	78.8
4	64.0	84.5
5	67.7	86.6

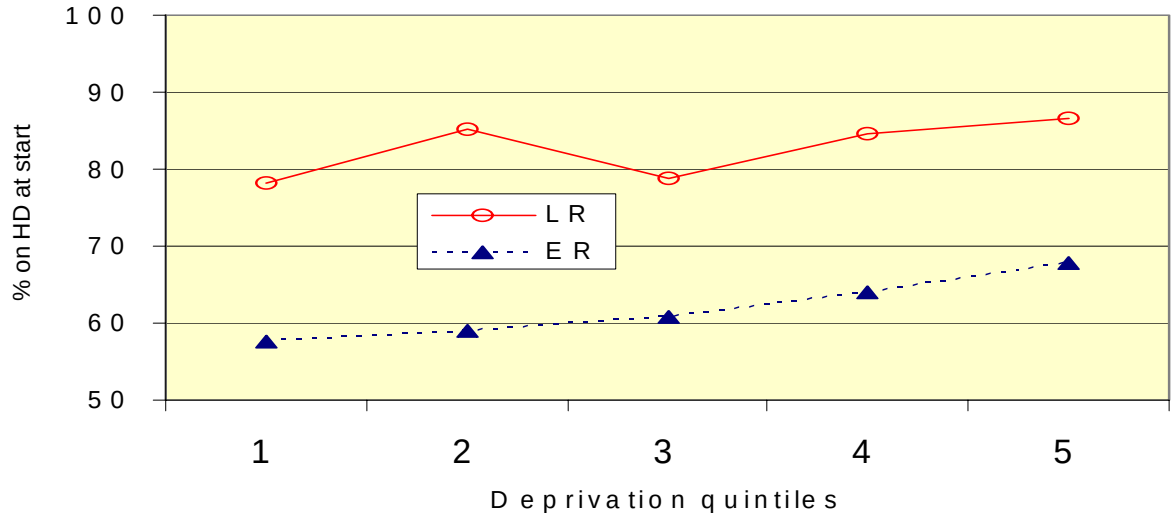

Figure 16.2. Modality by deprivation and referral

median haemoglobin is significantly lower in the late referral group (9.3 g/dl v 9.9 g/dl; $p < 0.0001$). PD patients had higher haemoglobin level than HD patients at start of RRT in both the late referral and early referral groups.

Survival

The analysis of survival (Tables 16.12–16.13) showed that the late referral group has a significantly lower survival probability than the early referral group at both day 90 and 1 year after day 90, even after adjusting for age and haemoglobin. When analysed by age group above and below 65, the increased risk of death in the late referral group remained at day 90 and 1 year after day 90 in both age groups. In patients aged over 65, there was a 50% increased risk of death in the late referral group at both time periods.

Patients on PD had a better survival than those on HD. This is probably due to a patient selection bias.

Discussion

There is no agreed definition of late referral within the UK or internationally. The studies listed in Tables 16.14 and 16.15 reflect the confusion in this lack of definition.

The aim of early referral is to optimise patient care prior to starting RRT: this would include:

- dialysis education
- correction of anaemia, acidosis, hyperparathyroidism
- good blood pressure control
- appropriate dialysis access ready for use at start of RRT
- immunisation against hepatitis B
- full assessment for fitness for transplantation and pre-emptive transplant listing
- work up potential live donor

In order to satisfy most of these requirements, the National Service Framework[8] states that referral to a renal multi-professional team should be at least 12 months prior to the anticipated start of RRT

Ratcliffe *et al.*[14] published a study regarding late referral in the early 1980s showing 42% of new RRT patients were referred within a month of starting RRT. Subsequently, UK-based studies show that this has improved to around 35% of new patients starting RRT being referred within 3

Table 16.11. Median Hb and eGFR (MDRD) at start of RRT

	Early referral			Late referral		
	All modality	**HD**	**PD**	**All modality**	**HD**	**PD**
N	2437	1474	920	959	775	183
Median eGFR (ml/min)	6.7	6.6	6.8	6.6	6.6	6.5
	Early referral			**Late referral**		
	All modality	**HD**	**PD**	**All modality**	**HD**	**PD**
N	2324	1394	887	876	697	178
Median Hb (g/dl))	9.9	9.7	10.2	9.3	9.2	9.7

Table 16.12 Survival at day 90 by modality and age

	ER Survival (95%CI)	**LR Survival (95%CI)**	**p value**
ALL adjusted age 60	94.8 (94.0–95.6)	89.2 (87.6–91.0)	p < 0.0001
HD adjusted age 60	93.3 (92.2–94.5)	87.9 (86.0- 90.0)	p < 0.0001
PD adjusted age 60	97.4 (96.4–98.3)	94.7 (91.9–98.3)	p = 0.0541
Age group 18–64	97.2 (96.4 – 98.0)	92.8 (90.7-94.9)	p < 0.0001
Age group 65+	88.8 (87.1-90.5)	78.3 (75.2–81.3)	p < 0.0001

months.

The problem of late referral is not confined to the UK. In 2001, 23% of new patients in Australia and 25% in New Zealand were late referrals (<3 months prior to start of RRT). Of those referred late, 43% (Australia) and 50% (New Zealand) had a primary disease diagnosis of either diabetes or hypertension.[15] In the US, 40% and 27% of patients starting on HD and PD were referred < 3 months prior to the start of RRT. This study was from the Dialysis Morbidity and Mortality Study (DMMS) wave 2, in which patients self-reported via a questionnaire the date of their first nephrological contact.[16] In Canada, Curtis *et al.*[17] reported a late referral percentage of 35%. In Europe, data from the Lombardy Registry showed that 46% of 1137 were referred late (<2 months).[18] The Flemish-speaking Belgian Society of Nephrology reported 34% of their new patients were referred within 1 month of starting RRT and another 15% were within 1–6 months.[19]

Roderick *et al.*[3] showed that 55% of the late referrals in their studies were unavoidable (Table 16.16). This refers to patients who were asymptomatic till the start of RRT and those with rapidly progressing renal diseases. However, the other 45% were missed opportunities for nephrological intervention. These were patients with signs/symptoms of early renal disease not acted upon (81%), or patients with risk factors such as diabetes or hypertension who should have been screened for signs of renal involvement (19%).

These late referral patients were disadvantaged by starting RRT in a poorer clinical state with possible lower residual renal function, lower haemoglobin, worse renal bone profile and lack of vascular access.[20–22] The Manchester SIRS group collected data regarding access at the start of RRT (Table 16.17). While only 1% of the late referrals starting on HD (n = 100) had an AV fistula or graft, disappointingly only 34% of the early referrals (n = 155) had permanent access in place.

Another study showed that 57% needed to start RRT as an emergency and 24% presented with pulmonary oedema.[23] The UK

Registry/SIRS cohort of late referral patients did have a lower Hb at the start of RRT. However there was no significant difference in the estimated creatinine clearance. Poorer survival in the Registry/SIRS cohort extended to the 1 year after ninety day period (after adjustment for age and haemoglobin). Similar results have been shown before in other studies,[2,22,24,25] although these mainly concentrated on the early mortality rate (1 year). In Australia, Cass *et al*.[26] analysed the 5-year survival for dialysis patients who survived the first year, and showed that the survival disadvantage of late referral remained.

The Registry is not yet in the position to analyse the co-morbidity of this patient cohort due to poor returns of these data items. Other studies have shown that late referral was associated with higher hospitalisation rates, longer duration of hospital stay[2,6,27] and a poorer quality of life.[28]

It is hoped that implementation of the NICE guideline regarding diabetic nephropathy in Type II diabetics will reduce late referral in this cohort.

The UK data on creatinine clearance at the start of RRT is identical to that shown in the multi-centre European survey on predialysis anaemia management[11] after the European creatinine data has been converted using MDRD estimation (6.7 mls/min UK and 6.6 mls/min Europe) rather than the Cockroft–Gault formula used in the paper (9.1 mls/min) which overestimates clearance at low levels. The UK also has a higher median haemoglobin at the start of RRT when compared with the multi-centre European study where the median haemoglobin was 9.4 g/dl (combined for early and late referral patients).

In conclusion, late referral remains a significant problem both in the UK and worldwide. Australia has reported the lowest incidence of late referral (20% at 3 months) and the UK should be aiming to reduce late referral down to these levels. This goal is compatible with the study of avoidable reasons for late referral.

Table 16.13 Survival at 1 year after day 90 by modality and age

	ER Survival (95%CI)	LR Survival (95%CI)	p value
ALL adjusted age 60	88.5 (87.2–89.9)	81.5 (79.0–84.2)	p < 0.0001
HD adjusted age 60	87.3 (85.5–89.0)	80.2 (77.4–83.3)	p < 0.0001
PD adjusted age 60	90.2 (88.3–92.3)	86. 9 (81.8–92.3)	p = 0.2104
Age group 18-64	92.2 (90.9–93.7)	87.6 (84.5–90.7)	p = 0.0022
Age group 65+	80.6 (78.0–83.2)	69.3 (65.0–73.6)	p < 0.0001

Table 16.14. Late referral studies based in the UK

Author	Publication	Study Year	Study No	Def	% Late Referral
Ratcliffe	BMJ 1984	1981	55	<1m	42
Eadington	NDT 1996	1987–92	325	<4m	47
Ellis	QJM 1998	1996–97	198	<3m	32
Stoves	PMJ 2001	1980–1999	1260	<3m	37
Roderick	NDT 2002	1996–97	361	<4m	35
Roderick	QJM 2002	1997–98	250	<4m	38
Metcalfe	KI 2003	10/97–9/98	523	<1m	25
Steel	EDTNA 2002	1/96–12/00	494	<3m	33

Table 16.15. Late referral studies in other countries (ordered by definition and study year)

Author	Publication	Country	Study Year	Study No	Def	% Late Referral
Lameire N[9]	NDT 1999	Europe	1993–95	2236	<1m	26
Schmidt R[10]	AJKD 1998	USA	90–97	238	<1m	24
Astor BC	AJKD 2001	USA	10/95–6/98	356	<1m	25
Kessler M	AJKD 2003	France	6/97–6/99	502	<1m	23
Paris V	EDTNA ERCA 2002	Italy	1/98–12/99	1137	<1m	46
Horl WH[11]	AJKD 2003	Europe	8/99–4/00	3918	<1m	14
Curtis BM	CN 2002	Canada	10/98–12/99	238	<3m	35
Avorn J	AIM 2002	USA	1991–96	3014	<3m	35
Winkelmayer WC[12]	KI 2001	USA	1991–96	3014	<3m	35
USRDS	USRDS 1997	USA	1996	3468	<3m	39*
Australia	ANZDATA 2002	Australia	2001	1882	<3m	23
New Zealand	ANZDATA 2002	New Zealand	2001	458	<3m	25
Roubicek C	AJKD 2000	France	1989–96	270	<4m	31
Arora P	JASN 1999	USA	10/92–12/97	135	<4m	22
Cass A	MJA 2002	Australia	4/95–12/98	4243	<3m	27
Kinchen KS	AIM 2002	USA	10/95–6/98	828	<4m	48
Stack A	AJKD 2003	USA	5/96–7/97	2522	<4m	32
Joly D	JASN 2003	France	1989–00	144	<4m	35
Jungers P[13]	NDT 2001	France	1989–98	1057	<6m	24

* calculated from data given separately for HD and PD patients

Table 16.16. Avoidable late referrals and source of referrals (adapted from Roderick et al.[3])

				Avoidable LR		Unavoidable LR	
				No	%	No	%
Total (*n* = 250)	No	%	Gen Physicians	29	67	21	43
Late referrals	96	38	GPs	4	9	7	14
Avoidable late referrals	43	45	Urologists	2	5	3	6
Renal damage ignored	35	81	Diabetologists	2	5	1	2
Missed opportunities for detection	8	19	Others	6	14	17	35

Table16. 17 Haemodialysis access at first dialysis (SIRS group)

	AVF/graft	Permcath	Temp line
LR (%)	1	29	70
ER (%)	34	17	49

References

1. Stoves J, Bartlett CN, Newstead CG. Specialist follow-up of patients before end stage renal failure and its relationship on survival on dialysis. *Postgraduate Medical Journal* 2001;77:586–588.
2. Roderick P, Jones C, Drey N, Blakeley S, Webster P, Goddard J, *et al.* Late referral for end stage renal disease: a region-wide survey in the south west of England. *Nephrology Dialysis and Transplantation* 2002;17:1252–1259.
3. Roderick P, Jones C, Tomson C, Mason J. Late referral for dialysis: improving the management of chronic renal disease. *QJM* 2002;95:363–370.
4. Steel J, Ellis P. Do demographic variables affect the timing of referral to the nephrologist? *EDTNA ERCA J* 2002;28:185-187.
5. Metcalfe W, Khan IH, Prescott GJ, Simpson K, MacLeod AM. End-stage renal disease in Scotland: Outcomes and standards of care. *KI* 2003;64:1808–1816.
6. Ellis PA, Reddy V, Bari N, Cairns HS. Late referral of end-stage renal failure. *QJM* 1998;91:727–732.
7. Joly D, Anglicheau D, Alberti C, Nguyen A, Touam M, Grunfeld J, *et al.* Octogenarians reaching end-stage renal disease: Cohort study of decision-making and clinical outcomes. *JASN* 2003;14:1012–1021.
8. Department of Health Renal Team. The National Service Framework for Renal Services, 2004.
9. Lameire N, Van Biesen W. The pattern of referral of patients with end-stage renal disease to the nephrologists – A European survey. *NDT* 1999;14:S16–S23.
10. Schmidt RJ, Domico JR, Sorkin MI, Hobbs G. Early referral and its impact on emergent first dialyses, health care costs, and outcome. *AJKD* 1998;32(2):278–83.
11. Horl WH, Macdougall IC, Rossert J, Rutkowski B, Wauters J, Valderrabano F. Predialysis survey on anemia management: Patient referral. *AJKD* 2003;41:49–61.
12. Winkelmayer WC, Glynn RJ, Levin R, Owen WJ, Avorn J. Late referral and modality choice in end-stage renal disease. *KI* 2001;60(4):1547–1554.
13. Jungers P, Massy ZA, Nguyen-Khoa T, Choukroun G, Robino C, Fakhouri F, *et al.* Longer duration of predialysis nephrological care is associated with improved long-term survival of dialysis patients. *Nephrology Dialysis and Transplantation* 2001;16:2357–2364.
14. Ratcliffe PJ, Phillips RE, Oliver DO. Late referral for maintenance dialysis. *British Medical Journal* 1984;288:441–443.
15. McDonald SP, Russ GR. Australia and New Zealand Dialysis and Transplant Registry Report 2001. *ANZDATA 2001*
16. U.S. Renal Data System. USRDS 1997 Annual Data Report. Bathesda, MD: National Institute of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1997:49–68.
17. Curtis BM, Barrett BJ, Jindal K, *et al.* Canadian survey of clinical status at dialysis initiation 1998-1999: a multicenter prospective survey. *Clinical Nephrology* 2002;58:282–288.
18. Paris V, Ballerini L, Gruppo Italiano Multidisciplinare Educazione Pre-dialisi. Patient flow analysis and referrals–how 1,137 ESRD patients started dialysis during 1998–1999. *EDTNA ERCA J* 2002;28(4):16-0-163.

19. Dutch-speaking Belgian Society of Nephrology. Annual report 1998, 1998:17–18.

20. Arora P, Obrador GT, Ruthazer R, Kausz AT, Meyer KB, Jenuleson CS, *et al.* Prevalence, predictors, and consequences of late nephrology referral at a tertiary care center. *Journal of American Society of Nephrology* 1999;10:1281–1286.

21. Astor BC, Eustace JA, Powe NR, Klag M, J., Sadler JH, Fink NE, *et al.* Timing of Nephrologist Referral and Arteriovenous Access Use: The CHOICE Study. *AJKD* 2001;38:494–501.

22. Stack AG. Impact of timing of nephrology referral and pre-ESRD care on mortality risk among new ESRD patients in the United States. *American Journal of Kidney Diseases* 2003;41:310–318.

23. Kessler M, Frimat L, Panescu V, Briancon S. Impact of nephrology referral on early and midterm outcomes in ESRD: Epidemiologie de l'Insuffisance Renal chronique terminale en Lorraine (EPIREL): Results of a 2-year, prospective, community-based study. *American Journal of Kidney Diseases* 2003;42:474–485.

24. Avorn J, Bohn R, Levy E, Levin R, Owen WF, Winkelmayer WC, *et al.* Nephrologist care and mortality in patients with chronic renal insufficiency. *Arch Intern Med* 2002;162:2002–2006.

25. Kinchen KS, Sadler J, Fink N, Brookmeyer R, Klag MJ, Levey AS, *et al.* The timing of specialist evaluation in chronic kidney disease and mortality. *Archives of Internal Medicine* 2002;137:479–486.

26. Cass A, Cunningham J, Arnold PC, Snelling P, Wang Z, Hoy W. Delayed referral to a nephrologist: outcomes among patients who survive at least one year on dialysis. *Medical Journal of Australia* 2002;177:135–138.

27. Roubicek C, Brunet P, Huiart L, Thirion X, Leonetti F, Dussol B, *et al.* Timing of nephrology referral: Influence on mortality and morbidity. *American Journal of Kidney Diseases* 2000;36:35–41.

28. Caskey FJ, Wordsworth S, Ben T, de Charro FT, Delcroix C, Dobronravov V, *et al.* Early referral and planned initiation of dialysis: what impact on quality of life? *Nephrology Dialysis and Transplantation* 2003;18:1330–1338.