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# Chapter 15

## RRT Incidence and use of Home Dialysis Modalities

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### Key Words

Dialysis · End stage renal disease · Guidelines · Haemodialysis · Incidence · Peritoneal dialysis · Personnel · Primary care · Renal replacement therapy · Service delivery · Treatment modality

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### Summary

- There were 406.4 whole time equivalent nephrologists working in the UK in 2010 with a mean of 7.4 nephrologists per million population (range 2 pmp–19 pmp, SD 2.7); there was a 9-fold variation between renal centres.
- There were 195.9 whole time equivalent home team nurses employed in the UK in 2010, resulting in a mean of 2.9 per centre (range 0.0–12.6, SD 0.5) and a median of 1.8 (range 0.0–8.0, IQR 0.6–2.7) per 100 incident patients.
- A median of 20% of over 75 year old patients with CKD 5 known to UK renal centres were considered to be undergoing conservative care (IQR 10–30).
- The median percentage of patients presenting to renal services within three months of requiring RRT was 22.5% (IQR 16.3–29.0) range 3–67%.
- Sixty-four centres (89%) offered home haemodialysis to their patients.
- A mean (SD) of 22% (8) of prevalent dialysis patients were treated with either peritoneal dialysis (PD) or home haemodialysis (HHD) with a 13-fold variation between centres.
- There was no evidence that centre use of PD was associated with centre use of HHD ( $R^2 = 0.0004$ ,  $p = 0.9$ ).
- The median (IQR) percentage of prevalent dialysis patients using HHD was 2.9% (1.3–3.9).

**Introduction**

The optimal rate of dialysis initiation and home dialysis usage is not known, but the principle that access to renal treatment should be equal for all suitable patient groups is one of the tenets of the UK Renal Registry.

Variation in RRT incidence in the UK is in part related to the age, ethnicity, socio-economic (SES) and health status of each renal centre’s population [1, 2]. Variation in the proportion of patients treated with a home dialysis modality might also be influenced by these factors, although to a lesser degree [3, 4].

This chapter presents the results of a nationwide renal survey which was undertaken to identify renal centre characteristics and practice patterns which might explain:

1. Variation in RRT incidence
2. Variation in the proportion of patients treated with a home dialysis modality.

**Methods**

The survey instrument was developed in a multistep process.

*1. Systematic literature review*

A search of MEDLINE (1950 to June 2009), SCOPUS and EconLit (2000 to June 2009) was performed in conjunction with the Aberdeen Health Economics Unit, followed by hand searching the references lists and a search of citing articles using OVID OSP. Abstracts were viewed and resulted in 20 references relating to

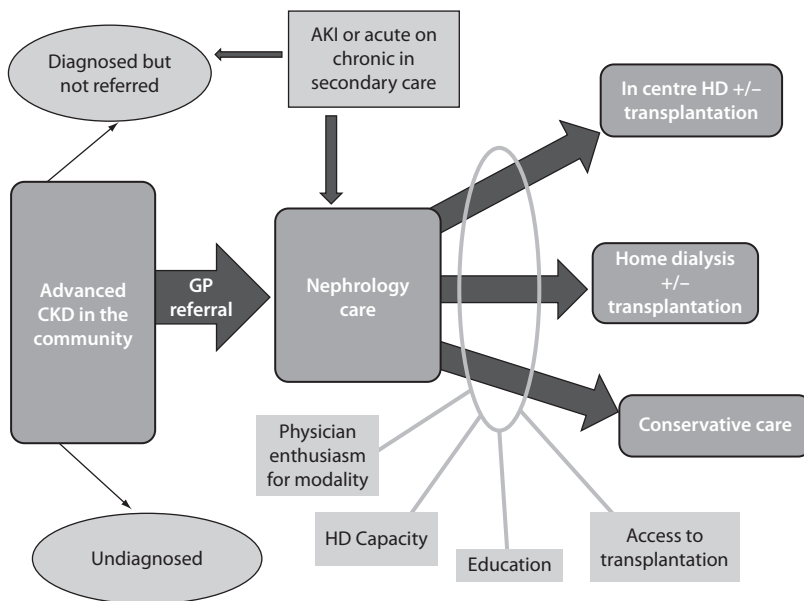
RRT incidence and 26 relating to home modality use. Tested or untested hypotheses arising from these articles were used as the potential characteristics of renal centre organisation or clinical practice patterns that the renal consensus panel were asked to score. These factors are presented below in figure 15.1 to show the proposed pathways and barriers to both RRT initiation and use of home dialysis as a treatment modality.

*2. Modified Delphi consensus generating process*

A purposively sampled group, consisting of 7 nephrologists, 3 general practitioners with an interest in CKD, 3 renal commissioners/network managers, 3 senior renal nurses and 3 renal patient representatives, was asked to participate in a 2-stage modified Delphi process. This is a consensus generating procedure which attempts to allow equal weighting to each participant’s opinion. In stage 1, the group was requested to score each characteristic extracted from the literature search on its ability to predict a) RRT incidence, b) PD usage or c) Home HD usage. They were also requested to suggest additional characteristics which might influence these outcomes. In stage 2, each group member was asked to re-score each original characteristic (knowing the average score it had received in stage 1) and to provide a score for the characteristics suggested in stage 1. The highest scoring items were then included in the national renal unit survey.

*3. Survey design, piloting and distribution*

SurveyGizmo™ 2.6 software was utilised to develop the online survey and ethical approval was obtained from the National Research Ethics Service and local approval from the Research and Innovation Department, Southmead Hospital, Bristol. In addition, approval for circulation of the survey was obtained from the Renal Association Clinical Affairs Board. Questions were written, tested and amended in an iterative process. The complete survey was then piloted for comprehension and accuracy by 4 nephrologists and amended as necessary. The survey was sent to two nephrologists at each renal centre in the



**Fig. 15.1.** Proposed pathways and barriers to RRT initiation and home dialysis utilisation

\*CKD = chronic kidney disease; AKI = acute kidney injury

UK (n = 72 excluding Shetland as this centre had become a main unit within the past year). If there was no response from a centre after 4 weeks, the survey was then sent to an alternative nephrologist in the centre, if available.

#### Survey content

The survey consisted of 43 questions in 5 sections: demographics, staffing, referrals, service provision and decision making processes. To improve completion rates a personalised introductory letter explaining the nature of the research question, reminders to complete the survey, a link to the sponsoring university and coloured advertising images were used [5, 6]. To limit the potential for social desirability bias it was stated that individual responses would not be made available and a subset of questions were asked in the negative.

A variety of questions types were used: numeric, multiple choice, yes/no and scaled (using a 5-point Likert scale).

#### Statistical analyses

Centres with more than one responder were combined to provide a single mean response. Aggregate data were used to calculate means, standard deviations (SD), medians, interquartile ranges (IQR) and frequencies; chi squared tests were performed to compare groups and a p test for trend was used to explore relationships between variables. Centres were grouped into Strategic Health Authorities (SHAs) for English centres and into nations for Welsh, Scottish and Northern Irish centres as well as into transplanting and non-transplanting centres to allow comparisons

to be made. Catchment area populations for each renal centre were used to calculate per million population rates. The methodology for this in England has been described in Chapter 1 UK RRT Incidence rates in 2009. Catchment populations were provided by personal communication, for Wales (Dr K Donovan, Dr A Williams) and for Northern Ireland (Dr D Fogarty). These populations were not available for Scotland and so Scottish centres were excluded from population rate analyses.

## Results

### Characteristics and practice patterns chosen

The highest scoring factors from the consensus group were included in the national survey. These are listed in table 15.1 with the proposed effect on RRT incidence or the proportion of patients using a home dialysis modality if known.

### Response rate

There were responses from all of the 72 renal centres in the UK, 12 (17%) centres provided two responses and 1 (1.4%) centre provided three responses. Seventy-eight (88%) of the respondents were male.

**Table 15.1.** The relationships between renal centre characteristics and practice patterns and the rate of RRT and home dialysis uptake

Renal centre characteristic/practice pattern	Expected influence on RRT	Expected influence on home dialysis uptake
Number of nephrologists/education team/home dialysis team members	Increase	Increase
Consultant level responsibility for home dialysis patients (team vs. named consultant vs. overview)	NA	Increase with 'team' model
Educational outreach to primary care	Increase	NA
Late referral/non-referral rates	Decrease	
Intensity of out-patient review	NA	Increase
Availability of new patient appointments	Increase	
Intensity of in-patient review	Increase	NA
Availability of renal beds	Increase	NA
Use of ITU when renal bed unavailable	Decrease	NA
Proximity of high risk specialties (e.g. urology)	Increase	NA
Range of treatments offered	Increase	Increase
Availability of chronic HD slots	Increase	Decrease if good availability
Financial incentive to keep HD units full	Increase	Decrease
Pre-dialysis education programme (components/personnel/availability)	NA	?Increase
Conservative care (active management/uptake)	Decrease	NA
Home dialysis patient support	NA	Increase
PD access placement capacity	NA	Increase
Preparation for home HD (self care/training/adaptations)	NA	Increase
Practice patterns (survival/QoL/ideal modality mixture)	Either	Either

*Incidence of RRT*

There was an eight fold variation in RRT incidence between PCTs/health boards in the UK (29 pmp–240 pmp). The variation was 2.3 fold between renal centres (67 pmp–156 pmp).

*Home dialysis usage*

A mean (SD) of 22% (8) of prevalent dialysis patients were treated with either peritoneal dialysis (PD) or home haemodialysis (HHD) with a 13-fold variation between centres. There was no evidence that centre use of PD was associated with centre use of HHD ( $R^2 = 0.0004$ ,  $p = 0.9$ ).

*Staffing*

There were 406.4 whole time equivalent nephrologists working in the UK in 2010 with a mean of 7.4 nephrologists per million population (range 2 pmp–19 pmp, SD 2.7); this represents a 9-fold variation between renal centres. The mean number of doctors per 100 RRT patients was 1.1 (range 0.3–3.2, SD 0.5) with a lower doctor: patient ratio observed in transplanting centres (0.7 vs. 1.3,  $p < 0.001$ ). Overall there was a mean of 1.7 doctors per 100 dialysis patients (range 0.5–3.7, SD 0.6).

There were 136.3 whole time equivalent education nurses/advisers employed in UK renal centres in 2010, resulting in a mean of 2 per centre (range 0.25–8.00 SD 1.6). This equates to a mean of 1.7 whole time equivalent education nurses per 100 incident dialysis patients (range 0.2–9.1, SD 1.7) and in England, Wales and Northern Ireland a mean of 3.5 pmp (range 0.5–19.2, SD 3.4).

There were 195.9 whole time equivalent home team nurses employed in the UK in 2010, resulting in a mean of 2.9 per centre (range 0.0–12.6, SD 0.5) and a median of 1.8 (range 0.0–8.0, IQR 0.6–2.7) per 100 incident patients. Two centres reported that they did not employ any home team nurses; one of these centres also had no home dialysis patients. There was a mean of 4.4 home team members per million population (range 0–14 pmp, SD 3.5) in England, Wales and Northern Ireland.

*Renal centres*

There are 72 main adult renal centres in the UK (52 in England, 5 in Wales, 9 in Scotland and 6 in Northern Ireland) and 207 satellite units (178 in England, 18 in Scotland and 11 in Wales) of which 76 were privately owned. No renal centres in Scotland had privately

owned dialysis units however there were 8 in Wales, 67 in England and 1 in Northern Ireland.

The mean renal centre catchment population in England/Wales/Northern Ireland is 900,636 (range 176,500–2,317,660, SD 556,067). There were on average 90 haemodialysis machines per million population in England/Wales/Northern Ireland with a mean of 4.4 haemodialysis patients per machine in England (range 1.0–6.4, SD 1.1), 3.8 per machine in Wales (range 3.4–4.3, SD 0.4), 3.7 per machine in Scotland (range 2.5–6.6, SD 1.2) and 3.6 per machine in Northern Ireland (range 1.8–5.8, SD 1.4).

*Characteristics and practice patterns influencing RRT incidence**In patient capacity*

The capacity to transfer stable patients to the renal ward was assessed for patients who did not require immediate dialysis but who had been deemed to benefit from further investigation and treatment. Thirty-seven renal centres (51%) were able to transfer at least 50% of such patients on the same day with 20 further centres (28%) transferring at least 50% of such patients the next day and only 4 centres (6%) requiring 3 or more days to transfer the majority of these patients (figure 15.2). There was no difference in transfer time between transplanting and non-transplanting centres or between countries/SHAs.

Six centres (9%) reported that they were forced to use ITU beds to manage haemodynamically stable patients with single organ renal failure more than once per week, 28 centres (38%) used ITU in this way more than once per month and only 12 centres (17%) reported that this never occurred at their centre. There was no difference in the rate of this type of ITU use between SHAs/countries or between transplanting and non-transplanting centres.

*Out-patient capacity*

The methods employed to accommodate new patients into the chronic haemodialysis programme were examined. All centres responded that they frequently used existing empty dialysis slots, 15 centres (21%) responded that they frequently opened an extra dialysis session (e.g. twilight) in order to accommodate patients. Eight centres (11%) placed patients on a waiting list whilst a slot became available and 3 centres (0.4%) frequently used in-patient beds to accommodate their chronic haemodialysis patients. Seven centres (10%) responded that they converted some patients onto PD in order to accommodate new patients onto the HD programme

**Table 15.2.** Summary statistics for continuous variables

Variable	Total (N)	Mean (SD) Range	% missing
Number of nephrologists (WTE)	406.4	1.1 (0.5) 0.3–3.2 per 100 RRT patients 1.7 (0.5) 0.5–3.7 per 100 dialysis patients 7.4 (3.2) 2–19 per million population*	0.0
Education team members	136.3	2 (0.6) 1–8 per centre 1.6 (1.7) 0–9 per 100 incident patients 3.4 (3.5) 0.6–19.3 per million population*	6.0
Home team members	195.9	2.8 (2.5) 0–12.6 per centre 2.1 (1.9) 0–8 per 100 incident patients 4.2 (3.5) 0.6–14.4 per million population*	6.0
% >75years receiving conservative care	–	21 (14) 1–70	11.0
% late presentation**	–	23 (12) 3–67	12.0
HD machine	4695	4 (1.1) 1–6.6 HD patients per machine 92 (54) 5–311 per million population*	4.0
Percentage of prevalent patients on home dialysis	–	20 (7.6) 0–37	0.0

Variable	Median (IQR) Range	% missing
Training time for HHD (weeks)	10 (6–12) 2–52	19.6
Optimal treatment in <65 year old patients	–	7.0
In centre HD	40 (30–55) 0–75	
HHD	25 (15–30) 5–80	
PD	30 (23–35) 10–80	
Optimal treatment in >65 year old patients	–	7.0
In centre HD	63 (50–70) 20–90	
HHD	10 (5–20) 5–50	
PD	25 (20–30) 5–60	

## Abbreviations:

WTE – whole time equivalent, RRT – renal replacement therapy, fu – follow up

\* England, Wales and Northern Ireland

\*\* defined as less than 90 days between the date first seen by a nephrologist and the start of RRT

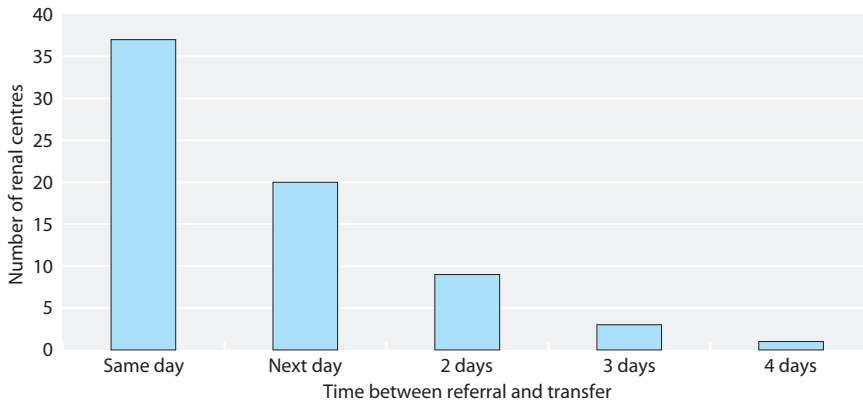
and 8 centres (11%) dialysed some patients twice a week in order to find space for new patients (figure 15.3). There were no significant differences in these responses by SHA/country. Transplanting centres were more likely to open extra sessions to accommodate patients (41% vs. 10%,  $p=0.01$ ) and to place patients in an HD unit that was not the closest to their home (71% vs. 23%,  $p=0.001$ ) whereas non-transplanting centres were more likely to place patients on a waiting list (15% vs. 4%,  $p=0.003$ ).

*Conservative care*

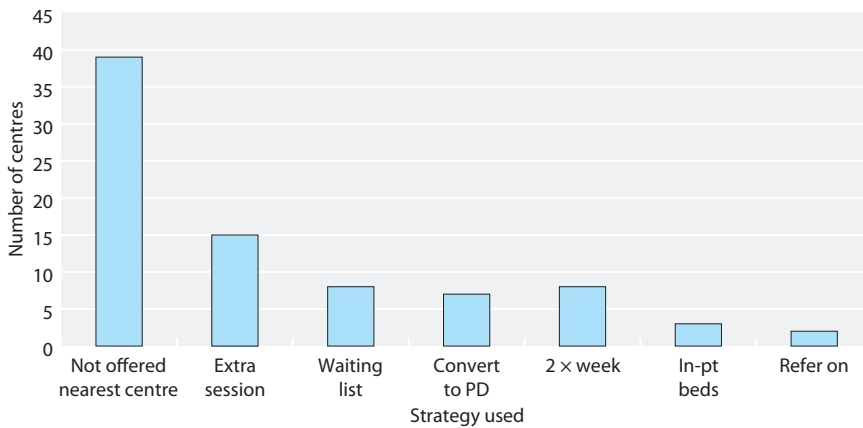
The emphasis on conservative care employed by each centre was assessed by asking about the percentage of over 75 year old patients with CKD 5 who opted for conservative management and the method of follow up for these patients. A median of 20% of over 75 year old patients with CKD 5 known to UK renal centres were

considered to be undergoing conservative care (IQR 10–30). One centre responded that only 1% of these patients had opted for conservative care and 5 centres responded that over 50% of such patients did. There was no significant difference in the proportion of patients opting for conservative care according to SHA/country or transplanting status of the centre.

There was wide variation between centres in how patients opting for conservative care were followed up. Fifty-four centres (75%) followed these patients up in a nephrology clinic, either low clearance or general nephrology and 18 centres (28%) utilised a dedicated conservative care clinic. Fourteen centres (19%) employed renal palliative nurses to provide outreach community care to these patients. Twenty-nine centres (44%) referred such patients back to primary care (8 of these with outreach community renal nurse support) and 1 centre utilised the general palliative care clinic



**Fig. 15.2.** The time between referral and transfer to a renal ward for investigation and management



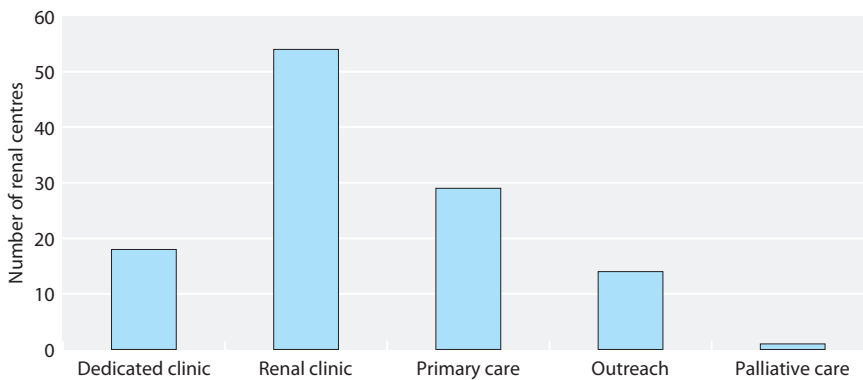
**Fig. 15.3.** The strategies used to incorporate new patients into chronic HD programmes  
 Extra session = an additional session (e.g. twilight) is opened to accommodate new patients  
 Refer on = patients are referred to a neighbouring centre  
 2 x week = patients are reduced to twice a week in order to accommodate new patients

for follow up (figure 15.4). There were no differences in these responses between SHAs/countries except that only centres in England and Scotland provided outreach community nursing support for these patients. There was no difference in patterns of follow up in transplanting and non-transplanting centres.

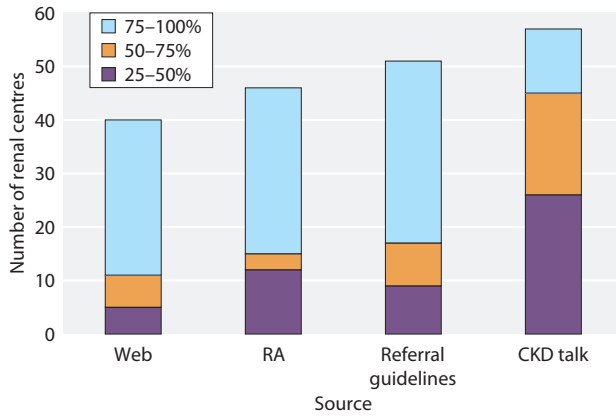
*Interface with primary care*

Engagement with primary care colleagues was assessed based on the types of communication methods used.

Twenty-nine centres (40%) had advertised web-based local guidance on CKD management and referral to over 75% of their local GPs. Thirty-one centres (43%) had advertised the Renal Association guidance on CKD management and referral guidelines to over 75% of their local GPs, and 34 centres (47%) had emailed or posted written referral information to over 75% of local GPs. Twelve centres (17%) had reached over 75% of local GPs with a CKD talk and 45 centres had reached between 25% and 75% of GPs with a CKD talk (figure 15.5).



**Fig. 15.4.** The methods employed for follow up of conservative care patients



**Fig. 15.5.** The percentage of GPs receiving guidance from renal centres

Respondents were asked to rate the prevalence of non referral in their area. Only eight centres (11%) felt that the prevalence of non referral was either moderate or high with all other centres rating it as low or very low. The centres who felt that non referral was either moderate or high also reported that less than 50% of GPs had attended a talk on CKD. There were no differences in these responses between SHAs/countries or between transplanting and non-transplanting centres. The median (IQR) percentage of patients presenting to renal services within three months of requiring RRT was 22.5% (16.3–29.0) range 3–67%.

*Interface with other areas in secondary care*

The level of involvement in the care of acute kidney injury (AKI) in referring hospitals was determined.

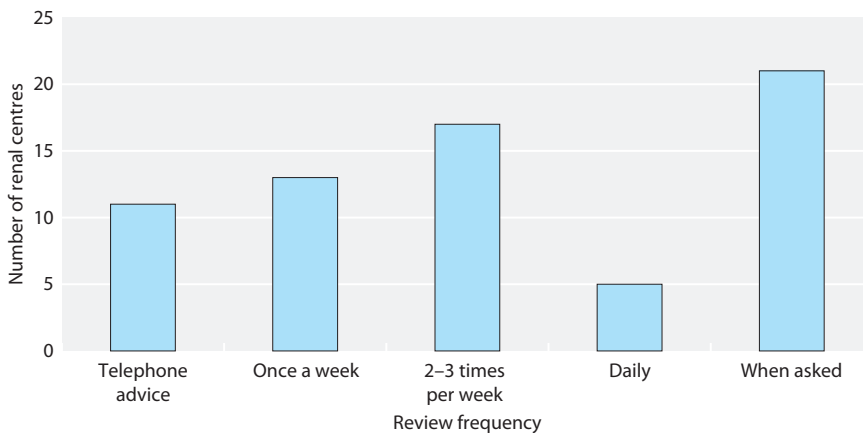
Renal centres had a median of 3 hospitals referring patients to them (IQR 1–5) with 6 centres having no referrals from external hospitals. On average, transplant centres had more referring hospitals than non-transplanting centres (5.0 vs. 2.4,  $p=0.003$ ). As renal centres had

differing numbers of referring hospitals the frequency with which patients were reviewed was condensed down into the most frequently stated response for each centre. Eleven centres (15%) provided telephone advice most frequently for patients referred from outlying hospitals, 13 centres (18%) reviewed these patients once per week, 17 centres (24%) reviewed patients 2–3 times per week and at 26 centres (36%) patients were reviewed daily or when asked (figure 15.6).

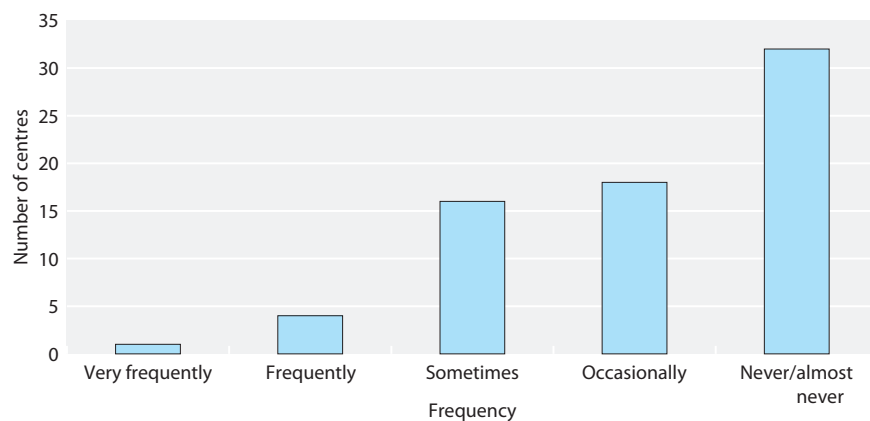
*Characteristics and practice patterns influencing home dialysis usage*

*Home dialysis provision*

Seventy-one renal centres in the UK offered peritoneal dialysis to their patients. The mean percentage of prevalent dialysis patients on PD was 18.8 (SD 7.7) with a range from 0–35%. Sixty-four centres (89%) offered home haemodialysis to their patients. Four of the centres who did not offer this therapy stated that suitable patients were referred to a neighbouring centre for home HD. It was not clear what arrangements were in



**Fig. 15.6.** Frequency of renal review of referred patients in outlying hospitals or wards



**Fig. 15.7.** Frequency of acute PD use

place in the remaining centres. The median (IQR) percentage of prevalent dialysis patients using HHD was 2.9% (1.3–3.9).

#### *Access to therapies*

The range of therapies that were on offer to patients at each centre was investigated. Forty-eight percent of patients reported as receiving home HD were dialysing more than three times per week with 47 centres able to provide frequent home HD. Six percent of home HD patients were dialysing overnight with 10 centres providing this therapy. There were 5 centres where patients could receive in centre HD overnight and there were 42 patients reported as receiving this therapy (0.002% all HD patients). Twenty-eight centres were providing more than thrice weekly in centre HD to some of their patients and among those centres a median of 1.2% of all HD patients were dialysing this frequently.

The median time required to train a patient for home HD was 10 weeks (IQR 5.5–12.0) with a range between 2 weeks and 52 weeks. Training time was defined as from the beginning of training to the first independent session at home, however some centres were unclear what constituted the beginning of training. The level of patient involvement in haemodialysis care was assessed by asking what percentage of HD patients connected their own lines, self-cannulated and weighed themselves during dialysis sessions. A median of 5% of patients connected their own lines (IQR 0.0–10.0), 5% self-cannulated (IQR 2.0–7.5) and 80% weighed themselves (IQR 50–100).

It was reported that 138 patients were receiving assisted automated PD, defined as a paid carer performing the exchanges, with 34 centres providing this therapy. Acute PD (defined as commencing exchanges less than 9 days after PD tube insertion) was initiated at least

‘frequently’ in 5 centres (7%) and ‘never/almost never’ in 33 centres (46%) (figure 15.7).

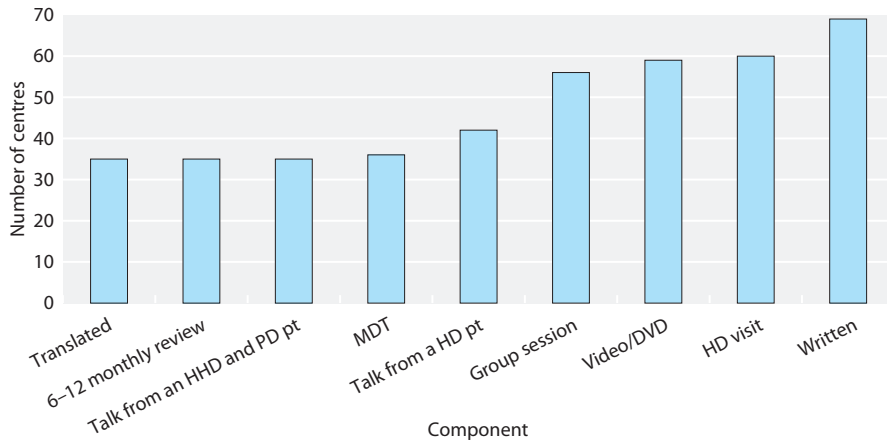
#### *Pre-dialysis education*

The content of the pre-dialysis education programme was ascertained by asking if certain services were provided to the majority of patients. Sixty-nine centres (96%) provided written information to their patients; this was translated into appropriate languages in 35 centres. Twenty-eight of the 52 renal centres with >2% non-white patients provided translated educational materials (54%). Fifty-nine centres (82%) provided video/DVD educational materials for patients to take home and 56 centres (78%) provided group education sessions for patients. Forty-two centres (58%) organised a current patient on HD to talk to pre-dialysis groups and 36 centres (50%) organised a current patient on home HD and PD to talk to pre-dialysis groups. Thirty-six centres (50%) routinely discussed all patients at a multidisciplinary team meeting before dialysis commencement. Thirty-five centres (49%) stated that there was a systematic 6–12 monthly review of dialysis modality after the start of RRT (figure 15.8). Three centres provided a computer based learning/decision tool to educate their patients pre-dialysis and only one centre used a commercial company to provide pre-dialysis education.

#### *Access*

To assess how easy it would be to initiate a patient on peritoneal dialysis questions were asked about PD tube placement. Twenty-five centres (35%) responded that it would be ‘easy’ or ‘very easy’ to insert a PD tube within one week and 20 centres (28%) responded that it would be ‘difficult’ or ‘very difficult’. Nephrologists (or specialist nurses) inserted PD catheters at 23 centres





**Fig. 15.8.** Components of the pre-dialysis education programme

(32%) with one centre using Moncrief as well as Tenckhoff type catheters.

*Clinical management style*

Three separate clinical management styles were identified for home dialysis patients:

- a) a team approach where all patients on a particular modality were managed by one consultant (or group of consultants in larger centres)
- b) an overview approach where one consultant took an overview of all patients on a home modality but other aspects of patient care were managed by other consultants
- c) a named consultant approach where patients are looked after by a particular consultant or by rotating consultants regardless of the dialysis modality they currently use.

For PD, 37 centres (51%) used a team approach, 25 centres (36%) used a named consultant approach and 9 centres (13%) used an overview approach. For HHD, 34 centres (47%) used a team approach, 23 centres (32%) used a named consultant approach and 9 centres used an overview approach (figure 15.9).

*Physical limitations*

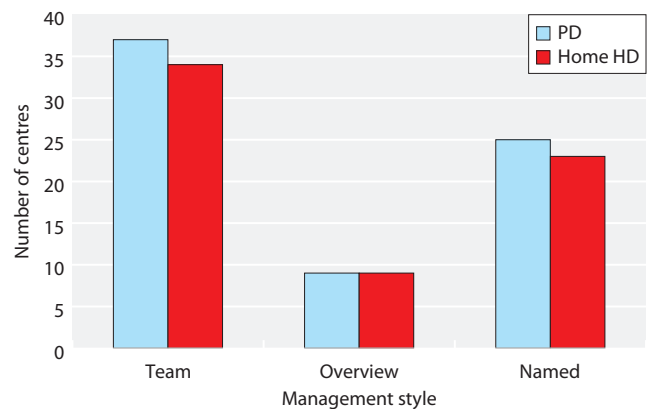
To understand the barriers to initiating home HD, centres were asked if space limitation played a role and if so whether there were funding barriers to overcoming space limitations.

Twenty-one (33%) of the centres providing home HD responded that space within patients' homes was 'never/almost never' a factor preventing home HD and 8 centres (12%) responded that space was at least 'frequently' a factor preventing home HD (figure 15.10). Twenty-five

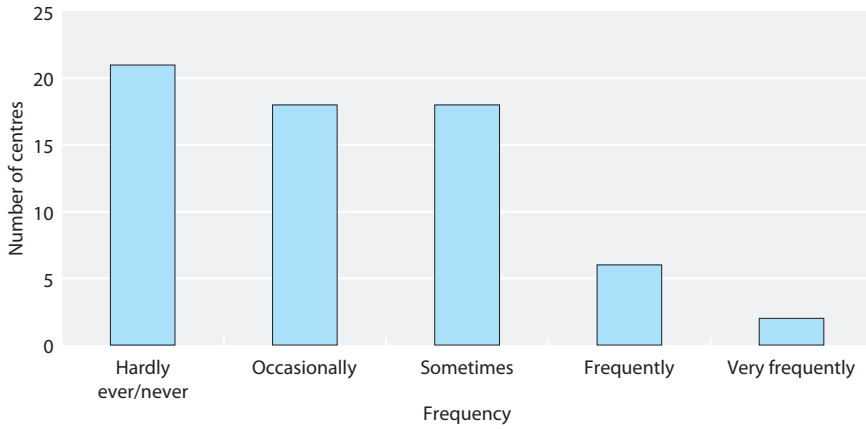
centres (39%) responded that funding restrictions prevented a patient receiving home HD in at least some cases (figure 15.11).

*Physician attitudes*

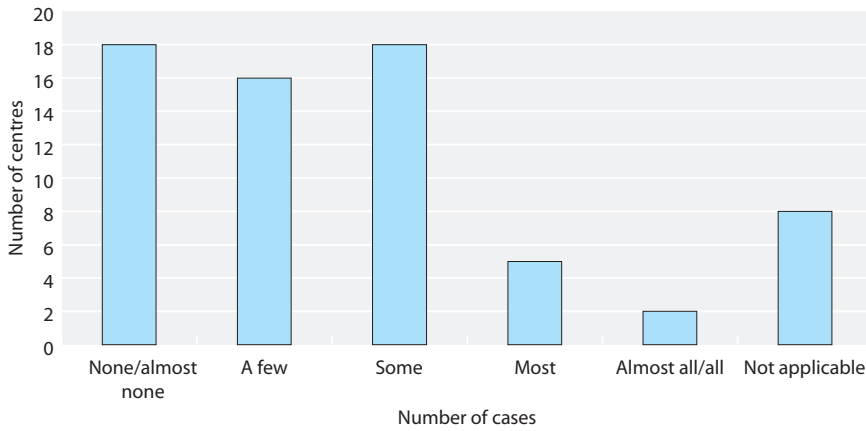
To assess individual clinician attitudes towards home dialysis, centres were asked to describe the ideal proportion of patients on each modality given current transplantation rates and levels of co-morbidity (figures 15.12, 15.13). They were also asked about survival and quality of life benefits of each modality (figure 15.14). There was a positive association between the proportion of patients treated with PD in a centre and the respondent's ideal proportion on PD. In the under 65 year age group, 15% of the variation in PD usage could be explained by the clinician's enthusiasm for the modality ( $R^2 = 0.15$ ,  $p = 0.02$ ). There was a similar positive association between the proportion of patients treated with HHD in a centre and the respondent's ideal HHD use ( $R^2 = 0.16$ ,  $p = 0.001$ ).



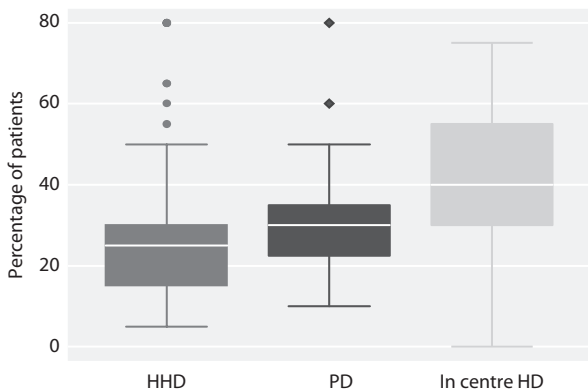
**Fig. 15.9.** Clinical management style used for home dialysis patients



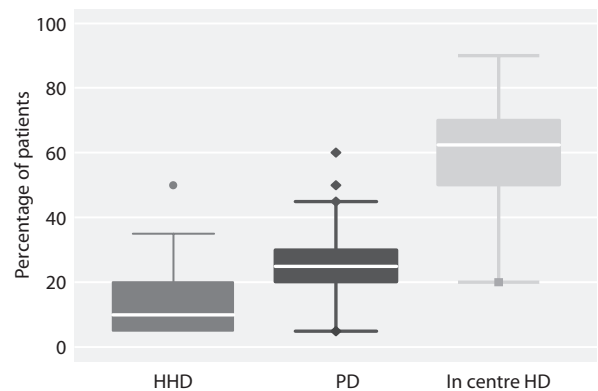
**Fig. 15.10.** The frequency that space within patients’ homes prevents the use of HHD



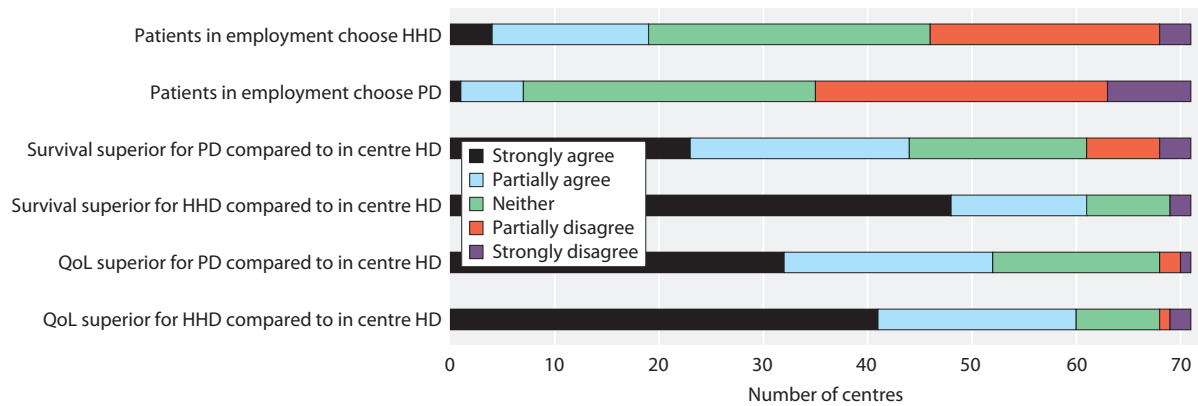
**Fig. 15.11.** The number of cases where the lack of funding for home adaptation prevents the use of HHD



**Fig. 15.12.** Renal physicians’ aspirations for modality use in patients aged less than 65 years  
The line within the box represents the median response, box ends the inter-quartile range and the individual points outlying data



**Fig. 15.13.** Renal physicians’ views on ideal modality usage in patients aged over 65 years  
The line within the box represents the median response, box ends the inter-quartile range and the individual points outlying data



**Fig. 15.14.** Renal physicians' opinions regarding modality choice

### Discussion

There was wide variation between renal centres in the incidence of RRT and in the proportion of patients using a home dialysis modality. Whilst the factors affecting these two outcomes are reported separately here, it is acknowledged that factors affecting home dialysis usage might also influence rates of RRT incidence and *vice versa*.

The rate of referral from primary care was considered one of the strongest determinants of RRT incidence rate by the consensus group. A great deal of work has been done in previous years to highlight the inequalities in RRT provision in the UK including the contribution of referral patterns – referral rates have been shown to be affected by both the geographical distance from a renal centre [7–11] and the level of resource available for RRT treatment [12]. Despite many recent advances in the provision of renal services in the UK and the now comparable rate of RRT incidence to that in most other Northern European countries [13], non-referral remained a concern amongst the consensus group. Although the gatekeeper function of general practitioners has been proposed as part of the explanation for the lower rates of ESRD treatment in the UK [14], a recent multivariable analysis of data from 46 countries found presence of a gatekeeper system not to be independently associated with RRT incidence [15]. This national survey revealed that only a minority (8) of renal centres considered non-referral to still be prevalent but there remained wide variation in late presentation rates between centres and this may translate into variation in pick up rate of advanced kidney disease.

The introduction of formal conservative care programmes was felt by the consensus group to be another

important determinant of RRT incidence rate via differential enthusiasm for such programmes. The DOPPS sub-study into the organisation of renal services also considered rates of conservative care to be an important determinant of RRT incidence [16]. The survey demonstrated wide variation not only in the percentage of patients enrolled in conservative care programmes between renal centres but also in the organisation of these programmes.

It was hypothesised from the literature that a centre's capacity to accommodate patients into the chronic haemodialysis programme would affect RRT incidence rates [17, 18]. The consensus group agreed this would be influential in determining RRT incidence and the survey revealed that a sizeable minority of centres (13) did continue to have insufficient haemodialysis provision for their local needs.

The number of nephrologists per million population has been cited by several papers as being associated with RRT incidence [2, 12, 14, 16, 19], although the direction of the association has not been established. These results show that there was a wide variation both in the number of nephrologists per million population and in the number of patients nephrologists look after between UK renal centres.

It was hypothesised from the literature search and consensus group suggestions that a centre's capacity to transfer in-patients and the level of involvement of the renal team in the care of referred patients in other wards or hospitals would also affect RRT incidence, either by decreasing the number of cases of non-recoverable AKI or by greater referral of patients with established renal failure from other hospital teams increasing the incidence of RRT. The number of renal

beds available has been associated with RRT incidence [2, 18] although again it was unclear to what extent the number of patients on RRT determined the number of beds available and to what extent the greater provision of in-patient renal beds encourages referral and treatment of acute and chronic kidney disease. It is clear from this survey that a large number of hospitals without renal services received only telephone renal advice and that some centres find it much harder than others to transfer in-patients for investigation.

The wide variation between UK renal centres in the percentage of patients treated with a home dialysis modality is likely to be multifactorial. It has been shown that the percentage of patients deemed unsuitable for home dialysis varied with clinician practice patterns [4] but that when patients were given a fully informed choice, around 50% will choose a home dialysis modality over in-centre HD [20]. Indeed this survey has demonstrated that clinician enthusiasm for a particular modality is a strong determinant of how many patients are treated with that modality in a centre. There often appears to be a gap between clinicians' stated 'ideal' mix of dialysis modality usage for their patients and the actual proportions of patients using each type of treatment. Some of this discrepancy might be due to patient preference but the literature review and consensus group also revealed several additional factors which might account for this. Patients who presented within 3 months of requiring dialysis were less likely to receive a home dialysis treatment [21] and this survey revealed that in different centres, between 3% and 67% of patients were still presenting late.

The quality and quantity of pre-dialysis education [22–24] and the level of support, in the form of a team of specialist nurses, available for patients choosing a home modality (from the consensus group) was also felt to influence the number of patients choosing a home modality. This factor might be particularly important in areas of greater socio-economic deprivation where more time might be needed for this decision [25, 26]. This survey has revealed that there are differences in the constituents of pre-dialysis education

programmes between centres and also in the number of staff employed to deliver such education.

The presence of a 'local champion' of a modality was felt by the consensus group to be an important determinant of its usage. This survey revealed that home dialysis patients were managed by a single consultant in around half of the UK renal centres. Clinicians' practice patterns and beliefs about patient survival, treatment effectiveness and quality of life when using each type of dialysis treatment were considered the most important factor in determining home dialysis usage in a centre by the consensus group. Lack of exposure to PD during training [27, 28, 29] and in one US study less recent completion of training [30] were found to bias clinicians against home dialysis therapies, whereas belief in a superior quality of life associated with home dialysis [31, 32] and the belief that rates of home dialysis use should increase [29, 33, 34] bias clinicians towards home therapies. This survey demonstrates that a broad range of opinions about dialysis modality-related patient survival and quality of life are held by UK nephrologists.

This survey has collected responses from all adult renal centres in the UK on a wide range of factors identified through a systemic literature search and consensus methods (including staff and patients). One limitation of this work lies in the necessary compromise made between the ease of completion of the survey for nephrologists and the availability, detail and accuracy of the data. Responses were provided by a small number of physicians in each centre and were therefore liable to reporting bias. In particular, the use of scales to grade practice is open to differences in interpretation between individuals though we have attempted to minimise the effect of this by comparing the extremes of the scales whenever possible.

Further work is ongoing to investigate which of these renal centre characteristics and practice patterns are associated with RRT incidence and with home dialysis usage after the effect of each centre's population demographics and health status have been taken into account.

Conflicts of interest: none

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