

# Chapter 7: Haemodialysis Dose

Andrew J Williams, Daniel Ford, Anna Casula and Charlie Tomson

## Summary

- This chapter summarises analyses of data submitted to the UK Renal Registry on urea reduction ratio (URR) in patients receiving haemodialysis in the UK in 2006. Sixty two of the seventy one centres providing treatment of adults in the UK submitted data on URR. Of these 62 centres, 46 returned URR data on 90% or more of prevalent haemodialysis patients, 14 provided data on between 50% and 90% and 2 centres provided data on less than 50% of prevalent patients.
- Overall, 80% of prevalent haemodialysis patients met the UK Renal Association standard for URR (>65%) in 2006. There was a linear relationship between the proportion of patients in a given centre attaining this standard and the median URR of patients treated in that centre.
- There has been an increase from 56% in 1998 to 80% in 2006 in the proportion of patients in the UK who achieved a URR >65%.
- The haemodialysis dose (URR) delivered to patients who had just started dialysis treatment was lower than that of patients who had been treated for longer and increased further with time.

## Introduction

Amongst patients with established renal failure the delivered dose of haemodialysis was an important predictor of outcome<sup>1</sup> which has been shown to influence survival<sup>2,3</sup>. It depends on treatment (duration and frequency of dialysis; dialyser size; dialysate and blood flow rate) and patient (size; weight; haematocrit and vascular access) characteristics. There are two accepted methods of quantifying it. Firstly, there is a ratio (Kt/V) between the product of urea clearance

(K, in ml/min) and dialysis session duration (t, in minutes) to the volume of distribution of urea in the body (V, in ml). Secondly, it can also be assessed by a related measure, the urea reduction ratio (URR).

Based on published evidence, clinical practice guidelines have been developed by various national and regional organisations which can be found at [www.kdigo.org](http://www.kdigo.org). There is considerable uniformity between them with regard to the recommendations for minimum dose of dialysis although there are slight differences in the methodology advised<sup>4</sup>.

The UK Renal Association standard<sup>5</sup> in operation at the time these data were collected was as follows:

***HD should take place at least three times per week in nearly all patients. Reduction of dialysis frequency to twice per week because of insufficient dialysis facilities is unacceptable. (Good practice)***

***Every patient receiving thrice weekly HD should show:***

- ***either urea reduction ratio (URR) consistently >65%***
- ***or equilibrated Kt/V of >1.2 (calculated from pre- and post-dialysis urea values, duration of dialysis and weight loss during dialysis). (B)***

***Patients receiving twice weekly dialysis for reasons of geography should receive a higher sessional dose of dialysis, with a total Kt/V urea (combined residual renal function and haemodialysis) of >1.8. If this cannot be achieved, then it should be recognised that there is a compromise between the practicalities of dialysis and the patient's long-term health. (Good practice)***

***Measurement of the 'dose' or 'adequacy' of HD should be performed monthly in all hospital HD patients and may be performed***

*less frequently in home HD patients. All dialysis units should collect, and report to the Registry, data on pre- and post-dialysis urea values, duration of dialysis, and weight loss during dialysis. (Good practice)*

*Post-dialysis blood samples should be collected either by the slow-flow method, the simplified stop-flow method, or the stop-dialysate-flow method. The method used should remain consistent within renal units and should be reported to the Registry. (B)*

During 2007, the Renal Association issued revised (4th Edition) Clinical Practice Guidelines for haemodialysis, which extend these recommendations.

Current evidence suggests that there is no survival advantage for patients undergoing thrice weekly haemodialysis in whom the dialysis dose (equilibrated Kt/V) is  $>1.5^6$ . The impact of duration and frequency of dialysis independent of dialysis dose is uncertain<sup>7</sup> although there is some evidence that longer treatment time improves survival<sup>8</sup>.

For pragmatic reasons (because most centres do not report duration of dialysis or weight loss during dialysis) the Registry has chosen URR rather than Kt/V for comparative audit. Data on post-dialysis sampling methods were last collected by telephone survey in 2002<sup>9</sup>. No reliable data are available to clarify whether the important variations in post-dialysis sampling methodology that were identified at that time persist.

The Registry collected data on recorded session time from most centres although a few centres reported prescribed session time. No data were collected on dialyser characteristics (eg surface area, clearance, flux, membrane type).

Several centres in the UK now use online measurement of ionic dialysance to measure small molecular clearance during haemodialysis, relying on studies that have demonstrated a close linear relationship between this measure and conventional measures of urea clearance<sup>10</sup>. However, the Registry strongly encourages these centres to continue to perform and report conventional pre- and post-dialysis measurements of blood urea concentration at least on a 3-monthly basis, to allow comparative audit.

## Methods

Two groups of patients were included in the analyses. Firstly, analysis was undertaken using data from the prevalent patient population on 31st December 2006. For this analysis data for URR were taken from the last quarter of 2006 unless that data point was missing in which case data from the 3rd quarter were taken. As the prevalent population only included those patients alive on 31st December, data from those patients who had died earlier in the year have not been included in the analysis. The second analysis involved the incident patient population for 2006. For these patients analysis was undertaken using the last recorded URR during the quarter in which the patient had started dialysis.

Data on frequency of dialysis were not routinely reported by all centres and were last collected systematically as part of the 2002 National Renal Survey<sup>11</sup>. Data from patients known to be receiving twice weekly dialysis were omitted. However, because not all centres report frequency of dialysis, it is possible that data from a small number of patients receiving dialysis less or more frequently than thrice weekly were included in the analyses. Due to the small numbers involved it is unlikely that this would have influenced the overall centre mean.

All patients with data were included in the statistical analysis, although centres with fewer than 20 patients, or providing less than 50% data completeness were excluded from centre level analyses.

## Results

### **Data completeness**

URR data were available from most centres (Table 7.1) on at least 90% of patients. Fourteen centres were included in the analysis but returned data from less than 90% of patients – Brighton (88%), Dumfries & Galloway (88%), Kilmarnock (86%), Preston (84%), Wolverhampton (83%), Guys (82%), Chelmsford (81%), Dundee (80%), Dudley (73%), Oxford (70%), Carshalton (64%), London West (59%), Swansea (54%) and Manchester West (53%). Seven centres

**Table 7.1: Percentage completeness of URR data returns**

Centre	% complete	Centre	% complete
Abrdn	98	L Kings	0
Airdrie	97	L Rfree	0
Antrim	100	L West	59
B Heart	93	Leeds	96
B QEH	95	Leic	98
Bangor	96	Liv Ain	94
Basldn	99	Liv RI	93
Belfast	95	ManWst	53
Bradfd	99	Middlbr	95
Brightn	88	Newc	0
Bristol	100	Newry	99
Camb	44	Norwch	92
Cardff	94	Nottm	98
Carlisle	95	Oxford	70
Carsh	64	Plymth	93
Chelms	81	Ports	98
Chestr	98	Prestn	84
Clwyd	92	Redng	92
Covnt	94	Sheff	97
D&Gall	88	Shrew	92
Derby	97	Stevng	94
Derry	95	Sthend	90
Dorset	95	Sund	96
Dudley	73	Swanse	54
Dundee	80	Truro	96
Dunfn	98	Tyrone	94
Edinb	98	Ulster	100
Exeter	94	Wirral	3
Glasgw	97	Wolve	83
Glouc	97	Wrexm	0
Hull	96	York	99
Inverns	100	<b>England</b>	<b>75</b>
Ipswi	100	<b>N Ireland</b>	<b>97</b>
Klmarnk	86	<b>Scotland</b>	<b>95</b>
L Barts	0	<b>Wales</b>	<b>74</b>
L Guys	82	<b>UK</b>	<b>78</b>

(Cambridge, Kings, London Barts, Newcastle, Royal Free, Wirral and Wrexham) reporting on less than 50% of prevalent patients were not included in the centre level analyses. The number preceding the centre name in each figure indicates the percentage of missing data from that centre.

### **Achieved URR**

The median URR and percentage of reported patients attaining the Renal Association standard of a URR >65% are shown in Figures 7.1 and 7.2.

Figure 7.3 illustrates the close relationship between the two.

### **Changes in URR over time**

The change in median URR and attainment of the Renal Association standard (URR >65%) by each centre between 1998 and 2006 is shown in Figures 7.4 and 7.5. Figure 7.6 shows that whilst the median URR has risen from 67% to 72% between 1998 and 2006 there has been a rise in the proportion of patients attaining the RA standard from 56% to 80%.

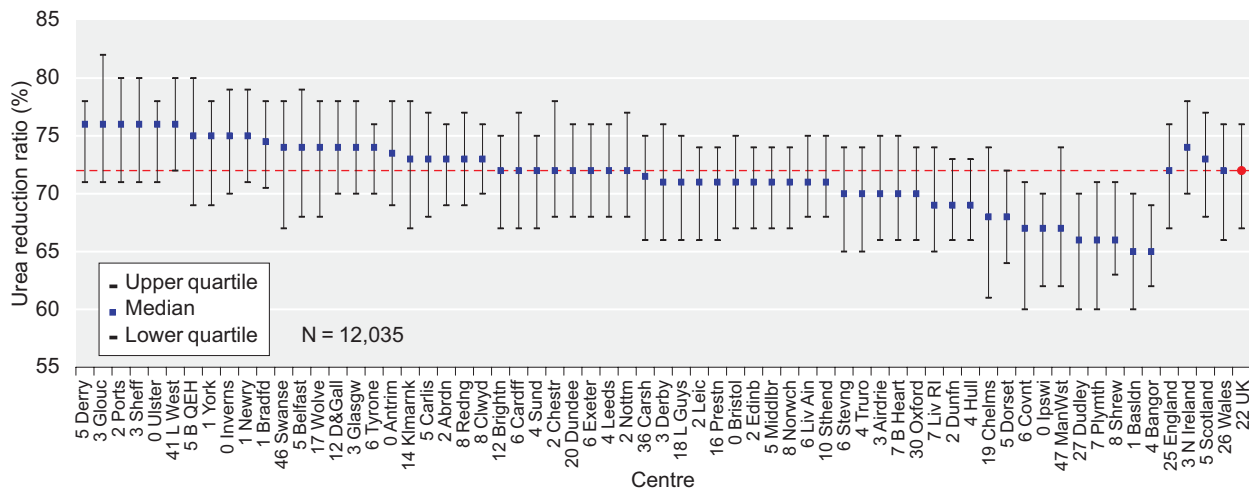


Figure 7.1: Median URR achieved in each centre, 2006

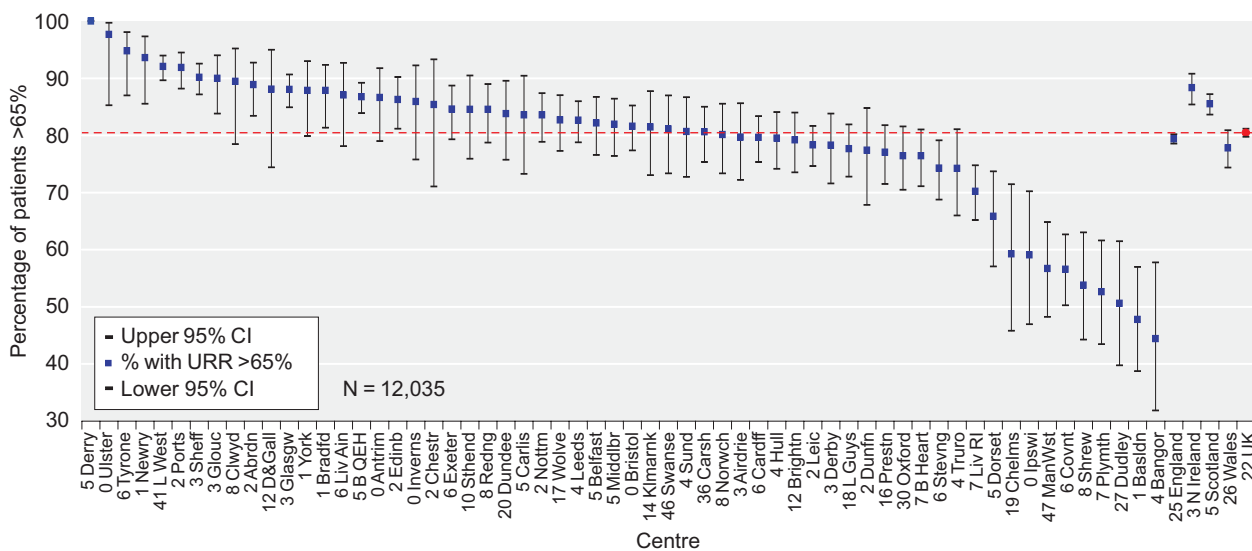


Figure 7.2: Percentage of patients with URR >65% in each centre, 2006

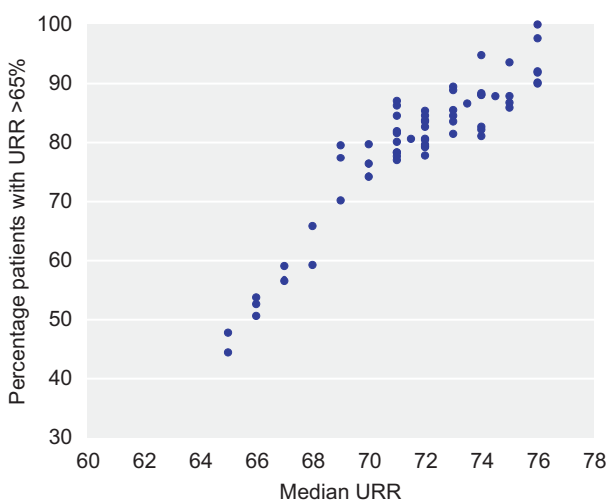


Figure 7.3: Relationship between achievement of the Renal Association standard for URR and the median URR in each centre, 2006

### Variation of achieved URR with time on dialysis

The proportion of patients who attain the Renal Association standard increased in parallel with the time since those patients started dialysis (Figure 7.7). Of those dialysed for less than six months, 60% had a URR >65% whilst 85% of patients who had been dialysed for more than two years attained the standard.

The median URR during the first quarter after starting haemodialysis of the incident haemodialysis population in the UK in 2006 was 64% (Figure 7.8).

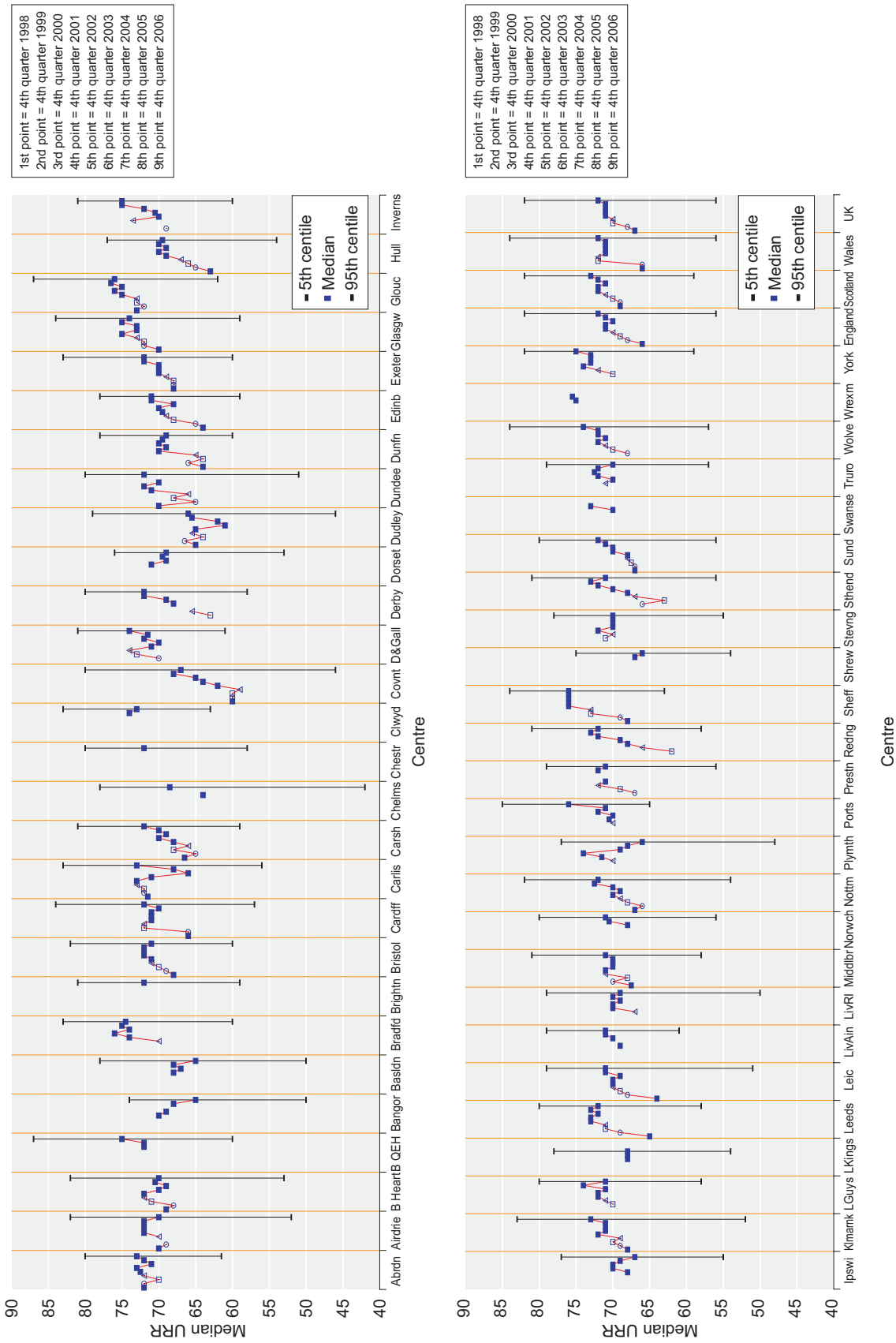
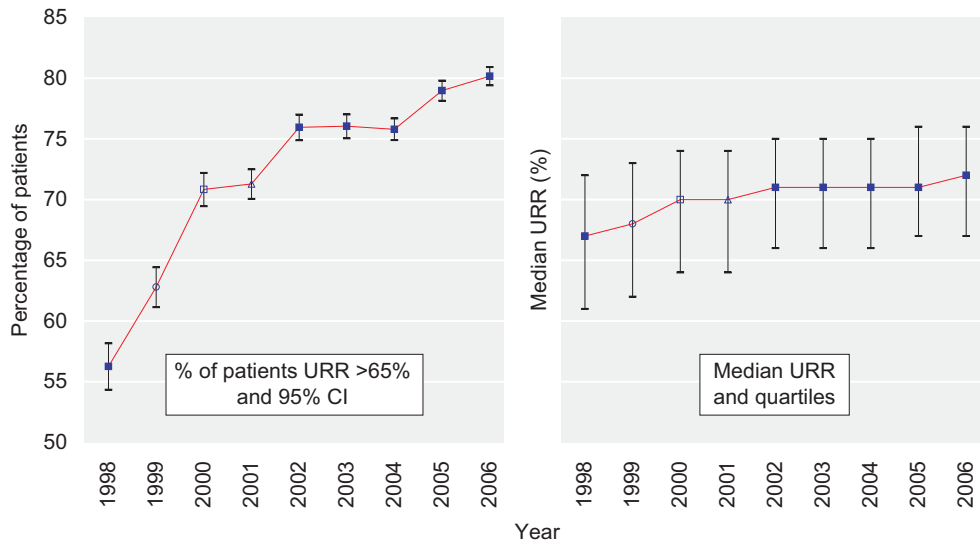
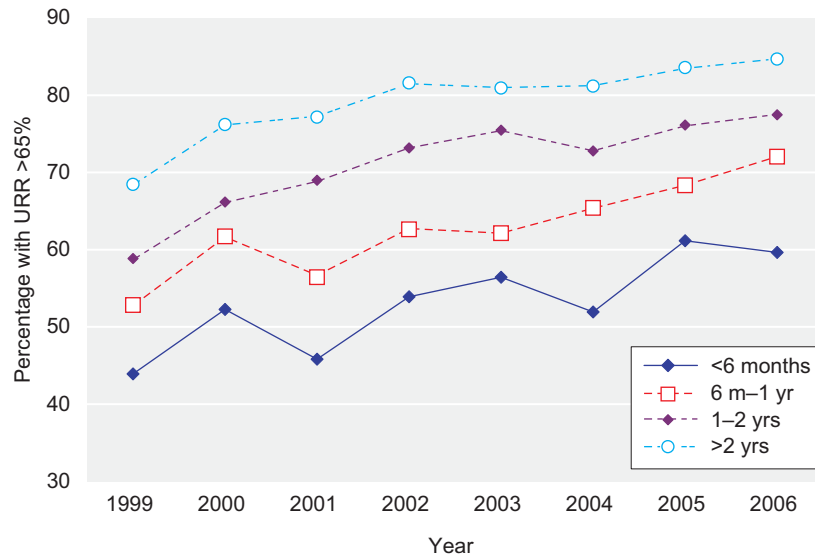


Figure 7.4: Change in median URR in each centre between 1998 and 2006

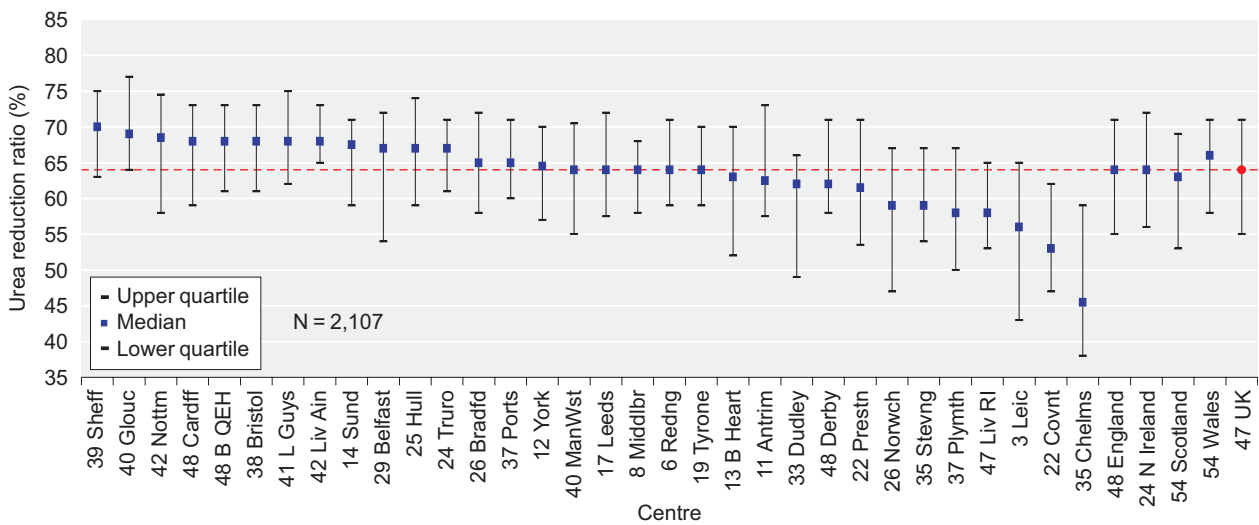




**Figure 7.6: Change in the percentage of patients with URR >65% and the median URR between 1998 and 2006 in England, Wales and Scotland**



**Figure 7.7: Percentage of prevalent haemodialysis patients achieving URR >65% against duration on haemodialysis between 1999 and 2006**



**Figure 7.8: Median URR in the first quarter after starting RRT in patients who started haemodialysis in 2006**

## Discussion

Haemodialysis dose has risen in most centres during the past eight years and approximately 80% of patients undergoing thrice weekly dialysis attain the target that has been set by the UK Renal Association.

Thus far there are no Clinical Practice Guidelines on which to base audit of patients undergoing more frequent haemodialysis regimens or haemofiltration.

There was a gradual rise in delivered haemodialysis dose as the length of time that patients had been on dialysis increased. However, because data regarding residual renal function was not available it is difficult to know whether this represented a change in overall urea clearance.

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