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UK Renal Registry 20th Annual Report: Chapter 10 2016 Multisite Dialysis Access Audit in England, Northern Ireland and Wales and 2015 Peritoneal Dialysis One Year Follow-up: National and Centre-specific Analyses

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Keywords
Chronic kidney disease · Diabetes · Dialysis · End stage renal disease · Established renal failure · Haemodialysis · Peritoneal dialysis · Prevalence · Renal replacement therapy · Transplantation · Treatment modality · Vascular access

Summary

- In 2016, 55 of 62 centres in England, Wales and Northern Ireland returned data on first access for 4,564 incident haemodialysis (HD) and 1,246 incident PD recipients.
- Of these 5,810 incident patients, 50% started dialysis with definitive access: 21.5% started PD, 28.5% started HD with an arteriovenous fistula (AVF) or graft (AVG), 28.4% with a tunnelled line (TL) and 21.7% with a non-tunnelled line (NTL).
- Wide variation in definitive access use (defined as primary AVF, AVG or PD) was apparent between centres.
- Sixteen centres achieved the 60% target for AVF/AVG use amongst incident HD recipients.
- Seventeen centres achieved the 80% target for AVF/AVG/PD use amongst prevalent dialysis recipients.
- Timely presentation to a nephrologist and referral to a dialysis access surgeon remained key determinants of the likelihood of definitive access at dialysis initiation
- For late-presenting patients, definitive access 90 days after initiating dialysis ranged between 42.9% and 0.0% by centre, implying variation in the responsiveness of dialysis access pathways.
- For centres returning data on one-year PD access outcomes, 70.7% of patients starting PD continued to use this modality or have been transplanted one year later.
- The mean one-year PD catheter failure rate was 18.4%.
- This report demonstrates wide variation in practice between centres across several domains in the provision of dialysis access.

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Introduction

Provision of definitive dialysis access is an important measure of good clinical care for patients with established renal failure. Relevant recommendations and audit standards are presented in the Renal Association clinical practice guidelines (table 10.1). The annual multisite dialysis access audit provides centre-level information on access provision in England, Wales and Northern Ireland. Although the Renal Association undertook a national vascular access audit in 2005, published with outcomes data in 2012 by the UK Renal Registry (UKRR) [1], this is the sixth annual audit that combines peritoneal and vascular access, presenting information for patients starting dialysis between 1 January and 31 December 2016. The objective of this audit is to highlight centre-level performance variation and explore factors that may contribute to the provision of high quality vascular and peritoneal access.

The term 'established renal failure' used within this chapter is synonymous with the terms 'end stage renal failure' and 'end stage kidney disease'. These alternative terms are in widespread international use, but are less acceptable to patients.

Methods

In 2017, all adult renal centres in England, Wales and Northern Ireland were asked to provide vascular and peritoneal access data for incident (1 January to 31 December 2016) and prevalent dialysis patients. Access data for incident patients were collected at patient level, whereas centre-level data were submitted for prevalent patients. Table 10.2 presents a full glossary of collected variables. Data were collected using Microsoft Excel spreadsheets circulated by the UKRR.

Records were validated against the UKRR database to confirm that the population collected at each centre for the audit was the same as, or representative of, the incident population at that centre collected via the routine quarterly return. Data checks were made by cross-referencing with the UKRR database. Any patients identified from the UKRR as not incident to dialysis between 1 January 2016 and 31 December 2016 were excluded. For the purposes of this audit, patients were categorised as having acute kidney injury (AKI) if their access at three months was recorded as 'recovered renal function' and were therefore excluded from analysis. Patients

Table 10.1. Summary of relevant audit standards stated in the Renal Association clinical practice guidelines

RA audit measure/guideline*		Reported	Notes
1	Proportion of planned renal replacement therapy initiations with established access or pre-emptive transplantation (no minimum audit standard)	Yes	Table 10.3 Table 10.4 Table 10.9 Table 10.10
2	60% of all incident patients with established end stage kidney disease commencing planned haemodialysis should receive dialysis via a functioning arteriovenous fistula or arteriovenous graft	Yes	Table 10.3 Table 10.4 Table 10.9 Table 10.10 Figure 10.5
3	80% of all prevalent long-term dialysis patients should receive dialysis treatment via 'definitive access': arteriovenous fistula, arteriovenous graft or peritoneal dialysis	Yes	Figure 10.7 Table 10.10
4	Peritoneal dialysis catheter patency – more than 80% of catheters should be patent at one year (censoring for death and elective modality change)	Partly	Figure 10.13 Figure 10.15
5	Complications following peritoneal dialysis catheter insertion:	Partly	Figure 10.14 Figure 10.15
5a	Bowel perforation <1%	No	Not captured by the audit
5b	Significant haemorrhage <1%	No	Not captured by the audit
5c	Exit site infection within two weeks of catheter insertion <5%	No	Not captured by the audit
5d	Peritonitis within two weeks of catheter insertion <5%	Yes	Figure 10.13

*Audit standards from the most recent Renal Association guidelines (June 2017) are presented. Current and previous guidelines are available on the Renal Association website (www.renal.org/guidelines/current-guidelines)

Table 10.2. Glossary of variables collected in the 2016 Multisite Dialysis Access Audit

Audit data item	Definition [format]	PD/HD or both
ID	Local hospital number [numerical]	Both
NHS number	NHS number (England & Wales) [numerical]	Both
Surname	[text]	Both
Forename	[text]	Both
DoB	Date of birth [DD/MM/YY]	Both
Sex	[Male/Female/Unknown]	Both
Date of death	[DD/MM/YY]	Both
Postcode	The postcode of the patient's usual address [alpha-numerical]	Both
First RRT treatment centre code	Renal treatment centre where first dialysis took place [treatment centre ID code]	Both
Primary renal diagnosis	Primary renal diagnosis [EDTA four digit diagnosis code]	Both
BMI	BMI at time of access insertion (weight in kg/height in m^2) [numerical]	Both
Date first seen by renal physician	The date the patient was first seen by a renal physician (as an outpatient or inpatient) [DD/MM/YY]	Both
Assessed by surgeon for an AVF, AVG or PD catheter at least three months before dialysis?	Was the patient assessed by a surgeon regarding dialysis access at least three months before their first dialysis date? [Yes/No]	Both
Was an AVF/AVG attempted before 1st dialysis?	Was an AVF/AVG attempted before the first ever dialysis session? [Yes/No/Unknown]	Both
Date FIRST EVER dialysis session	Date of first ever dialysis session [DD/MM/YY]	Both
First ever modality	First ever renal replacement modality [HD/PD]	Both
Access in use at first ever dialysis	Dialysis access in use at first dialysis (may not be first access created) [AVF/AVG/vein loop/TL/NTL/PD/temporary PD catheter]	Both
Access in use at three months	Dialysis access in use three months after the start of first treatment [AVF/AVG/vein loop/TL/NTL/PD/temporary PD catheter/recovered/transplant/conservative/death/lost to follow-up/transferred out]	Both
Same access in use 3 months later	Same actual access in use at first dialysis and 3 months i.e. same catheter, same AVF; same AVG) [Yes/No]	Both
Date of first ever access insertion/construction	Date of creation/insertion of first ever dialysis access (if Moncrief PD catheter, date of externalisation) [DD/MM/YY]	Both
Diabetes at time of access creation	Does the patient have diabetes mellitus (type 1 or 2) at time of dialysis access creation? [Yes/No]	Both
PD catheter insertion technique	Technique used to insert PD catheter [open /laparoscopic/ percutaneous]	PD only
Peritonitis episode	Peritonitis episode within two weeks of insertion? [Yes/No]	PD only
Access complication	Reason for access failure/discontinuation [selection from 27 item list]	Both
Date of access failure/discontinuation	Date access is no longer usable for treatment [DD/MM/YY]	Both
Comments	Any relevant comments [text]	Both

RRT – renal replacement therapy; BMI – body mass index; HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

with missing information for access at start, age and date of starting renal replacement therapy (RRT) were excluded from the analysis. Patients were excluded when there was no matching record in the UKRR database (patient assumed to be AKI) and when aged <18 years. If a centre reported prevalent numbers that differed by more than 10% from those in the UKRR database, it was excluded. Cross-referencing also enabled ascertainment of mortality within three months of commencing dialysis.

Patients starting haemodialysis were grouped by type of first vascular access: arteriovenous fistula, arteriovenous graft, tunnelled dialysis line, non-tunnelled dialysis line. Patients starting peritoneal dialysis were categorised by the insertion technique: open surgery, laparoscopic, peritoneoscopic or percutaneous. Access at three months was defined as the type of access in use at three months after starting dialysis. If a patient was no longer receiving dialysis at three months (but had not recovered renal function), the reason was recorded instead, for example, 'death' or 'transplantation'. Referral time was defined as the number of days between the date of first being seen by a renal physician (as an inpatient or outpatient) and the date of commencing dialysis. A patient was classified as presenting 'late' if they had a referral time of less than 90 days.

Access failure was defined when it was no longer usable for dialysis with the date and cause of access failure reported. For the purposes of analysis, HD access failure was grouped into five causes: maturation, mechanical, infection, other and unknown. PD technique failure was grouped into six causes: infection, catheter related, solute/water clearance, leaks/hernia, other and unknown. Access failure was censored for death, transplantation, withdrawal from RRT and elective switching of access type. It was the intention to only capture access failures relating to the first access that was performed. If the reason recorded for access failure was not related to the first type of access recorded, then the data were not included in this analysis.

Centres that reported data on PD patients in the 2015 vascular and peritoneal access audit were asked to complete a one year follow-up of their PD patients. Additional information was requested on the date of PD catheter failure, the reason for catheter failure, the number of catheters used during the year and the modality in use at one year after starting PD. Analyses that use these data are titled 'PD follow-up audit'.

As in the 19th Annual Report, this chapter includes data for pre-emptive transplant (PTx) recipients. This reflects the amended (2015) Renal Association guidelines for planned RRT initiation, which include PTx in the audit standard (table 10.1). Where possible, these data have been included at centre level to aid in the interpretation of the effects of PTx upon rates of definitive and non-definitive dialysis access. Transplant and non-transplant centres work together to prepare patients for PTx, but for the purpose of these analyses, patients have been allocated to their most likely treatment centre (transplant or non-transplant) using the approach of Judge *et al.* [2]; this is based on patient postcode and the likelihood of receiving care in a centre.

Separate and combined analyses were performed for incident HD and PD patients as appropriate. Analyses have been limited to descriptive statistics of frequencies, percentages and unadjusted associations between variables. All inter-centre performance comparisons are made in the context of varying patient demography, case mix and volume. If a centre had >50% missing returns for a particular data field, then all patients from that centre were excluded from analyses involving that data field. The data were analysed using SAS 9.3.

Results

Of 62 centres contacted, 55 returned data on first dialysis access used. After individual patient exclusions, 5,810 patients were included, comprising 4,564 starting HD and 1,246 starting PD (figure 10.1, table 10.3). UKRR 2016 incident data for centres submitting data were 4,546 HD and 1,298 PD patients. The slight over-reporting represents the inability to check all patients against the UKRR dataset, because some centres did not provide patient-level data. It is also possible that a small number of patients with AKI remained in the audit data because of incomplete data at three months. Furthermore, it is possible that some patients who were excluded because they did not match to the UKRR database did not have AKI, but instead started dialysis towards the end of 2016 and the UKRR had not yet received that data from renal centres.

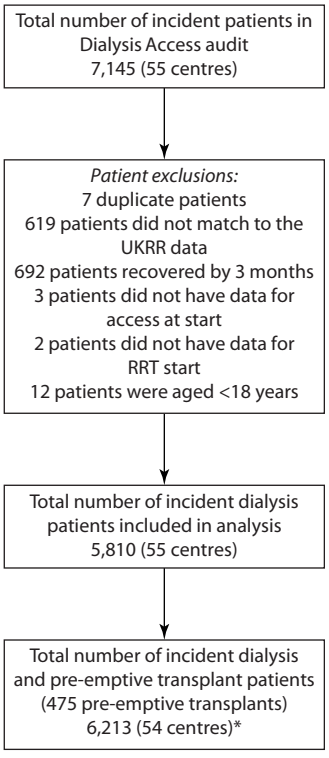

Fig. 10.1. STROBE flow diagram of patients included in the 2016 Multisite Dialysis Access Audit
*Cambridge excluded as patient level data for pre-emptive transplants in 2016 were not submitted to the UKRR

Table 10.3. Demographics and characteristics of patients in the 2016 Multisite Dialysis Access Audit, stratified by first dialysis access type

		HD patients				PD patients						
Variable		*N*	AVF/AVG	TL	NTL	*N*	Open surgery	Laparo-scopic	Peritoneo-scopic	Percuta-neous	Missing	Total
Total number		**4,564**	1,658	1,648	1,258	**1,246**	404	291	30	410	111	5,810
Percentage			36.3	36.1	27.6		32.4	23.4	2.4	32.9	8.9	
Age at first dialysis	Median (IQR)	**67 (55,76)**	68 (56,77)	66 (54,75)	69 (55,78)	**61 (47,72)**	60 (47,71)	61 (49,71)	65 (50,75)	60 (46,72)	57 (44,69)	64 (51,74)
	<45	**523**	27.2	43.6	29.3	**268**	32.8	20.1		34.3		791
	45–54	**608**	37.7	37.3	25.0	**225**	32.4	24.0	3.1	32.4	8.0	833
	55–64	**932**	38.3	37.6	24.1	**250**	33.6	24.8		29.2		1,182
	65–74	**1,204**	37.0	35.9	27.2	**297**	30.0	27.3	2.7	32.3	7.7	1,501
	75+	**1,297**	37.4	31.7	30.9	**206**	34.0	19.4	3.9	36.9	5.8	1,503
BMI	<20	**157**	31.2	43.3	25.5	**36**	44.4	25.0		16.7		193
	20–24	**541**	40.3	34.6	25.1	**207**	37.7	31.9		24.2		748
	25–29	**646**	43.5	31.1	25.4	**222**	38.7	34.7	2.3	20.7	3.6	868
	30–34	**461**	46.6	33.0	20.4	**144**	38.2	37.5		20.8		605
	35+	**382**	48.4	31.7	19.9	**65**	36.9	41.5		15.4		447
	No data	**742**	23.7	29.9	46.4	**130**	30.8	14.6		46.9		872
PRD	Diab	**1,214**	41.2	39.0	19.8	**338**	24.9	26.0	2.1	37.3	9.8	1,552
	Glom	**450**	39.6	37.6	22.9	**211**	34.1	24.6	2.8	30.3	8.1	661
	Hypert	**282**	47.9	30.9	21.3	**89**	28.1	16.9		44.9		371
	Other	**906**	16.9	34.1	49.0	**157**	34.4	24.2	3.8	29.3	8.3	1,063
	Polyc	**208**	63.0	26.4	10.6	**88**	47.7	28.4		19.3		296
	Pyelo	**245**	41.2	35.9	22.9	**60**	31.7	28.3		31.7		305
	RVD	**280**	40.7	30.0	29.3	**74**	41.9	12.2		33.8		354
	Uncert	**643**	36.4	39.2	24.4	**173**	30.1	22.5		39.3		816
	No PRD	**166**	24.7	43.4	31.9	**17**		35.3		29.4		183
Referral time (days)	<90	**1,116**	3.0	38.9	58.2	**82**	31.7	19.5		35.4		1,198
	90–180	**202**	24.3	56.9	18.8	**83**	34.9	19.3		32.5		285
	180–365	**341**	37.5	41.3	21.1	**116**	28.4	27.6		31.0		457
	365+	**2,789**	51.0	32.7	16.3	**952**	32.5	23.6	2.4	33.1	8.4	3,741
	No data	**116**	23.3	39.7	37.1	**13**	53.8					129
Assessed by surgeon	Yes	**2,010**	72.9	21.6	5.5	**514**	34.8	28.0	1.0	25.1	11.1	2,524
	No	**2,379**	6.1	48.0	45.9	**616**	30.7	20.0	4.1	43.0	2.3	2,995
	No data	**77**	26.0	35.1	39.0	**82**	36.6	26.8		19.5		159
Sex	Female	**1,647**	35.4	37.9	26.7	**461**	36.7	23.2	3.0	28.6	8.5	2,108
	Male	**2,917**	36.9	35.1	28.0	**785**	29.9	23.4	2.0	35.4	9.2	3,702
Ethnicity	Asian	**520**	33.5	43.7	22.9	**160**	21.9	19.4		48.1		680
	Black	**330**	27.3	48.2	24.5	**87**	17.2	25.3		37.9		417
	Other	**129**	31.0	43.4	25.6	**54**	37.0	18.5		29.6		183
	White	**3,265**	38.1	33.1	28.9	**893**	35.3	23.4	2.9	30.6	7.8	4,158
	No data	**251**	33.1	34.3	32.7	**49**	34.7	38.8		20.4		300
eGFR at start	Median (IQR)	**7(5,9)**	7(6,9)	7(5,9)	7(5,9)	**7(6,10)**	8(6,10)	7(6,9)	7(6,12)	7(6,9)	8(6,10)	7(6,10)
Diabetes	Yes	**1,686**	41.7	35.8	22.5	**405**	28.4	27.7	2.5	37.3	4.2	2,091
	No	**2,164**	35.7	34.1	30.3	**684**	36.4	24.1	2.9	33.3	3.2	2,848
	No data	**192**	22.4	24.0	53.6	**46**	23.9	26.1		21.7		238

Centres with >50% missing data for a variable were excluded from summary data and analyses relating to that variable, hence the total number of patients does not always sum to 5,810

Blank cells – <5 patients, percentages not shown

IQR – interquartile range; BMI – body mass index; PRD – primary renal diagnosis; DM – diabetes mellitus; GN – glomerulonephritis; HTN – hypertension; PKD – polycystic kidney disease; Pyelo – pyelonephritis; RVD – renal vascular disease; HD – haemodialysis; PD – peritoneal dialysis; eGFR – estimated glomerular filtration rate; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

Data completeness

Data completeness varied between 100% (date of birth, sex, dialysis start date, first dialysis access, first dialysis modality and access at three months) and 28.7% (date of access failure). The data on diabetes were supplemented by triangulation with UKRR comorbidity and primary renal diagnosis (PRD), increasing completeness of diabetic status to 89.0%. Of 50 centres that reported data on PD patients in 2015 ($N = 1,075$), 38 completed the one year follow-up, returning data on 902 patients.

Variations in first dialysis access

The following observations can be made of incident dialysis access. These represent associations and do not imply causality. Data were unadjusted for patient factors.

- 50.0% of dialysis patients started therapy using definitive access: AVF/AVG or a PD catheter.
- 36.3% of HD patients started therapy using an AVF or AVG.
- AVF use increased with increasing referral time, with corresponding reductions in TL/NTL use: 48.0% of incident HD patients known to a nephrologist for over 90 days had an AVF/AVG which was below the Renal Association audit standard of 60% (table 10.1).
- AVF use increased with increasing age and BMI, with corresponding reductions in TL/NTL use.
- Percutaneous PD catheter placement was less common at extremes of BMI.
- Use of definitive access was high (74.0%) for patients with polycystic kidney disease listed as their PRD. This has been a consistent finding in the audit, likely to reflect factors associated with the disease – including early diagnosis and referral, younger age, a predictable clinical course and high health literacy.
- For patients starting haemodialysis with 'other' listed as their PRD, AVF/AVG use was particularly low (16.9%).
- Incident HD recipients who had been reviewed by a surgeon at least three months prior to starting dialysis had higher AVF/AVG use than those who had not (72.9% vs 6.1%).
- Black patients starting HD had markedly lower rates of AVF/AVG use (27.3%) compared to the average (36.3%).

Figure series 10.2 assists interpretation of table 10.3 by including annual PTx data. Transplant data were included to provide a more complete depiction of incident RRT patterns. Data remain otherwise unadjusted. For detailed analysis see chapters 3 and 9 of this annual report. Data were plotted and stratified by age (figure 10.2a), BMI (figure 10.2b), PRD (figure 10.2c), referral time (figure 10.2d), diabetic status (figure 10.2e) and surgical referral (figure 10.2f). Centres with >50% missing data for a variable were excluded, as detailed in the figure legend. BMI data on PTx recipients are not presented due to low data returns, although it is recognised that very few transplant recipients will have BMI >35. Transplant data were not presented against surgical referral data because all patients who received a PTx will have received surgical review. HD and PD data are displayed separately in figure 10.2f because the surgical

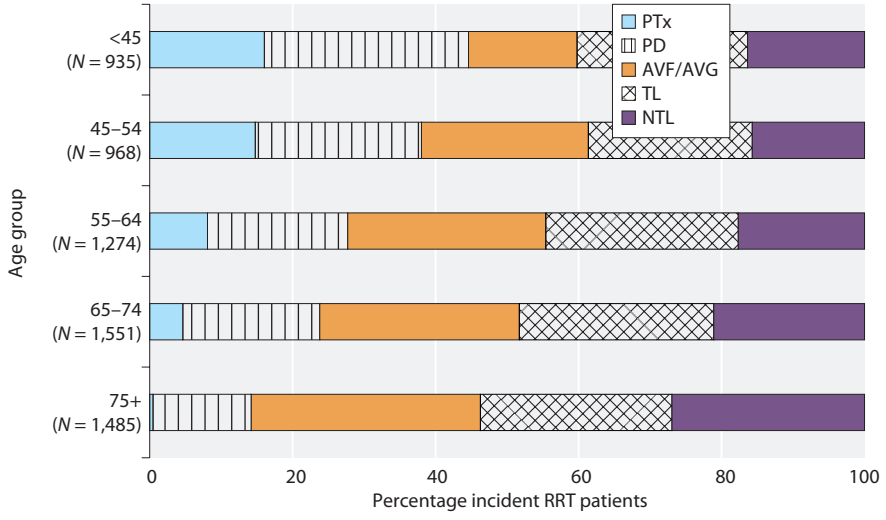

Fig. 10.2a. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by age
Number of patients in each group in brackets. PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

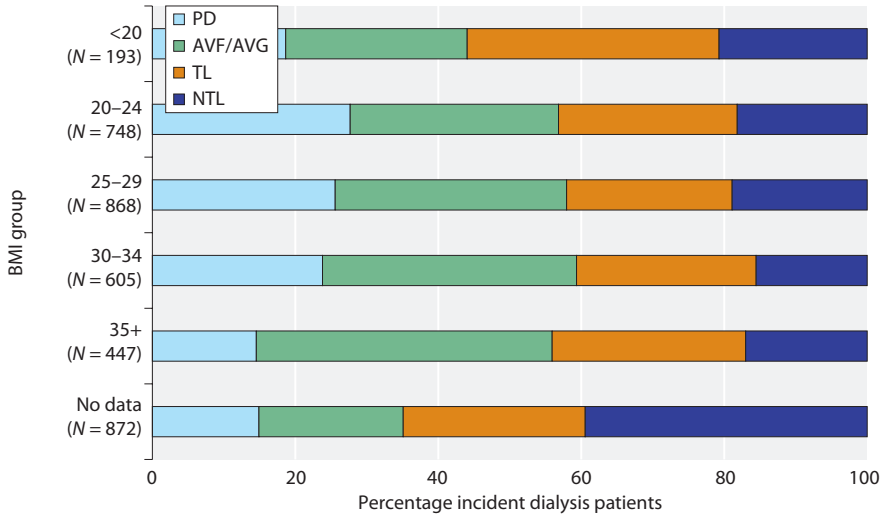

Fig. 10.2b. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by BMI

Number of patients in each group in brackets. 17 centres were excluded due to >50% missing BMI data

PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; BMI – body mass index; RRT – renal replacement therapy

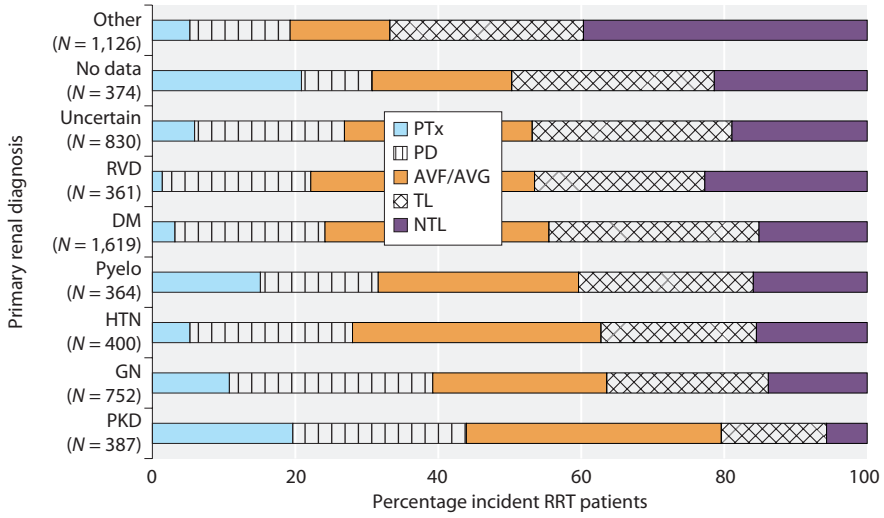

Fig. 10.2c. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by PRD

Number of patients in each group in brackets. PRD groups are sorted by decreasing proportion of patients initiating RRT with a HD catheter

PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RVD – reno-vascular disease; DM – diabetes mellitus; Pyelo – pyelonephritis; HTN – hypertension; GN – glomerulonephritis; PKD – polycystic kidney disease; RRT – renal replacement therapy

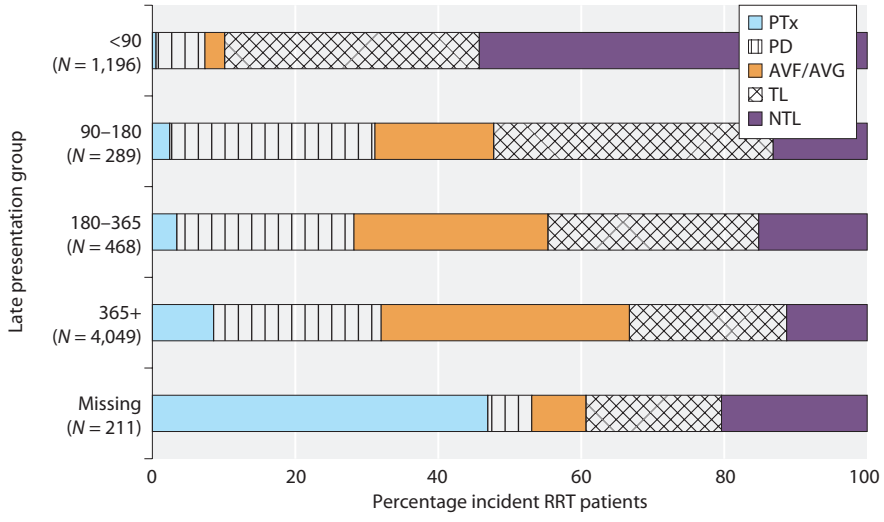

Fig. 10.2d. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by referral time

Number of patients in each group in brackets.

PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

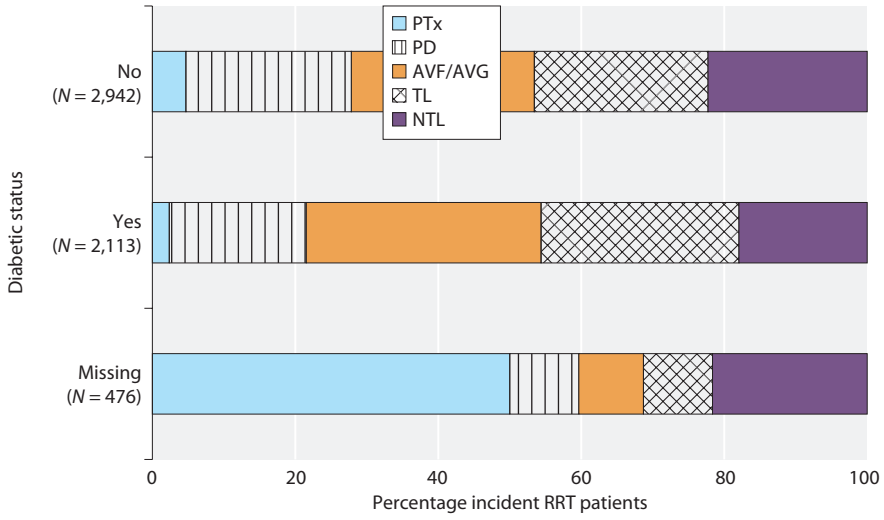

Fig. 10.2e. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by diabetic status
Number of patients in each group in brackets. Four centres were excluded due to >50% missing diabetes data after triangulation with UKRR data
PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

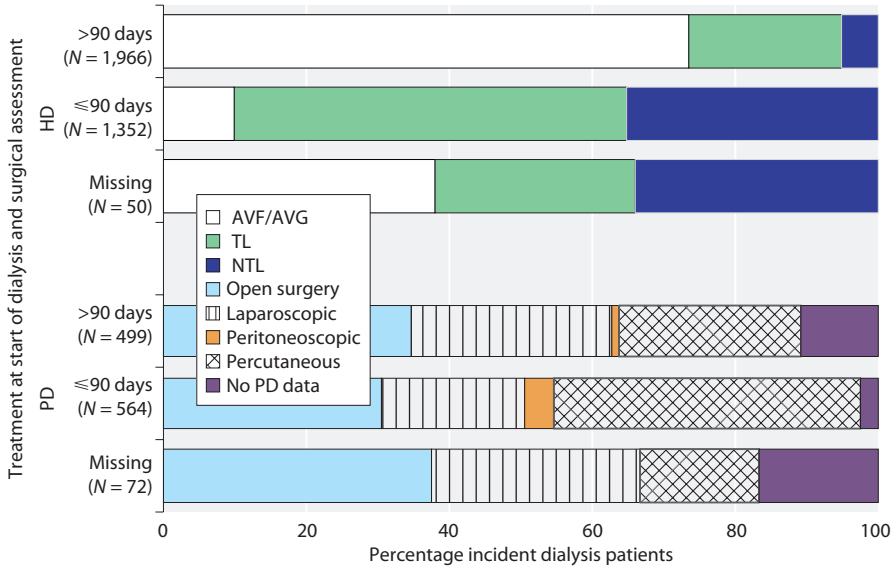

Fig. 10.2f. Incident RRT approach for patients in the 2016 Multisite Dialysis Access Audit, stratified by surgical referral
Number of patients in each group in brackets. Two centres were excluded due to >50% missing data for date of surgical assessment. Late presenting patients were also excluded from this analysis
AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

pathways for vascular and PD access differ. Late presenting patients were excluded from this analysis. The following observations can be made:

- Rising use of AVF/AVG with increasing age was associated with falling rates of transplant and PD.
- Amongst incident RRT patients with BMI <20, PD use was low (18.7%) and TL/NTL use was high (56.0%). Otherwise the rising use of AVF/AVG with increasing BMI was associated with falling rates of PD.
- PRD had a variable association with use of definitive dialysis access and PTx. For example, for polycystic kidney disease both definitive dialysis access (60.0%) and PTx (19.6%) were common. Where PRD was listed as 'other', definitive dialysis access (28.0%) and PTx (5.2%) were both uncommon. In renovascular disease definitive dialysis access was established in 52.1% of incident patients, whilst PTx was very rare (1.4%).
- Increasing referral time was associated with a progressive increase in PD, AVF/AVG and PTx use, with corresponding reductions in use of TL/NTL. This pattern continued as referral time increased beyond 365 days for PTx and AVF/AVG.
- 64.5% of incident RRT patients known to a nephrologist for over 90 days had definitive access or a transplant. Whilst the Renal Association presents this as an audit standard, no minimum standard is set (table 10.1).

- PD was initiated for only 6.9% of late presentations (people known to a nephrologist for less than 90 days).
- Patients with diabetes were more likely to use an AVF/AVG and less likely to receive PTx or PD than patients without diabetes, but use of TL/NTL was similar.
- AVF/AVG use was much higher amongst haemodialysis recipients referred to a surgeon >90 days before dialysis initiation (73.5%) than those who were not (9.9%).

Variations in first dialysis access by renal centre

Figure 10.3 plots incident RRT first access method stratified by centre. Practice variation was apparent. Initiating HD via an AVF/AVG ranged between <15% (Ipswich, London St Bartholomew's, London West, Ulster, Carlisle) and >40% (Chelmsford, Dorset, Middlesbrough). Initiating HD via a TL ranged between <10% (Nottingham, Derby, Basildon, Newry) and >45% (London West, Carlisle, Ipswich). Initiating with a PD catheter ranged from <10% (Truro, Sunderland, Stevenage) to >40% (Derby). There is no obvious difference in the pattern of first RRT access method used when comparing transplanting and non-transplanting centres.

Table 10.4 provides centre-level data for incident dialysis access, grouping patients by time of presentation to nephrology (early ⩾90 or late <90 days before initiating dialysis). Late presentation was associated with low rates of definitive access placement (9.6%). Peritoneal catheter placement accounted for 71.3% of definitive access placed in late presenting patients. Nineteen centres reported no late presenting patients dialysing with definitive access at initiation. Some centres were able to establish definitive vascular access for late presenting patients, although absolute numbers of patients were small. Surgical referral was made 90 days or more before dialysis initiation for 45.9% of incident patients, and ranged between >70% (Birmingham QEH, Bangor, Ipswich) and <25% (Plymouth, Swansea, Carlisle).

Table 10.5 provides centre-level data for dialysis access three months after initiation, grouping patients by time of initial presentation to nephrology (early ⩾90 or late <90 days before initiating dialysis). Late presentation remained associated with low rates of definitive access use at three months (15.1%) compared with early presentation (60.2%). TL was the mode of access for 59.6% of late presenting patients at three months. Of early presenters, 1.3% were transplanted by three months. Of late presenting patients, 0.2% were transplanted by three months. Ten centres had no late presenting patients dialysing with definitive access at three months.

Figure 10.4 plots RRT approach at three months for late presenting patients. Definitive access ranges between 42.9% and 0.0% by centre, implying variation in the responsiveness of dialysis access pathways. Some centres were able to establish definitive access in over 30% of late presenting patients by three months, the majority of whom started PD.

Table 10.6 shows dialysis access three months after initiation, stratified by first access type. The shaded cells highlight proportions of patients who continued with their initial dialysis access technique at three months. This analysis reflects RRT approach at initiation and three months, and therefore cannot identify access failure unless this results in a change in access approach. See figure 10.14 for failure of initial access. Of patients who initiated dialysis with definitive access, 87.7% continued with definitive access at three months and 89.4% had definitive access or a transplant, whilst 5.8% converted to TL/NTL. Of patients who started dialysis without definitive access, 10.4% received a transplant or were dialysing with definitive access at three months. Of patients who initiated dialysis with a TL, 78.7% continued with a TL at three months and only 11.0% had converted to definitive access or a transplant. The majority of patients who initiated dialysis with a NTL continued HD via a TL (60.3%). Death before three months was much more common in this group than any other (25.2%).

Figure 10.5 provides a funnel plot of the percentage of patients starting HD with an AVF or AVG. Late presenting patients are excluded as a surrogate for 'unplanned dialysis initiation' as per the Renal Association guidelines (table 10.1). This analysis shows that the majority of UK renal centres fell below the Renal Association audit standard of ⩾60% AVF/AVG use at 'planned' HD initiation. Sixteen centres achieved the target. Twelve centres were below the 99.9% limit.

Figure 10.6 depicts the percentage of incident HD patients by first access used, stratified by time between date of first access formation attempt and HD initiation. Data from patients incident to dialysis in 2015 and 2016 are included. Longer duration between first attempt at forming dialysis access and first HD session was associated with greater levels of AVF/AVG use at initiation. Amongst patients for whom the first attempt at forming dialysis access was made more than one year before starting HD, 86.3% initiated with AVF/AVG; whereas for

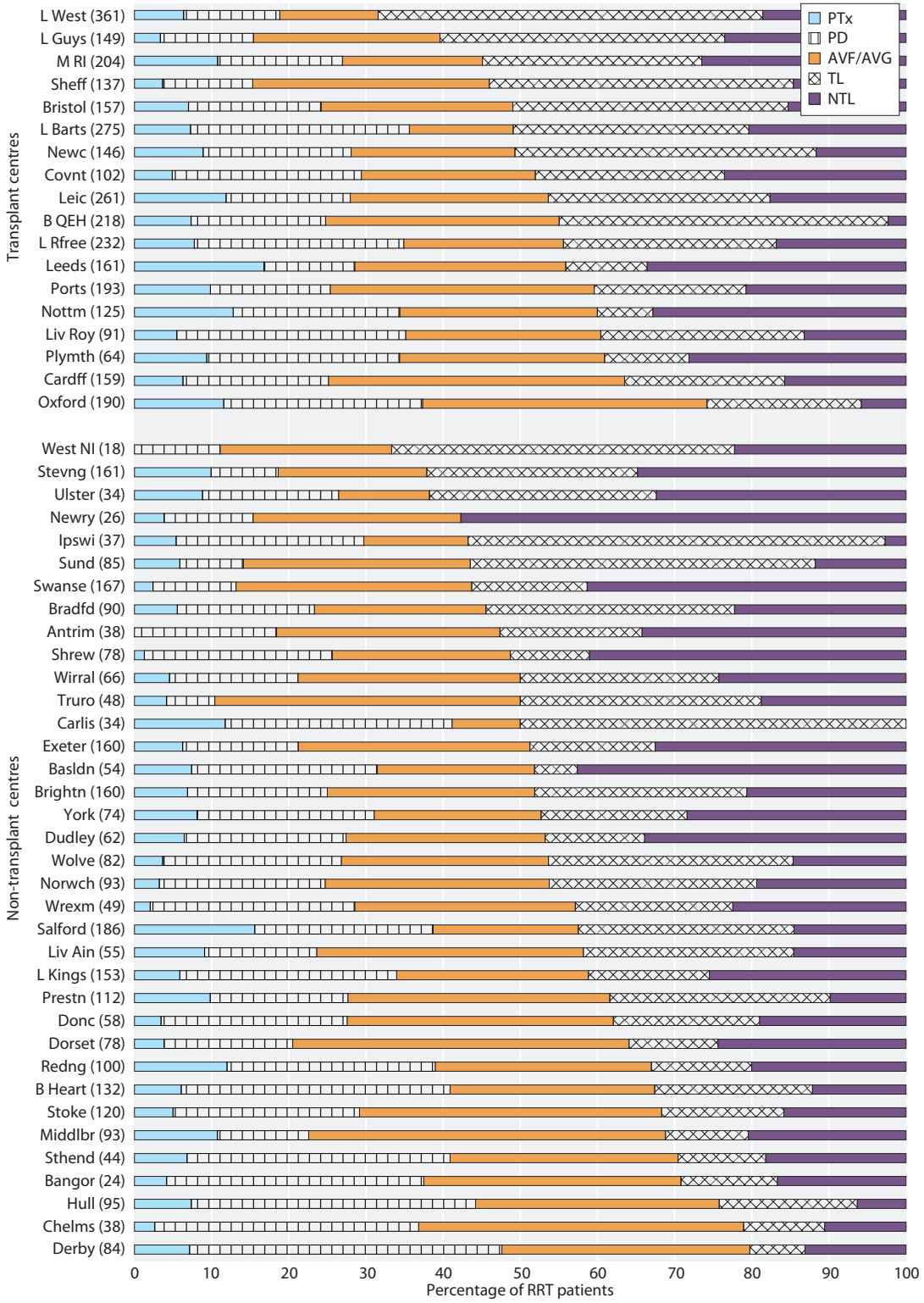

Fig. 10.3. Incident RRT first access method for patients in the 2016 Multisite Dialysis Access Audit, stratified by renal centre
Centre size in brackets. Centres are stratified by transplanting/non-transplanting centre and sorted by decreasing proportion of patients initiating RRT with a HD catheter (TL/NTL). Eight centres were excluded due to missing transplant or vascular access data.
PTx – pre-emptive transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

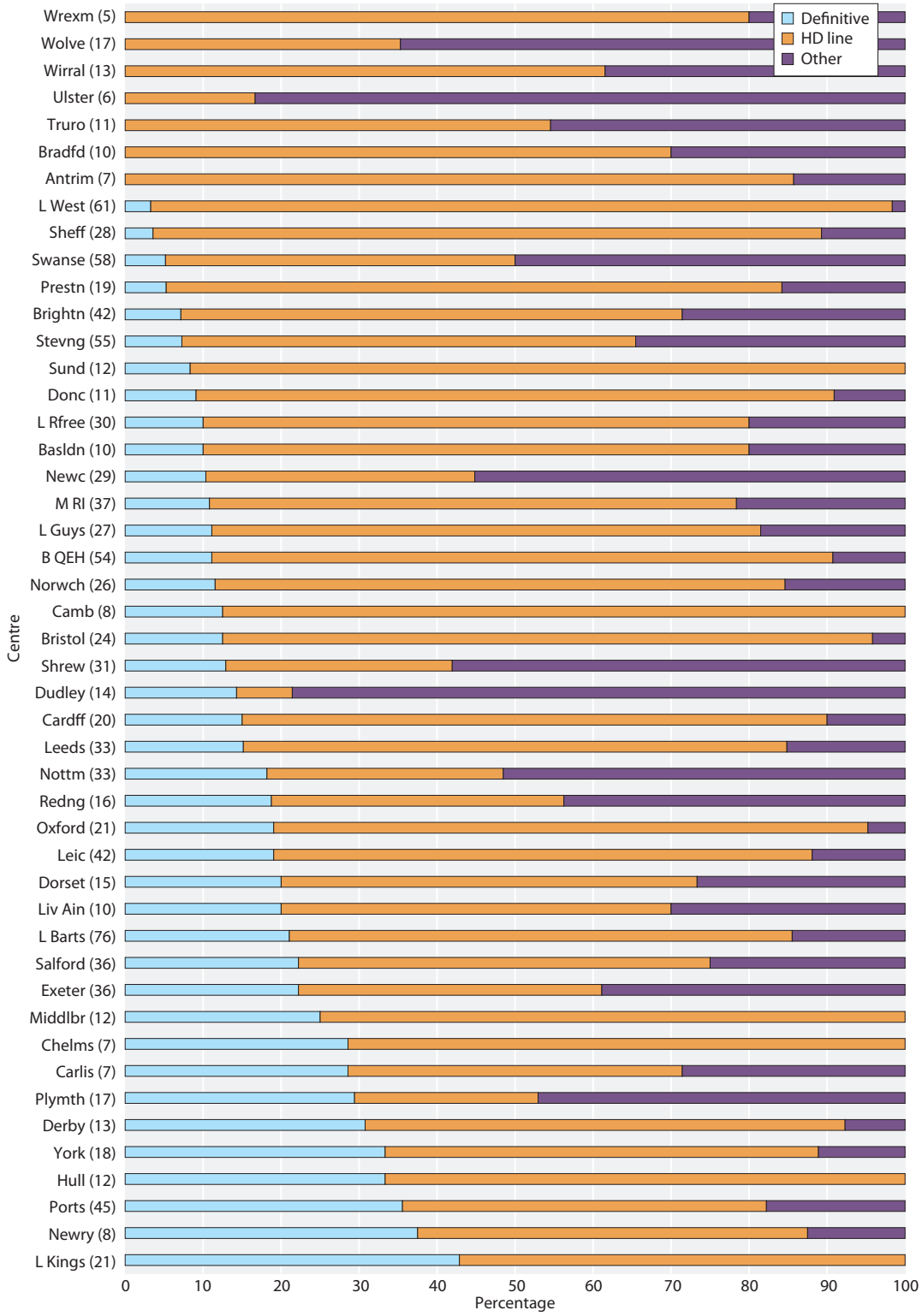

Fig. 10.4. RRT approach at three months for late-presenting patients in the 2016 Multisite Dialysis Access Audit
Centres are sorted by increasing proportion of patients with definitive access (AVF/AVG/PD). Five centres were excluded as they had <5 late presenting patients and three centres due to missing data on treatment modality at three months
PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; RRT – renal replacement therapy

Table 10.4. Modality at start of dialysis and access in use for patients in the 2016 Multisite Dialysis Access Audit, by early and late presentation at dialysis initiation, by centre, including surgical referral rates within three months before start of dialysis

	Early presenters (≥90 days before start of dialysis)					Late presenters (<90 days before start of dialysis)					Surgical assessment (%)		Treatment at start (%)		
Centre	*N*	PD %	AVF/ AVG%	TL %	NTL %	*N*	PD %	AVF/ AVG%	TL %	NTL %	Yes	No	HD	PD	PTx
Antrim	31	22.6	35.5	16.1	25.8	7	0.0	0.0	28.6	71.4	68.4	31.6	81.6	18.4	0.0
B Heart	120	38.3	29.2	20.0	12.5	*	0.0	0.0	75.0	25.0	41.9	58.1	59.1	34.8	6.1
B QEH	148	22.3	43.9	31.8	2.0	54	9.3	1.9	85.2	3.7	70.8	29.2	75.2	17.4	7.3
Bangor	20	40.0	40.0	10.0	10.0	*	0.0	0.0	100.0	0.0	72.7	27.3	62.5	33.3	4.2
Basldn	37	35.1	27.0	8.1	29.7	10	0.0	0.0	0.0	100.0	46.0	54.0	68.5	24.1	7.4
Bradfd	75	21.3	26.7	32.0	20.0	10	0.0	0.0	50.0	50.0	46.4	53.6	76.7	17.8	5.6
Brightn	107	25.2	39.3	27.1	8.4	42	4.8	2.4	35.7	57.1	45.3	54.7	75.0	18.1	6.9
Bristol	120	22.5	31.7	35.0	10.8	24	0.0	0.0	54.2	45.8	46.8	53.2	75.8	17.2	7.0
Camb	47	6.4	36.2	55.3	2.1	8	0.0	0.0	100.0	0.0	54.2	45.8			
Cardff	128	22.7	47.7	18.0	11.7	20	5.0	0.0	50.0	45.0	66.4	33.6	74.8	18.9	6.3
Carlis	22	45.5	13.6	40.9	0.0	7	0.0	0.0	100.0	0.0	23.3	76.7	58.8	29.4	11.8
Chelms	30	40.0	53.3	3.3	3.3	7	14.3	0.0	42.9	42.9	70.3	29.7	63.2	34.2	2.6
Covnt	71	29.6	26.8	26.8	16.9	20	20.0	5.0	30.0	45.0	68.8	31.3	70.6	24.5	4.9
Derby	65	49.2	38.5	4.6	7.7	13	15.4	15.4	23.1	46.2	32.1	67.9	52.4	40.5	7.1
Donc	45	28.9	44.4	15.6	11.1	11	9.1	0.0	36.4	54.5	51.8	48.2	72.4	24.1	3.4
Dorset	58	22.4	55.2	10.3	12.1	15	0.0	0.0	20.0	80.0	48.0	52.0	79.5	16.7	3.8
Dudley	44	27.3	36.4	18.2	18.2	14	7.1	0.0	0.0	92.9	47.2	52.8	72.6	21.0	6.5
Exeter	113	21.2	42.5	15.9	20.4	36	0.0	0.0	22.2	77.8	36.7	63.3	78.8	15.0	6.3
Hull	76	42.1	38.2	17.1	2.6	12	25.0	8.3	33.3	33.3	60.2	39.8	55.8	36.8	7.4
Ipswi	*	25.0	25.0	50.0	0.0	*	33.3	0.0	33.3	33.3	100.0	0.0	70.3	24.3	5.4
L Barts	174	36.8	21.3	31.0	10.9	76	18.4	0.0	38.2	43.4	28.8	71.2	64.4	28.4	7.3
L Guys	117	13.7	29.9	41.0	15.4	27	7.4	3.7	25.9	63.0	46.2	53.8	84.6	12.1	3.4
L Kings	122	32.0	30.3	17.2	20.5	21	19.0	4.8	9.5	66.7	36.8	63.2	66.0	28.1	5.9
L Rfree	184	33.2	25.5	27.2	14.1	30	6.7	3.3	46.7	43.3	49.2	50.8	65.1	27.2	7.8
L West	277	15.5	16.6	53.4	14.4	61	3.3	0.0	52.5	44.3	44.7	55.3	81.2	12.5	6.4
Leeds	99	17.2	43.4	13.1	26.3	33	6.1	3.0	9.1	81.8	44.0	56.0	71.4	11.8	16.8
Leic	188	20.2	34.6	29.8	15.4	42	9.5	4.8	45.2	40.5	50.4	49.6	72.0	16.1	11.9
Liv Ain	40	20.0	42.5	25.0	12.5	10	0.0	20.0	50.0	30.0	61.2	38.8	76.4	14.5	9.1
Liv Roy	70	35.7	28.6	25.7	10.0	5	40.0	40.0	0.0	20.0	57.5	42.5	64.8	29.7	5.5
M RI	133	21.8	27.8	33.1	17.3	37	5.4	0.0	29.7	64.9	38.1	61.9	73.0	16.2	10.8
Middlbr	71	14.1	59.2	9.9	16.9	12	8.3	8.3	25.0	58.3	48.8	51.3	77.4	11.8	10.8
Newc	104	26.9	27.9	34.6	10.6	29	0.0	6.9	72.4	20.7	31.6	68.4	71.9	19.2	8.9
Newry	17	17.6	35.3	0.0	47.1	8	0.0	12.5	0.0	87.5	52.0	48.0	84.6	11.5	3.8
Norwch	64	28.1	42.2	25.0	4.7	26	7.7	0.0	34.6	57.7	31.1	68.9	75.3	21.5	3.2
Nottm	76	34.2	39.5	6.6	19.7	33	3.0	6.1	12.1	78.8	32.1	67.9	65.6	21.6	12.8
Oxford	146	32.2	47.3	15.8	4.8	21	9.5	4.8	66.7	19.0	64.2	35.8	62.6	25.8	11.6
Plymth	41	34.1	41.5	9.8	14.6	17	11.8	0.0	17.6	70.6	6.7	93.3	65.6	25.0	9.4
Ports	111	22.5	50.5	18.0	9.0	45	11.1	17.8	28.9	42.2	51.0	49.0	74.6	15.5	9.8
Prestn	81	24.7	46.9	24.7	3.7	19	0.0	0.0	57.9	42.1	60.4	39.6	72.3	17.9	9.8
Redng	72	36.1	38.9	16.7	8.3	16	6.3	0.0	6.3	87.5	30.7	69.3	61.0	27.0	12.0
Salford	117	29.1	29.9	29.1	12.0	36	13.9	0.0	50.0	36.1	39.1	60.9	61.3	23.1	15.6
Sheff	99	15.2	41.4	36.4	7.1	28	3.6	0.0	57.1	39.3	53.8	46.2	84.7	11.7	3.6
Shrew	46	34.8	39.1	6.5	19.6	31	9.7	0.0	16.1	74.2	47.4	52.6	74.4	24.4	1.3
Stevng	90	14.4	33.3	38.9	13.3	55	1.8	1.8	16.4	80.0	37.2	62.8	81.4	8.7	9.9
Sthend	37	40.5	35.1	13.5	10.8	*	0.0	0.0	0.0	100.0	31.7	68.3	59.1	34.1	6.8
Stoke	99	28.3	47.5	17.2	7.1	15	6.7	0.0	13.3	80.0	61.4	38.6	70.8	24.2	5.0
Sund	68	10.3	36.8	48.5	4.4	12	0.0	0.0	41.7	58.3	36.3	63.8	85.9	8.2	5.9
Swanse	105	16.2	47.6	13.3	22.9	58	1.7	1.7	19.0	77.6	22.7	77.3	86.8	10.8	2.4
Truro	35	8.6	54.3	28.6	8.6	11	0.0	0.0	45.5	54.5	56.5	43.5	89.6	6.3	4.2
Ulster	25	24.0	16.0	40.0	20.0	6	0.0	0.0	0.0	100.0	64.5	35.5	73.5	17.6	8.8
West NI	15	13.3	26.7	46.7	13.3	*	0.0	0.0	33.3	66.7	55.6	44.4	88.9	11.1	0.0
Wirral	49	22.4	36.7	26.5	14.3	13	0.0	0.0	30.8	69.2	46.0	54.0	78.8	16.7	4.5
Wolve	61	31.1	36.1	26.2	6.6	17	0.0	0.0	58.8	41.2	41.1	58.9	73.2	23.2	3.7
Wrexm	39	33.3	35.9	20.5	10.3	5	0.0	0.0	40.0	60.0	55.9	44.1	71.4	26.5	2.0
York	50	32.0	32.0	22.0	14.0	18	5.6	0.0	16.7	77.8	36.8	63.2	68.9	23.0	8.1
Total	**4,483**	**25.7**	**35.6**	**26.1**	**12.6**	**1,198**	**6.8**	**2.8**	**36.2**	**54.2**	**45.9**	**54.1**	**72.3**	**20.0**	**7.6**

For a small number of centres the proportion of missing data for presentation date was high, therefore the total number of patients will not be the sum of the early and late presenting patients.
Blank cells – Cambridge did not submit PTx data, therefore percentage by treatment at start not known
*fewer than five patients reported
PTx – pre-emptive transplant; HD -– haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line.

Table 10.5. Modality at three months after start of dialysis and access in use for patients in the 2016 Multisite Dialysis Access Audit, by early and late presentation at dialysis initiation, by centre

	Early presenters (⩾90 days before start of dialysis) %								Late presenters (<90 days before start of dialysis) %								Treatment modality at 3 months (%)						
Centre	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss	Total (*N*)	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss	Total (*N*)	Tx	PD	AVF/ AVG	TL	NTL	Other	Miss
Antrim	0.0	22.6	35.5	35.5	0.0	6.5	0.0	31	0.0	0.0	0.0	85.7	0.0	14.3	0.0	7	0.0	18.4	28.9	44.7	0.0	7.9	0.0
B Heart	0.8	43.3	25.8	23.3	0.8	5.8	0.0	120	0.0	0.0	25.0	75.0	0.0	0.0	0.0	*	0.8	41.9	25.8	25.0	0.8	5.6	0.0
B QEH	0.7	24.3	41.9	27.7	0.0	5.4	0.0	148	0.0	9.3	1.9	77.8	1.9	9.3	0.0	54	0.5	20.3	31.2	41.1	0.5	6.4	0.0
Bangor	0.0	40.0	40.0	20.0	0.0	0.0	0.0	20	0.0	0.0	0.0	100.0	0.0	0.0	0.0	*	0.0	34.8	34.8	30.4	0.0	0.0	0.0
Basldn	0.0	35.1	29.7	24.3	0.0	10.8	0.0	37	0.0	10.0	0.0	70.0	0.0	20.0	0.0	10	0.0	28.0	24.0	32.0	0.0	16.0	0.0
Bradfd	1.3	18.7	26.7	49.3	0.0	4.0	0.0	75	0.0	0.0	0.0	70.0	0.0	30.0	0.0	10	1.2	16.5	23.5	51.8	0.0	7.1	0.0
Brightn	0.0	24.3	31.8	33.6	0.0	10.3	0.0	107	0.0	2.4	4.8	64.3	0.0	28.6	0.0	42	0.0	18.1	24.2	42.3	0.0	15.4	0.0
Bristol	4.2	17.5	30.0	45.0	0.0	3.3	0.0	120	0.0	8.3	4.2	83.3	0.0	4.2	0.0	24	3.4	15.8	26.0	51.4	0.0	3.4	0.0
Camb	0.0	8.5	46.8	40.4	0.0	4.3	0.0	47	0.0	0.0	12.5	87.5	0.0	0.0	0.0	8	0.0	5.6	48.6	43.1	0.0	2.8	0.0
Cardff	0.8	21.9	45.3	28.1	0.0	3.9	0.0	128	0.0	5.0	10.0	75.0	0.0	10.0	0.0	20	0.7	19.5	40.3	34.9	0.0	4.7	0.0
Carlis	0.0	50.0	13.6	31.8	0.0	4.5	0.0	22	0.0	14.3	14.3	42.9	0.0	28.6	0.0	7	0.0	40.0	13.3	33.3	0.0	13.3	0.0
Chelms	0.0	40.0	46.7	13.3	0.0	0.0	0.0	30	0.0	14.3	14.3	71.4	0.0	0.0	0.0	7	0.0	35.1	40.5	24.3	0.0	0.0	0.0
Covnt	1.4	18.3	25.4	16.9	1.4	4.2	32.4	71	0.0	20.0	0.0	25.0	0.0	20.0	35.0	20	1.0	17.5	21.6	17.5	1.0	9.3	32.0
Derby	1.5	47.7	35.4	13.8	0.0	1.5	0.0	65	0.0	7.7	23.1	61.5	0.0	7.7	0.0	13	1.3	41.0	33.3	21.8	0.0	2.6	0.0
Donc	2.2	26.7	37.8	28.9	0.0	4.4	0.0	45	0.0	9.1	0.0	81.8	0.0	9.1	0.0	11	1.8	23.2	30.4	39.3	0.0	5.4	0.0
Dorset	1.7	22.4	53.4	10.3	0.0	12.1	0.0	58	0.0	13.3	6.7	53.3	0.0	26.7	0.0	15	1.3	20.0	45.3	18.7	0.0	14.7	0.0
Dudley	2.3	31.8	34.1	22.7	0.0	9.1	0.0	44	0.0	7.1	7.1	7.1	0.0	78.6	0.0	14	1.7	25.9	27.6	19.0	0.0	25.9	0.0
Exeter	0.0	21.2	44.2	23.9	0.9	9.7	0.0	113	0.0	2.8	19.4	33.3	5.6	38.9	0.0	36	0.0	16.7	38.0	26.7	2.0	16.7	0.0
Hull	3.9	32.9	27.6	30.3	0.0	5.3	0.0	76	0.0	16.7	16.7	66.7	0.0	0.0	0.0	12	3.4	30.7	26.1	35.2	0.0	4.5	0.0
Ipswi	0.0	25.0	25.0	50.0	0.0	0.0	0.0	*	0.0	33.3	0.0	66.7	0.0	0.0	0.0	*	2.9	25.7	14.3	48.6	0.0	8.6	0.0
L Barts	1.7	32.2	21.8	39.7	0.6	4.0	0.0	174	0.0	21.1	0.0	61.8	2.6	14.5	0.0	76	1.2	28.2	14.9	47.5	1.2	7.1	0.0
L Guys	5.1	12.8	31.6	50.4	0.0	0.0	0.0	117	0.0	7.4	3.7	70.4	0.0	18.5	0.0	27	4.2	11.8	26.4	54.2	0.0	3.5	0.0
L Kings	0.8	27.0	27.0	40.2	0.0	4.9	0.0	122	0.0	38.1	4.8	57.1	0.0	0.0	0.0	21	0.7	28.5	23.6	42.4	0.0	4.9	0.0
L Rfree	0.5	34.2	29.3	27.7	0.0	8.2	0.0	184	0.0	6.7	3.3	70.0	0.0	20.0	0.0	30	0.5	30.4	25.7	33.6	0.0	9.8	0.0
L West	0.7	14.8	18.4	64.3	0.0	1.8	0.0	277	0.0	3.3	0.0	95.1	0.0	1.6	0.0	61	0.6	12.7	15.1	69.8	0.0	1.8	0.0
Leeds	2.0	19.2	44.4	28.3	0.0	6.1	0.0	99	0.0	12.1	3.0	66.7	3.0	15.2	0.0	33	1.5	17.2	33.6	38.8	0.7	8.2	0.0
Leic	4.3	15.4	28.7	42.0	0.0	9.6	0.0	188	0.0	14.3	4.8	69.0	0.0	11.9	0.0	42	3.5	15.2	24.3	47.0	0.0	10.0	0.0
Liv Ain	0.0	22.5	45.0	25.0	0.0	7.5	0.0	40	0.0	0.0	20.0	50.0	0.0	30.0	0.0	10	0.0	18.0	40.0	30.0	0.0	12.0	0.0
Liv Roy	0.0	32.9	0.0	1.4	0.0	0.0	65.7	70	0.0	40.0	0.0	0.0	0.0	0.0	60.0	5	0.0	29.1	0.0	1.2	0.0	0.0	69.8
M RI	2.3	17.3	27.1	43.6	0.0	9.8	0.0	133	0.0	10.8	0.0	67.6	0.0	21.6	0.0	37	1.6	15.9	19.8	47.8	0.0	14.8	0.0
Middlbr	0.0	8.5	60.6	23.9	0.0	7.0	0.0	71	0.0	8.3	16.7	75.0	0.0	0.0	0.0	12	0.0	8.4	54.2	31.3	0.0	6.0	0.0
Newc	1.9	26.9	26.9	33.7	1.9	8.7	0.0	104	0.0	3.4	6.9	34.5	0.0	55.2	0.0	29	1.5	21.8	22.6	33.8	1.5	18.8	0.0
Newry	0.0	11.8	47.1	35.3	0.0	5.9	0.0	17	12.5	25.0	0.0	37.5	12.5	12.5	0.0	8	4.0	16.0	32.0	36.0	4.0	8.0	0.0
Norwch	1.6	29.7	40.6	23.4	0.0	4.7	0.0	64	0.0	7.7	3.8	73.1	0.0	15.4	0.0	26	1.1	23.3	30.0	37.8	0.0	7.8	0.0
Nottm	3.9	32.9	36.8	23.7	0.0	2.6	0.0	76	0.0	9.1	9.1	30.3	0.0	51.5	0.0	33	2.8	25.7	28.4	25.7	0.0	17.4	0.0
Oxford	2.1	29.5	41.1	22.6	0.0	4.8	0.0	146	0.0	9.5	9.5	76.2	0.0	4.8	0.0	21	1.8	26.8	36.9	29.8	0.0	4.8	0.0
Plymth	0.0	29.3	39.0	14.6	2.4	14.6	0.0	41	0.0	23.5	5.9	23.5	0.0	47.1	0.0	17	0.0	27.6	29.3	17.2	1.7	24.1	0.0
Ports	2.7	25.2	44.1	20.7	0.0	7.2	0.0	111	0.0	15.6	20.0	46.7	0.0	17.8	0.0	45	1.7	20.7	33.9	29.3	0.0	14.4	0.0
Prestn	1.2	19.8	42.0	32.1	0.0	4.9	0.0	81	0.0	5.3	0.0	73.7	5.3	15.8	0.0	19	1.0	16.8	33.7	40.6	1.0	6.9	0.0
Redng	5.6	31.9	33.3	22.2	0.0	6.9	0.0	72	0.0	18.8	0.0	37.5	0.0	43.8	0.0	16	4.5	29.5	27.3	25.0	0.0	13.6	0.0
Salford	3.4	29.9	33.3	29.1	0.0	4.3	0.0	117	0.0	19.4	2.8	52.8	0.0	25.0	0.0	36	3.2	28.7	25.5	33.8	0.0	8.9	0.0
Sheff	1.0	13.1	38.4	42.4	0.0	5.1	0.0	99	0.0	3.6	0.0	85.7	0.0	10.7	0.0	28	0.8	10.6	30.3	52.3	0.0	6.1	0.0
Shrew	0.0	34.8	39.1	10.9	2.2	13.0	0.0	46	0.0	12.9	0.0	29.0	0.0	58.1	0.0	31	0.0	26.0	23.4	18.2	1.3	31.2	0.0
Stevng	1.1	13.3	30.0	51.1	0.0	4.4	0.0	90	0.0	5.5	1.8	58.2	0.0	34.5	0.0	55	0.7	10.3	19.3	53.8	0.0	15.9	0.0
Sthend	0.0	40.5	37.8	18.9	0.0	2.7	0.0	37	0.0	0.0	0.0	50.0	0.0	50.0	0.0	*	0.0	36.6	34.1	22.0	0.0	7.3	0.0
Stoke	0.0	29.3	44.4	21.2	0.0	5.1	0.0	99	0.0	13.3	0.0	60.0	0.0	20.0	6.7	15	0.0	27.2	38.6	26.3	0.0	7.0	0.9
Sund	1.5	4.4	45.6	45.6	1.5	1.5	0.0	68	0.0	0.0	8.3	83.3	8.3	0.0	0.0	12	1.3	3.8	40.0	51.3	2.5	1.3	0.0
Swanse	0.0	20.0	45.7	17.1	2.9	14.3	0.0	105	0.0	3.4	1.7	44.8	0.0	50.0	0.0	58	0.0	14.1	30.1	27.0	1.8	27.0	0.0
Truro	2.9	5.7	57.1	25.7	0.0	8.6	0.0	35	0.0	0.0	0.0	54.5	0.0	45.5	0.0	11	2.2	4.3	43.5	32.6	0.0	17.4	0.0
Ulster	0.0	20.0	20.0	52.0	0.0	8.0	0.0	25	0.0	0.0	0.0	16.7	0.0	83.3	0.0	6	0.0	16.1	16.1	45.2	0.0	22.6	0.0
West NI	0.0	13.3	20.0	60.0	0.0	6.7	0.0	15	0.0	0.0	0.0	100.0	0.0	0.0	0.0	*	0.0	11.1	16.7	66.7	0.0	5.6	0.0
Wirral	0.0	16.3	34.7	38.8	0.0	10.2	0.0	49	0.0	0.0	0.0	61.5	0.0	38.5	0.0	13	0.0	12.7	28.6	42.9	0.0	15.9	0.0
Wolve	0.0	26.2	42.6	21.3	0.0	9.8	0.0	61	0.0	0.0	0.0	35.3	0.0	64.7	0.0	17	0.0	20.3	32.9	25.3	0.0	21.5	0.0
Wrexm	0.0	30.8	38.5	23.1	0.0	7.7	0.0	39	0.0	0.0	0.0	80.0	0.0	20.0	0.0	5	0.0	25.0	31.3	31.3	0.0	12.5	0.0
York	2.0	30.0	28.0	34.0	2.0	4.0	0.0	50	0.0	27.8	5.6	50.0	5.6	11.1	0.0	18	1.5	29.4	22.1	38.2	2.9	5.9	0.0
Total	**1.3**	**25.0**	**35.2**	**30.5**	**0.3**	**6.0**	**1.8**	**4,483**	**0.2**	**9.8**	**5.3**	**59.6**	**0.8**	**22.4**	**1.8**	**1,198**	**1.2**	**20.9**	**27.7**	**38.2**	**0.4**	**9.9**	**1.6**

Other is made up from the following categories: withdrew, conservative care, died, transferred out and recovered
* – fewer than five patients reported
Tx – transplant; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; Miss – missing data

Table 10.6. Dialysis access at three months since dialysis start for patients in the 2016 Multisite Dialysis Access Audit, stratified by first access used

Access in use at first dialysis (*N*)	Access in use at three months (%)							
	AVF/AVG	TL	NTL	PD catheter	Transplanted	Died	Stopped/LTFU	No data
AVF/AVG (1,658)	86.9	5.5	0.1	0.2	1.1	3.5	1.1	1.6
TL (1,648)	7.5	78.7	0.2	2.5	1.0	7.0	0.9	2.2
NTL (1,258)	3.5	60.3	1.3	5.7	0.3	25.2	1.7	1.9
PD catheter (1,246)	0.2	5.9	0.2	88.3	2.6	1.8	0.5	0.4

Shaded cells highlight the percentage of patients who remained on the same modality at three months
PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line; LTFU – lost to follow-up

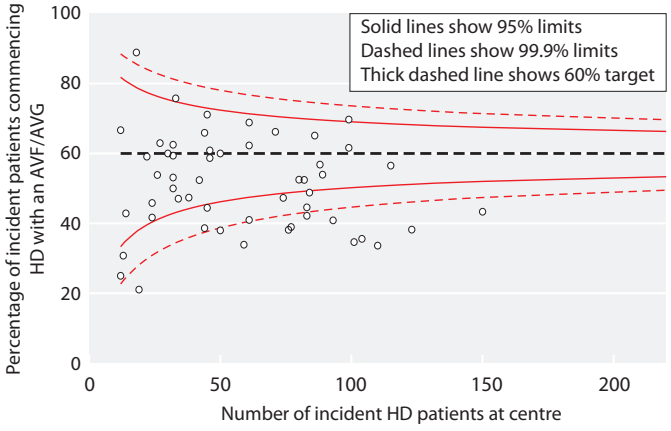

Fig. 10.5. Funnel plot of the percentage of incident HD patients in the 2016 Multisite Dialysis Access Audit who commenced dialysis with an AVF/AVG
The Renal Association audit standard (60%) is represented by the thick dotted line. Patients who were first seen by a nephrologist <90 days from initiating dialysis were excluded. One centre with <10 patients receiving HD was excluded
HD – haemodialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft

those patients for whom the first attempt at forming dialysis access was made <90 days before starting dialysis, 24.8% commenced HD with an AVF/AVG. The biggest increment in definitive dialysis access occurred between <90 and ⩾90 days. The data field used for this analysis did not specify which access was attempted, so it cannot be assumed that first access attempt and access used on first session were the same. Missing data had a similar distribution of access use to those patients for whom access was first attempted within 90 days of initiating dialysis. This pattern differs from previous years, which may be explained by much higher data completeness.

Variations in prevalent dialysis access by renal centre

Figure 10.7 provides a funnel plot of the percentage of prevalent dialysis patients receiving PD or HD via an AVF/AVG. Seventeen centres met the Renal Association audit standard of ⩾80% for definitive access use (thick dotted line). Fifteen centres were below the 99.9% limit.

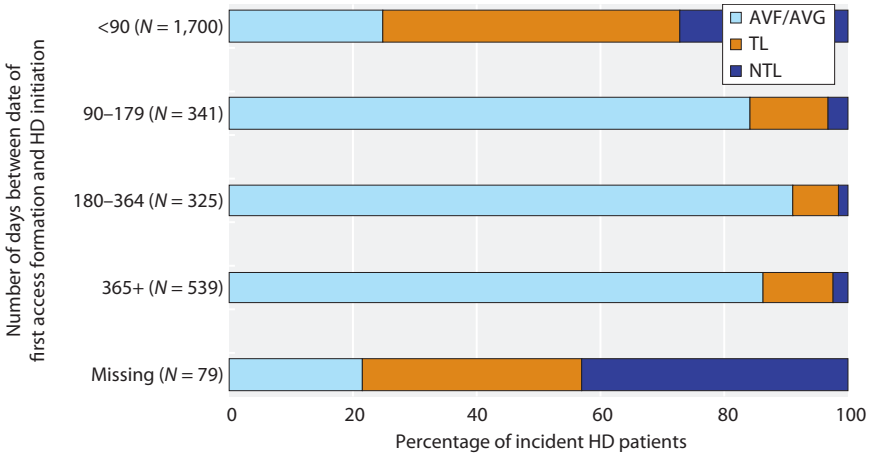

Fig. 10.6. Percentage of incident HD patients by first access used in the 2016 Multisite Dialysis Access Audit stratified categorically by days (<90; 90–179; 180–364; 365+) from first access attempt
Number of patients in each category in brackets. Late-presenting patients were excluded from this analysis. Four centres were excluded due to >50% missing data for date of first access attempt.
HD – haemodialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

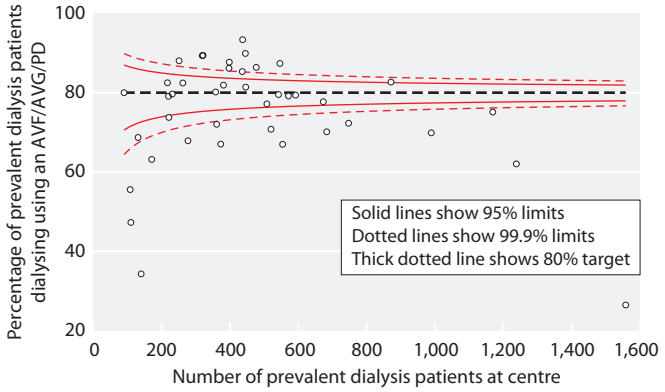

Fig. 10.7. Funnel plot of the percentage of prevalent patients in the 2016 Multisite Dialysis Access Audit receiving PD or HD via AVF/AVG

Thick dotted line = 80% Renal Association audit standard. A total of 14 centre-level exclusions were made for this analysis due to non-completion of prevalent dialysis access data and >10% differences between centre-reported and UKRR numbers of patients receiving dialysis

HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft

Figure 10.8 depicts dialysis access for prevalent patients by centre. Wide practice variation is apparent. Rates of definitive access ranged between >90% (Liverpool Royal) and <50% (London West, Southend, Ulster). PD accounted for between >25% (Carlisle) and <5% (Stevenage) of prevalent definitive access use.

Peritoneal dialysis audit one-year follow-up by renal centre

Figure 10.9 shows RRT modality one year after commencing PD by centre. Data for this analysis came from the 2016 one-year follow-up for patients incident to dialysis in 2015. Centres with 100% missing data at one year, or fewer than five PD patients were excluded. The percentage of patients remaining on PD or who were transplanted one year after initiation ranged between 46.0% (Wolverhampton) and >90.0% (Antrim, Newry) with an overall mean of 70.7%.

Figure 10.10 depicts PD catheter insertion technique stratified by centre. Four centres reporting fewer than five patients on PD were excluded from this analysis. Surgical techniques include open and laparoscopic. Non-surgical techniques include percutaneous and peritoneoscopic insertion. There was considerable practice variation. Twenty-three centres reported use of non-surgical PD catheter placement, accounting for 35.3% of all catheters placed and 17 of these centres placed >50% of their PD catheters this way. Five placed >90% of their PD catheters percutaneously (Birmingham Heartlands, Southend, Derby, London Kings, Preston). At the 23 centres that placed non-surgical PD catheters, 22.0% of incident RRT patients started PD, compared with 20.0% overall. Twenty-seven percent of incident RRT patients started PD at the six centres that placed >90% of their catheters percutaneously.

Figure 10.11 displays PD catheter insertion technique by referral time. There does not appear to be a strong relationship between referral time and technique used for PD catheter insertion. This suggests that the PD access referral pathway may be less dependent on timely referral than the vascular access pathway.

Figure 10.12 presents the percentage of incident PD patients by catheter insertion technique and BMI group. Associations between BMI and PD catheter insertion technique do not appear to be strong and apart from peritoneoscopic insertion (which was used infrequently overall) every approach was used for people in each BMI group, with a slight tendency to less frequent use of non-surgical techniques at the extremes of BMI. Patients with missing BMI data had much higher rates of percutaneous tube insertion (56.6%) than patients with BMI data.

Figure 10.13 shows a funnel plot of the percentage of PD catheter failures within one year of initiating dialysis. Data are from the one-year PD follow-up audit of patients incident to PD in 2015. PD catheter failure was censored for transplantation, elective transfer to HD or death. Of the 31 centres for which data were available, one was above the 95% limit for PD catheter failure with a catheter failure rate of 59.3%. Seven centres were below the lower 99.9% limit, only one of which reported any failed PD catheters. The mean one-year catheter failure rate was 18.4% (13.3% in 2015). Only 13 cases of peritonitis were reported within two weeks of catheter insertion in 2016, but data completeness was too low (20.8%) to permit a reliable estimate of early peritonitis rates.

Figure 10.14 shows comparative access failures by access type within three months of initiating dialysis. Data were drawn from the 2015 and 2016 Multisite Dialysis Access Audits. Access failure was defined as a documented date of failure/discontinuation recorded within three months of starting dialysis, unless a centre comment indicated that it was a planned discontinuation. Failure rates appeared marginally higher for PD than for HD access. Numbers of AVGs and peritoneoscopically inserted PD tubes were very low, hence the wide confidence intervals (CIs) for these data, which overlap with the failure rates of all other access techniques.

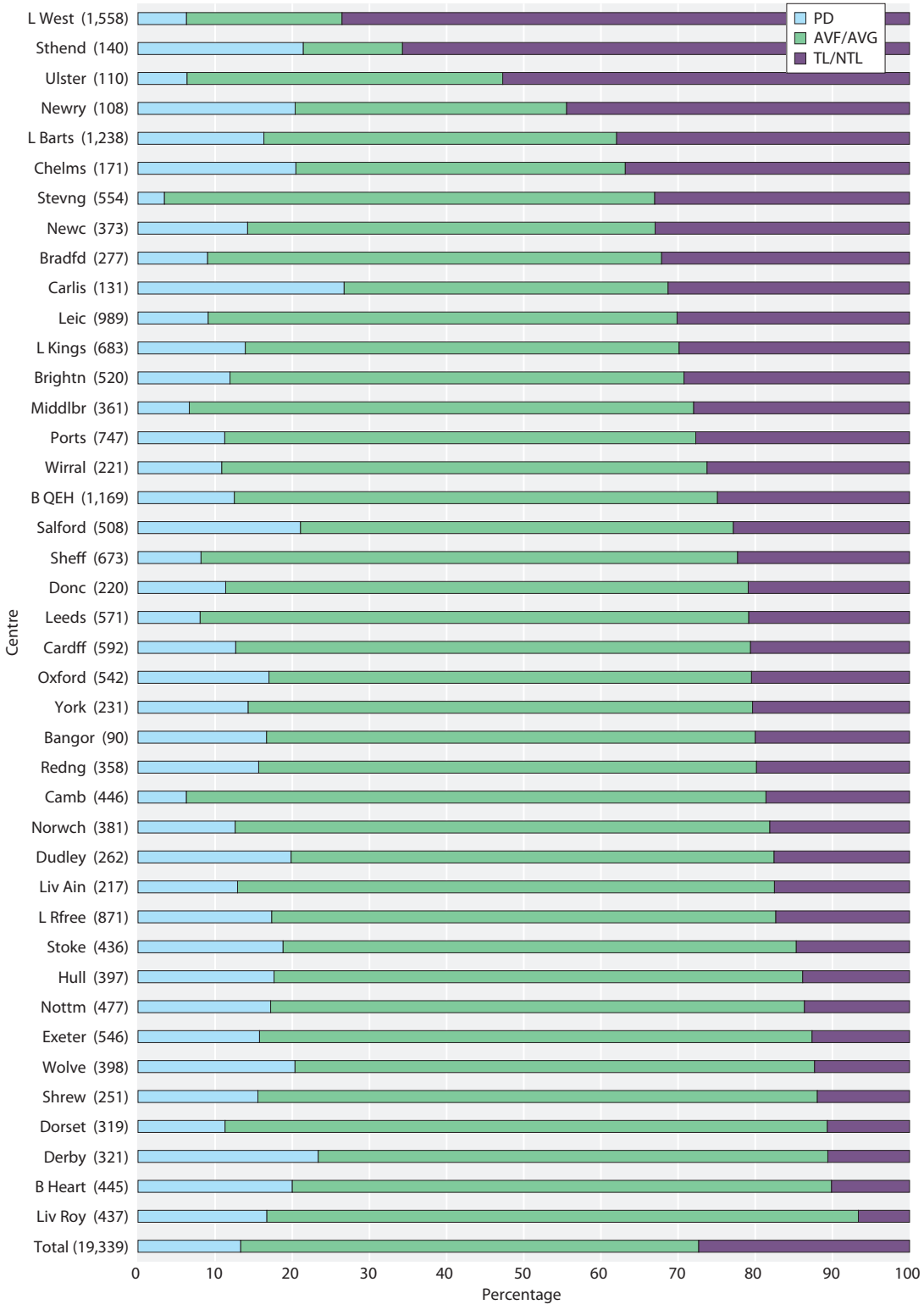

Fig. 10.8. Prevalent dialysis access by centre for patients in the 2016 Multisite Dialysis Access Audit

Centre size in brackets. Centres are sorted by decreasing proportion of patients initiating RRT with a HD catheter. Fourteen centre-level exclusions were made due to non-completion of prevalent dialysis access data and >10% differences between centre-reported and UKRR numbers of patients receiving dialysis

PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line; NTL – non-tunnelled line

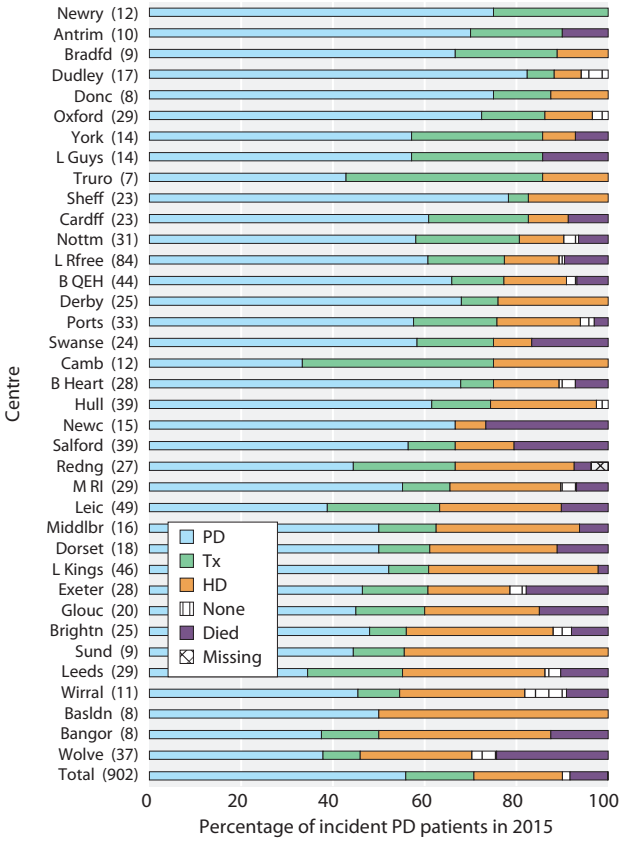

Fig. 10.9. Modality at one year after commencing PD in 2015, by centre

Number of patients receiving PD at each centre in brackets. Centres with 100% missing treatment data at one year (12 centres) or fewer than five PD patients (one centre) were excluded. Centres are sorted by decreasing proportion of patients transplanted or remaining on PD

PD – peritoneal dialysis; HD – haemodialysis; Tx – transplanted; None – not receiving RRT (e.g. conservative care, recovered)

Figure 10.15 shows cause of catheter failure within one year of initiating dialysis for the 166 failed PD catheters reported in the one-year PD follow-up audit (patients incident to dialysis in 2015). The small number of failed catheters increases the likelihood that differences in cause of failure between subgroups were due to chance. Patients undergoing surgical and non-surgical PD catheter insertion were also likely to differ in ways that influenced the likelihood of catheter failure.

Discussion

This audit shows, once again, that rates of definitive dialysis access amongst both incident and prevalent patients were below Renal Association audit standards. A small number of centres achieved high rates of definitive dialysis access for incident and prevalent dialysis recipients, demonstrating that the audit standards are attainable.

Several factors have recurrently been shown to associate with definitive dialysis access. Timely presentation to a nephrologist and referral to a dialysis access surgeon were associated with higher rates of definitive dialysis access use. Most patients who only meet a nephrologist for the first time within three months of starting dialysis commenced HD via a NTL/TL. However, a substantial proportion of patients known to a nephrologist for more than three months also commenced HD via a NTL/TL, and indeed conversion from a NTL/TL to definitive access by three months was infrequent in most centres. One in four individuals who initiated dialysis with a NTL died within three months. The contributions of acute renal pathology, comorbid illness and access complications to these deaths cannot be quantified with these data.

The need to begin access planning early is confirmed by the observation that most individuals who had access attempted more than a year before initiating HD started with an AVF/AVG. A small number of centres secured definitive access within three months for late-presenting patients, achieved for most through PD. No clinical practice guideline exists to drive rapid placement of definitive access amongst late presenting individuals, but centres achieving this have, by definition, responsive dialysis access pathways. Most commonly, responsive PD access pathways were achieved using a predominantly percutaneous rather than surgical catheter insertion approach. This is logical, since this is generally performed under local anaesthetic, avoiding the requirement for both a pre-operative assessment and operating theatre time. An increasing number of centres were performing percutaneous catheter insertion. Some centres were able to achieve surgical vascular access for a substantial proportion of late-presenting patients. Efforts to better understand practice patterns that enhance the responsiveness of vascular and PD access services are needed. Results from the UK Peritoneal Dialysis Outcomes and Practice Patterns Study (PDOPPS) Catheter Study are awaited [3]. A national survey of HD access in the UK by the British Renal Society Vascular Access Special Interest Group showed that the infrastructure to support delivery of quality vascular access is in place in most centres [4]. This would suggest that there are other factors that determine how effectively patterns of practice can achieve successful outcomes. Further work to improve

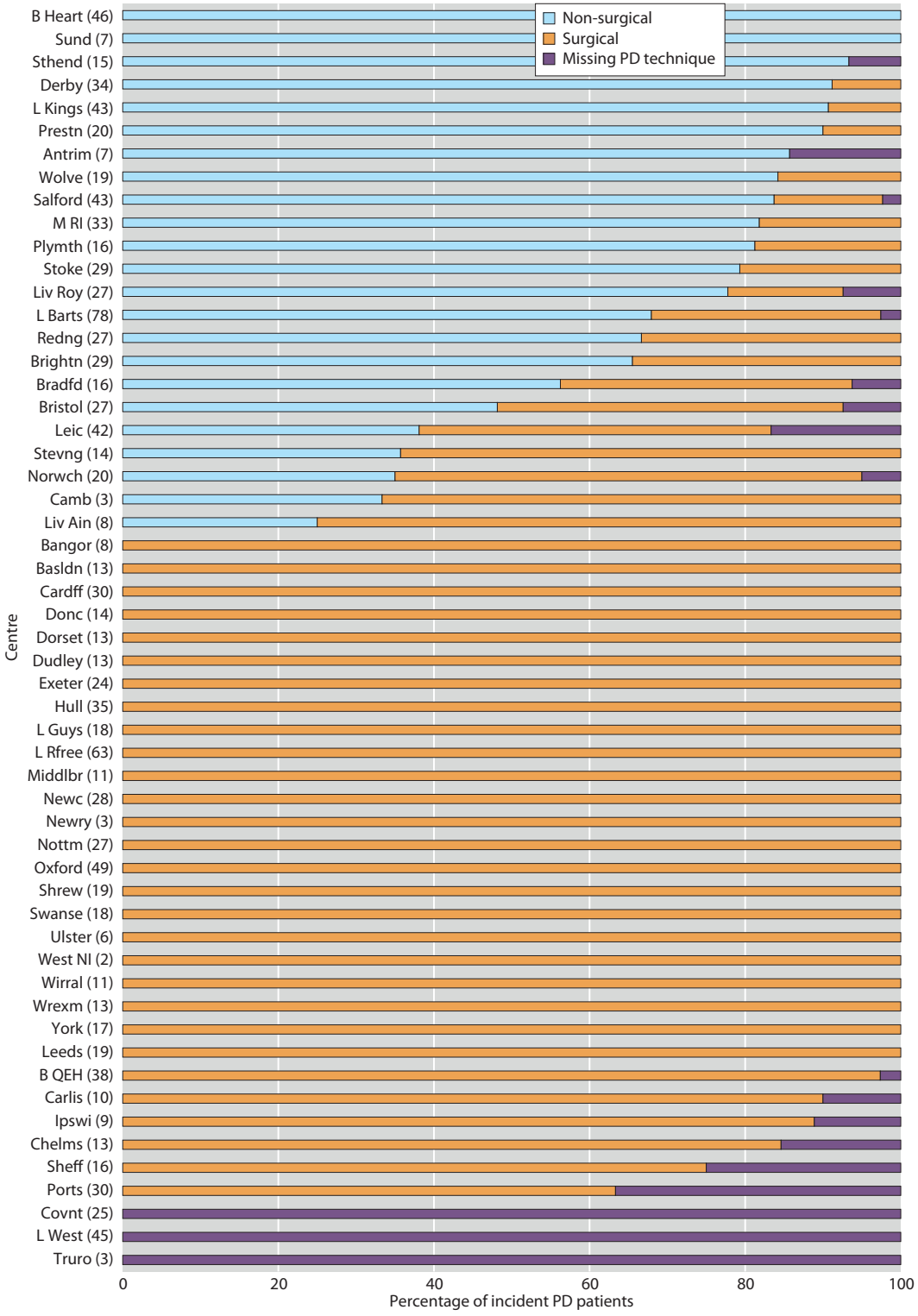

Fig. 10.10. PD catheter insertion technique (surgical vs non-surgical) stratified by centre for patients in the 2016 Multisite Dialysis Access Audit

Number of patients receiving PD at each centre in brackets. Four centres reporting fewer than five patients on PD were excluded from this analysis. Due to small numbers in the subcategories of surgical insertion techniques, open and laparoscopic insertions are grouped as 'surgical'; peritoneoscopic and percutaneous as 'non-surgical'

PD – peritoneal dialysis

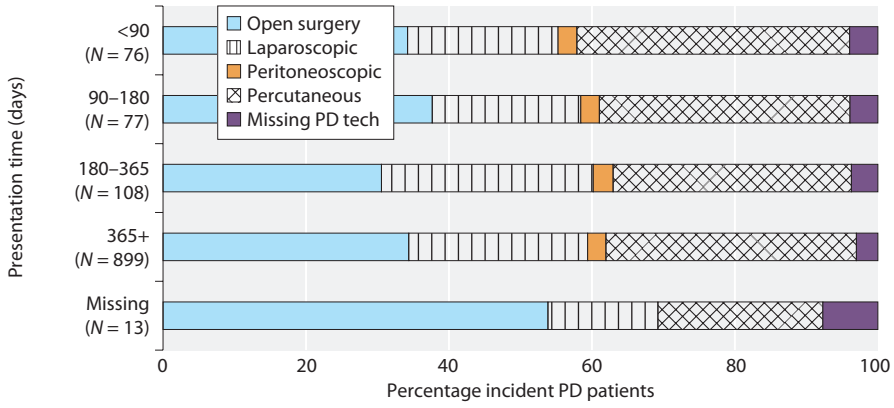

Fig. 10.11. PD catheter insertion technique by referral time (days) for patients in the 2016 Multisite Dialysis Access Audit

Number of patients in each category in brackets. Referral time was measured between first nephrology input (inpatient/outpatient) and initiating dialysis

PD – peritoneal dialysis

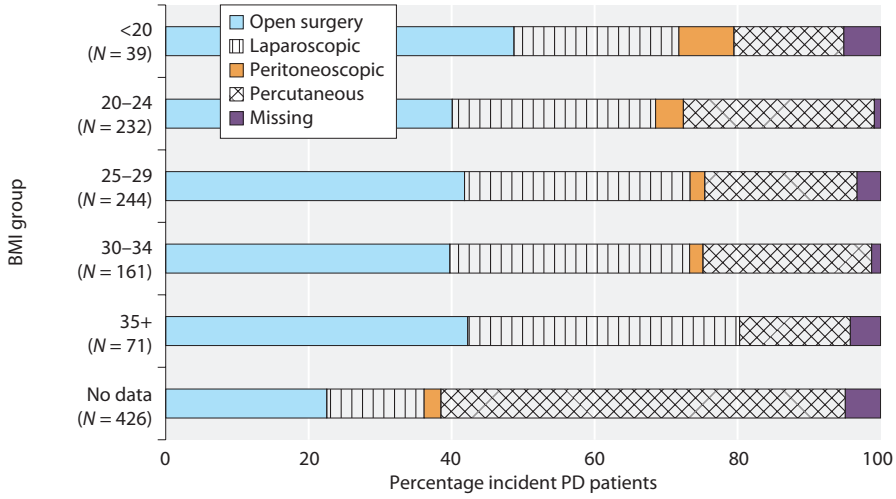

Fig. 10.12. Percentage of incident PD patients by catheter insertion technique and BMI group for patients in the 2016 Multisite Dialysis Access Audit

Number of patients in each category in brackets. 17 centres were excluded from this analysis due to >50% of missing data for BMI

PD – peritoneal dialysis; BMI – body mass index

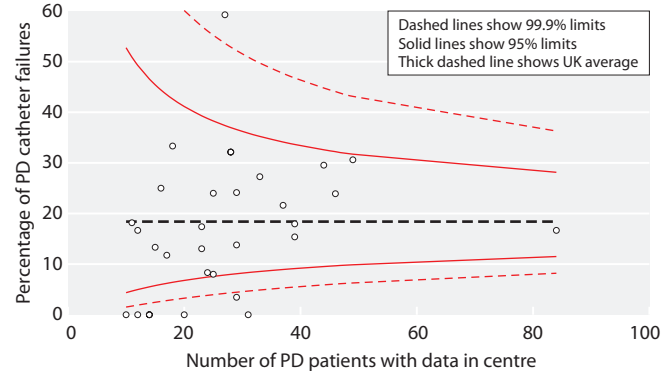

Fig. 10.13. Funnel plot of the percentage of PD catheter failures within one year of start date for patients incident to PD in 2015

Twelve centres did not return data for the one year follow-up

PD – peritoneal dialysis

compliance with Renal Association standards is highly recommended.

It has been suggested that lower rates of definitive dialysis access in some centres may be a result of higher rates of PTx because transplanted patients may otherwise have started dialysis with definitive access. This hypothesis is not supported by the data presented.

The UKRR has an important role in monitoring the quality of planned and unplanned RRT provision and informing guidance and practice improvement. Wide variation in practice reflects the absence of a cohesive approach, despite national guidance. The insights gained from the inclusion of information about all three RRT modalities in this chapter reflect the importance of a comprehensive approach in the exploration of trends in RRT access provision. Once again, this year's Multisite

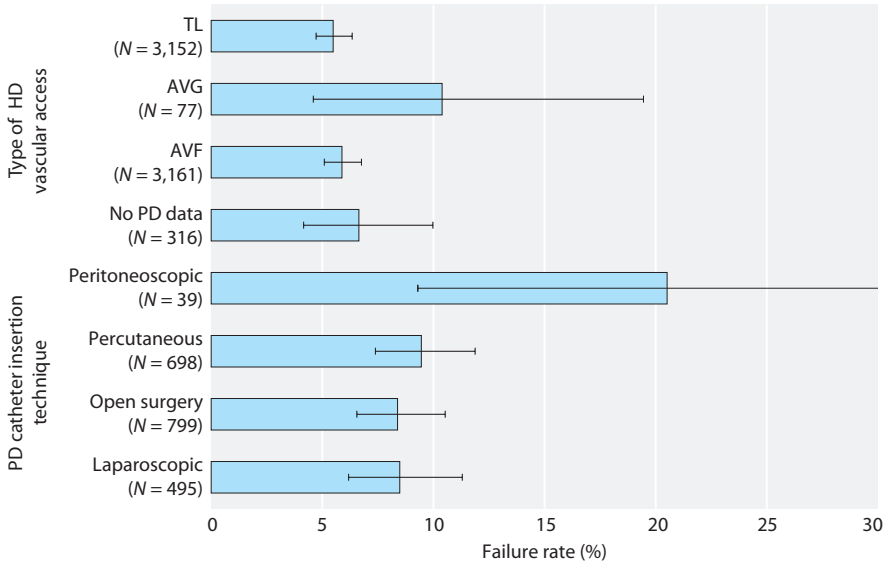

Fig. 10.14. Percentage of patients experiencing failure of first access within three months, by type of first access, for patients in the 2015 and 2016 Multisite Dialysis Access Audits
HD – haemodialysis; PD – peritoneal dialysis; AVF – arteriovenous fistula; AVG – arteriovenous graft; TL – tunnelled line

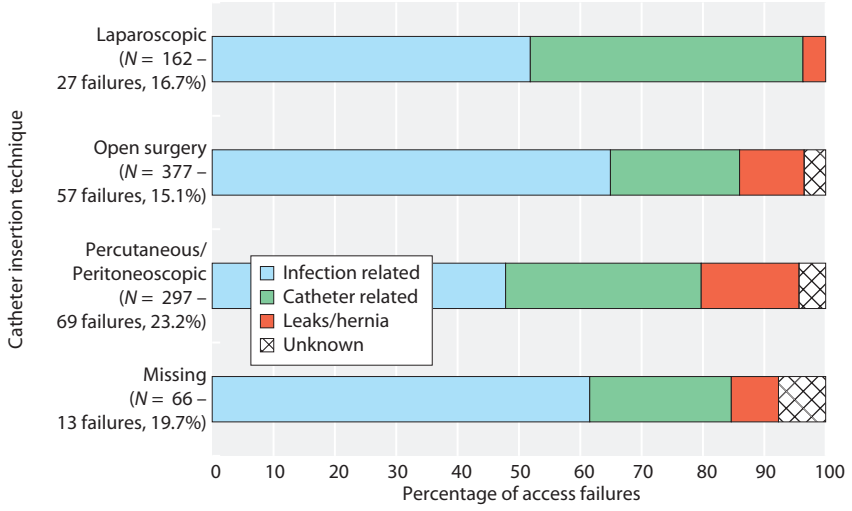

Fig. 10.15. Percentage of PD catheter access failures within one year of starting dialysis, from PD follow-up data, 2016
PD – peritoneal dialysis

Dialysis Access Audit identifies the need for an improved understanding of what drives heterogeneity in access practice along with approaches to standardise and enhance care.

Acknowledgement

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Conflicts of interest: the authors declare no conflicts of interest

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