



**QUEEN'S  
UNIVERSITY  
BELFAST**

## Quality of life with conservative care compared with assisted peritoneal dialysis and haemodialysis

Iyasere, O., Brown, E. A., Johansson, L., Davenport, A., Farrington, K., Maxwell, A. P., Collinson, H., Fan, S., Habib, A.-M., Stoves, J., & Woodrow, G. (2019). Quality of life with conservative care compared with assisted peritoneal dialysis and haemodialysis. *Clinical Kidney Journal*, 12(2), 262-268. <https://doi.org/10.1093/ckj/sfy059>, <https://doi.org/10.1093/ckj/sfy059>

**Published in:**  
Clinical Kidney Journal

**Document Version:**  
Publisher's PDF, also known as Version of record

**Queen's University Belfast - Research Portal:**  
[Link to publication record in Queen's University Belfast Research Portal](#)

### **Publisher rights**

Copyright 2018 the authors.

This is an open access Creative Commons Attribution-NonCommercial License (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits use, distribution and reproduction for non-commercial purposes, provided the author and source are cited

### **General rights**

Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

### **Take down policy**

The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact [openaccess@qub.ac.uk](mailto:openaccess@qub.ac.uk).

### **Open Access**

This research has been made openly available by Queen's academics and its Open Research team. We would love to hear how access to this research benefits you. – Share your feedback with us: <http://go.qub.ac.uk/oa-feedback>



## ORIGINAL ARTICLE

# Quality of life with conservative care compared with assisted peritoneal dialysis and haemodialysis

Osasuyi Iyasere<sup>1</sup>, Edwina A. Brown<sup>2</sup>, Lina Johansson<sup>2</sup>, Andrew Davenport<sup>3</sup>, Ken Farrington<sup>4</sup>, Alexander P. Maxwell<sup>5</sup>, Helen Collinson<sup>6</sup>, Stanley Fan<sup>7</sup>, Ann-Marie Habib<sup>8</sup>, John Stoves<sup>9</sup> and Graham Woodrow<sup>10</sup>

<sup>1</sup>John Walls Renal Unit, Leicester General Hospital, Leicester, UK, <sup>2</sup>Imperial College Renal and Transplant centre, Hammersmith Hospital, London, UK, <sup>3</sup>UCL Centre for Nephrology, Royal Free Hospital, London, UK, <sup>4</sup>Lister Hospital, Stevenage, UK, <sup>5</sup>Centre for Public Health, Queen's University Belfast, UK, <sup>6</sup>Hull Royal Infirmary, Hull, UK, <sup>7</sup>Royal London Hospital, London, UK, <sup>8</sup>St Helier Hospital, Carshalton, UK, <sup>9</sup>Bradford Teaching Hospitals, Bradford, UK and <sup>10</sup>St James University Hospital, Leeds, UK

Correspondence and offprint requests to: Edwina A. Brown; E-mail: [e.a.brown@imperial.ac.uk](mailto:e.a.brown@imperial.ac.uk)

## ABSTRACT

**Background.** There is little information about quality of life (QoL) for patients with end-stage kidney disease (ESKD) choosing conservative kidney management (CKM). The Frail and Elderly Patients on Dialysis (FEPOD) study demonstrated that frailty was associated with poorer QoL outcomes with little difference between dialysis modalities [assisted peritoneal dialysis (aPD) or haemodialysis (HD)]. We therefore extended the FEPOD study to include CKM patients with estimated glomerular filtration rate  $\leq 10$  mL/min/1.73 m<sup>2</sup> (i.e. individuals with ESKD otherwise likely to be managed with dialysis).

**Methods.** CKM patients were propensity matched to HD and aPD patients by age, gender, ethnicity, diabetes status and index of deprivation. QoL outcomes measured were Short Form-12 (SF12), Hospital Anxiety and Depression Scale depression score, symptom score, Illness Intrusiveness Rating Scale (IIRS) and Renal Treatment Satisfaction Questionnaire. Frailty was assessed using the Clinical Frailty Scale. Generalized linear modelling was used to assess the impact of treatment modality on QoL outcomes, adjusting for baseline characteristics.

**Results.** In total, 84 (28 CKM, 28 HD and 28 PD) patients were included. Median age for the cohort was 82 (79–88) years. Compared with CKM, aPD was associated with higher SF12 physical component score (PCS) [Exp B (95% confidence interval) = 1.20 (1.00–1.45),  $P < 0.05$ ] and lower symptom score [Exp B = 0.62 (0.43–0.90),  $P = 0.01$ ]; depression score was lower in HD compared with CKM [Exp B = 0.70 (0.52–0.92),  $P = 0.01$ ]. Worsening frailty was associated with higher depression scores [Exp B = 2.59 (1.45–4.62),  $P < 0.01$ ], IIRS [Exp B = 1.20 (1.12–1.28),  $P < 0.01$ ] and lower SF12 PCS [Exp B = 0.87 (0.83–0.93),  $P < 0.01$ ].

**Conclusion.** Treatment by dialysis, both with aPD and HD, improved some QoL measures. Overall, aPD was equal to or slightly better than the other modalities in this elderly population. However, as in the primary FEPOD study, frailty was associated with worse QoL measures irrespective of CKD modality. These findings highlight the need for an individualized approach to the management of ESKD in older people.

**Keywords:** conservative care, dialysis, end-stage kidney disease, frailty, quality of life

Received: 26.4.2018; Editorial decision: 4.6.2018

© The Author(s) 2018. Published by Oxford University Press on behalf of ERA-EDTA.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact [journals.permissions@oup.com](mailto:journals.permissions@oup.com)

## INTRODUCTION

Older, frailer individuals with end-stage kidney disease (ESKD) are arguably more likely to choose conservative kidney management (CKM) over dialysis therapies if they are offered the opportunity to participate in decision-making about their care. CKM includes interventions to delay progression of kidney disease and minimize complications as well as detailed communication, shared decision-making, advance care planning and psychologic and family support; it does not include dialysis [1]. Dialysis populations have changed markedly with ageing of the population and following the expansion of dialysis services allowing an exponential increase in the number of elderly patients now being treated by dialysis. Older patients with ESKD have a high burden of ageing-related health and social care problems, a high mortality rate and a greater likelihood of developing the frailty syndrome requiring social support within a few months of starting dialysis, whatever the modality [2–4]. Given this experience and observations that dialysis may not extend life in the very old, or those with multiple comorbidities and poor physical function [5–7], it is not surprising that a high percentage of the very old will select conservative care for ESKD (no dialysis but active supportive care) in healthcare cultures where this option is actively discussed, such as the UK [8] and Australia [9]. There is, however, limited information about the quality of life (QoL) and physical function of patients choosing conservative care compared with haemodialysis (HD) or peritoneal dialysis (PD). The two largest studies published come from the UK [10] and Australia [11]. The first included 30 patients choosing conservative care, but the groups were not age comparable and the dialysis modality was predominantly HD. The Australian study was larger, but again the groups were not age-matched, and only half of patients completed QoL or symptom questionnaires. In both studies, the conservative care cohort recruited patients choosing conservative care in pre-dialysis clinics, when requirement for dialysis was distant. Neither study mentions the estimated glomerular filtration rate (eGFR) of conservative care patients when enrolled, so are subject to lead-time bias.

The Frail and Elderly Patient Outcomes on Dialysis (FEPOD) study is a multicentre observational study comparing the QoL and physical function of older patients with ESKD and enrolled 129 patients receiving assisted peritoneal dialysis (aPD) matched to 122 patients on HD requiring hospital-supplied transport to hospital (incentre) dialysis facilities. This study showed that the frailty score was associated with lower physical function and higher illness intrusiveness and symptom scores; the only difference between the two dialysis modalities was a higher treatment satisfaction score on aPD [12]. Given these findings, we hypothesized that outcomes of QoL and physical function would be similar between older patients on dialysis and suitably matched patients receiving conservative care for ESKD. We compared outcomes between patients who had chosen conservative care with an eGFR  $\leq 10$  mL/min/1.73 m<sup>2</sup> (thus otherwise likely to require dialysis) and propensity matched aPD and HD patients.

## MATERIALS AND METHODS

### Study design and recruitment

This was a multicentre cross-sectional study of patients receiving CKM, aPD and HD. CKM patients were recruited from 21

centres in the UK (England and Northern Ireland), between December 2014 and June 2016. In this study, CKM patients were defined as those receiving active non-dialysis care, with an eGFR  $\leq 10$  mL/min/1.73 m<sup>2</sup>. This was to exclude patients on a supportive care pathway, who would opt for dialysis as renal function deteriorates, but were not yet needing dialysis. Eligible patients were  $\geq 60$  years old and had not been admitted to hospital for  $\geq 30$  days.

The recruited CKM patients were propensity matched to the original FEPOD cohort using the following criteria: age, gender, ethnicity, presence of diabetes and index of deprivation by post code [13]. The FEPOD cohort, which has been previously described [12], consists of older patients on HD and aPD ( $n = 251$ ). They had been recruited from the same renal centres, between June 2011 and December 2013. They were also over 60 years of age, had been on maintenance dialysis for at least 3 months and with no hospital admissions for  $\geq 30$  days.

Patients who were deemed to have a life expectancy of less than 6 months by the managing clinician were excluded from the study. Patients with dementia as well as those unable to understand English were also excluded. Centres were not asked to record how many patients they reviewed and then deemed ineligible for inclusion into the study.

aPD patients were defined as those who are unable to perform PD without the assistance of a paid healthcare worker or family member. HD patients were defined as those requiring hospital-funded transport (allocated after a mobility assessment) to receive incentre dialysis.

### Ethics and consent

The study was approved by the London–Fulham Research Ethics Committee (REC Approval: 11/LO/1886). Eligible patients were approached with a patient information sheet at least 24 h prior to the study visit. All participants provided written informed consent at the study visit.

### Study visit

The study visit was conducted by local research teams at individual centres. Demographic and clinical characteristics were collated at baseline from the medical records and during the visit. The comorbidity burden was evaluated with the Stoke–Davies comorbidity score. This prognostic score has been shown to be predictive of survival [14] and is superior to the Charlson Comorbidity index as a predictor of hospitalization in PD patients. A point is allocated for each of the following: ischaemic heart disease, peripheral vascular disease, left ventricular dysfunction, diabetes, active malignancy and systemic collagen vascular disease, and other significant comorbidities. Higher scores indicate higher disease burden.

Assessments of QoL and physical function were subsequently carried out, using questionnaires.

### Assessments

Seven outcome measures were evaluated. These include the Short Form-12 [SF12; Physical Component Summary scale (PCS) and Mental Component Summary scale (MCS)], Hospital Anxiety and Depression Scale (HADS), Palliative Outcomes Scale-Symptoms (POS-S) (Renal), Illness Intrusiveness Rating

Scale (IIRS), Renal Treatment Satisfaction Questionnaire (RTSQ) and the Barthel score. Frailty was also assessed at baseline using the Clinical Frailty Scale (CFS), as an important confounder, not as an outcome measure.

**SF12 version 2.** The SF12 is a self-assessment of physical and mental health-related quality of life (HRQOL). Using patient responses, two summary scores are calculated, namely, the PCS and MCS. Higher scores are indicative of better HRQOL. The SF12 has over 90% agreement with the widely used SF36. It has also been shown to be a valid and reliable measure of HRQOL in older people [15], with an associated lower completion burden.

**HADS.** This questionnaire screens for depression or anxiety with scores ranging from 0 to 21. A depression score of 8 and above is suggestive of possible depression [16]. The HADS scale does not assess somatic symptoms of depression, which may overlap with those of uraemia. It has been shown to have good internal consistency in older people [17].

**IIRS.** This self-reporting tool assesses the extent to which the illness and/or treatment interferes with a patient's life. The rating scale evaluates intrusiveness in 13 life domains. It has been validated in patients with ESKD [18], correlating with uraemic symptoms, intercurrent non-renal illnesses, fatigue and difficulties in daily activities. Scores range from 13 to 91, with higher scores indicating more illness intrusion.

**Symptoms.** Symptoms were measured using the POS-S renal scale. This is an adaptation of the POS, which was originally developed for oncology patients to evaluate their palliative care needs. For non-dialysis patients with advanced kidney disease, it has been modified to include renal-specific symptoms [19]. Scores range from 0 to 80, with higher scores indicating increasing symptom burden. The POS-S renal score has also been shown to be predictive of mortality in HD patients [20].

**Satisfaction with treatment.** This was assessed using the RTSQ [21]. This 11-item tool has been validated in HD, PD and transplant patients. It assesses various aspects of treatment satisfaction, including convenience, flexibility, freedom afforded by treatment and impact on lifestyle. Scores range from 0 to 66, with higher scores suggesting more treatment satisfaction.

**Barthel Index.** This questionnaire evaluates performance in 10 activities of daily living [22]. Scores range from 0 to 100, with lower scores suggesting increased dependence. It is, however, sensitive to change over time.

**CFS.** This was used to measure frailty. Scores range from 1 to 7, with higher scores corresponding to increasing levels of frailty. It takes into consideration the presence of comorbidities as well as dependence for activities of daily living. It has been shown to be predictive of death or the need to be institutionalized, similar to other established measures of frailty [23]. Frailty was measured as a potential confounder and not as an outcome measure.

## Statistical analysis

All analyses were carried out using the SPSS 22 package. Continuous variables were expressed as median and interquartile ranges, as they did not follow a normal distribution, whereas categorical variables were expressed as percentages.

**Unadjusted analysis.** Clinical characteristics were compared between the CKM, aPD and HD cohorts. Statistical significance tests were not used to compare demographic characteristics between the cohorts, which had been matched on demographics and therefore do not constitute random samples from the respective populations. Categorical variables were compared between the CKM, HD and aPD cohorts using Fisher's exact tests. Continuous variables were compared using the Kruskal-Wallis test.

**Regression analysis.** Generalized linear modelling with gamma error structure was used to evaluate the relationship between QoL outcome measures and treatment modality (CKM versus aPD; CKM versus HD). This is because the outcome measures did not meet the assumption of normal distribution. A generalized linear model was, therefore, generated for each of the outcome variables of interest, including the SF12 PCS, SF12 MCS, HADS depression score, IIRS, POS-S renal score, RTSQ score and Barthel score.

All models adjusted for age, gender, dialysis vintage, Stoke-Davies comorbidity score and frailty score in addition to treatment modality. These covariates were selected *a priori* as potential confounders. Dialysis vintage was included as a continuous variable. The majority of CKM patients were not exposed to dialysis. Therefore, the variable 'dialysis vintage' contained zero values. A fixed value of 0.001 was, therefore, added to all values in the variable, before inclusion at the modelling stage. Effect estimates were derived from the gamma regression models. Each estimate represents the effect of each covariate on the outcome measure after adjustment for all other covariates in the model. Those effects with  $P < 0.05$  were considered to be significant.

## RESULTS

Only 28 CKM patients were recruited and, as shown in Table 1, successfully propensity matched to aPD and HD patients on a 1:1:1 ratio, using aforementioned criteria. The cohort, therefore, consisted of 84 patients, with a median age [CKM=83, interquartile range (IQR) 80–87 years; aPD=81, IQR 79–88 years; HD=82, IQR 78–85 years] that was considerably higher than that for the original FEPOD cohort (PD 76, IQR 70–81 years; HD 75, IQR 69–80 years) [12].

Table 1. Patient matching criteria

	CKM (n=28)	aPD (n=28)	HD (n=28)
Median age, IQR	83 (80–88)	81 (79–88)	82 (78–85)
Male gender (%)	50	50	43
Ethnicity (%)			
White European	78.6	96.4	96.4
Asian	10.7	0.0	3.6
Afro Caribbean	10.7	3.6	0.0
Diabetes mellitus (%)	57	68	64.3
Median index of deprivation (IQR)	22 (13–38)	17 (11–34)	19 (9–31)

Table 2 shows the other demographic clinical and characteristics for the cohort. The Stoke–Davies comorbidity score of the CKM patients (median 1, IQR 0–2) was significantly ( $P=0.01$ ) lower than in the aPD and HD patients (median 2, IQR 1–3). Frailty, as defined by a frailty score  $\geq 5$ , was common in all three groups with no significant difference between them (CKM 39.3%, aPD 60.7%, HD 39.3%;  $P=0.18$ ). A higher proportion of CKM patients to be living alone (CKM 51.9%, aPD 42.9%, HD 30.9%), but this was not significant ( $P=0.07$ ).

### Study outcomes

Table 3 sets out the unadjusted outcomes of QoL for the CKM patients compared with those on PD and HD. There were no significant differences between the three groups for SF12 physical and mental component scores, IIRS and symptom score. The HADS depression score was lowest in the HD group (HD 5, IQR

3–7; aPD 7.5, IQR 5–10; CKM 7, IQR 5–10;  $P=0.03$ ), with a non-significant trend towards a lower prevalence of possible depression (HADS depression score  $>7$ , HD—25%, aPD—53.6%, CKM—46.4%;  $P=0.07$ ). There was also a trend towards lower RTSQ score in the HD group (median 52, IQR 43.5–56) compared with CKM (median 55.5, IQR 45.3–58.8) and PD (median 56, IQR 53–60;  $P=0.06$ ).

Multivariate analysis using generalized linear models adjusted for age, gender, dialysis vintage, comorbidity score, frailty and dialysis modality is shown in Table 4. The aPD patients had higher SF12 PCS scores compared with CKM patients [effect estimate PD versus CKM = 1.2 (1.00–1.45),  $P=0.05$ ]. There was no significant difference between CKM and HD patients. aPD patients also had significantly lower symptom scores [effect estimates PD versus CKM = 0.62 (0.43–0.90),  $P=0.01$ ] compared with CKM patients, with no difference between HD and CKM. The HD patients had lower HADS depression scores [effect estimates HD versus CKM = 0.70 (0.52–0.92),  $P=0.01$ ] compared with CKM patients. Frailty was associated with lower PCS on SF12 [effect estimate = 0.87 (0.83–0.93),  $P < 0.01$ ], higher depression score [Effect estimate = 2.59 (1.45–4.62),  $P < 0.01$ ] and illness intrusiveness [effect estimate = 1.20 (1.12–1.28),  $P < 0.01$ ]. There was also a trend towards lower RTSQ scores in the HD cohort [effect estimate = 0.90 (0.80–1.00),  $P=0.06$ ] compared with CKM patients, with no difference between aPD and CKM patients. Treatment modality was not associated with any differences in SF12 MCS and IIRS scores.

### DISCUSSION

The aim of this study was to compare the QoL and physical function of patients on a conservative care pathway for ESRD compared with those receiving aPD and in-centre HD. Patients were defined as being on a conservative care pathway at the point after they have engaged in an active decision-making process about the options for management of ESKD and have opted not to have dialysis. The timing of such discussions is at the discretion of nephrology healthcare teams. Indeed, in two recent retrospective studies comparing survival of those choosing conservative care and those starting on dialysis [6, 7], analyses were undertaken when patients still had an eGFR of 20 mL/min/1.73 m<sup>2</sup>, that is, at a time point when dialysis is not required; many of the deaths would therefore be related to comorbid conditions and not to ESKD *per se*. In our study, all the patients on the conservative care pathway had an eGFR of  $\leq 10$  mL/min/1.73 m<sup>2</sup>, so would likely to have started dialysis if that had been their wish.

The patients in the conservative care group, as expected, were very old with a median age of 83 years. Surprisingly, they

Table 2. Clinical characteristics

	CKM (n = 28)	aPD (n = 28)	HD (n = 28)	P
Median Stoke–Davies comorbidity score, IQR	1 (0–2)	2 (1–3)	2 (1–3)	0.01
Comorbidity (%)				
Ischaemic heart disease	25.9	28.6	42.9	0.32
Left ventricular dysfunction	7.1	21.4	25.0	0.18
Peripheral vascular disease	3.6	28.6	21.4	0.04
Malignancy	25.0	10.7	14.3	0.33
Systemic collagen vascular disorder	0.0	7.1	3.6	0.36
Median frailty score (IQR)	4 (3–5)	5 (4–5)	4 (3–5)	0.21
Frailty score $\geq 5$ (%)	39.3	60.7	39.3	0.18
Dialysis vintage (%)				
No dialysis	96.4	0.0	0.0	
1–12 months	0.0	32.1	10.7	
13–60 months	0.0	53.6	89.3	
60–120 months	0.0	10.7	0.0	
>120 months	3.6	3.6	0.0	
Fall in preceding 6 months (%)	25.9	28	48.1	0.17
Social network				
Residence (%)				
Own home	85.2	89.3	78.6	0.36
Warden-controlled flat	14.8	10.7	14.3	
Nursing home	0.0	0.0	7.1	
Lives alone (%)	51.9	42.9	30.8	0.07
Help from friend/family (%)	36.1	32.8	31.1	0.66
Paid help received (%)	37	33.3	56	0.21

Table 3. Univariate comparison: outcomes of QoL and physical function

Outcome measures	CKM	aPD	HD	P
SF-12 PCS <sup>a</sup> , median (IQR)	28.9 (19.8–33.3)	30.8 (20.9–33.1)	29.2 (23.4–34.7)	0.62
SF-12 MCS <sup>a</sup> , median (IQR)	46.3 (38.8–55.2)	50.2 (38.3–61.6)	49.9 (40.4–57.9)	0.68
HADS depression score, median (IQR)	7 (5–9)	7.5 (5–10)	5 (3–7)	0.03
HADS $>7$ (%)	46.4	53.6	25	0.07
Illness Intrusiveness Rating Scale, median (IQR)	30.5 (21.5–31.8)	32.0 (20.8–41.8)	31.0 (21–38)	0.79
Renal Treatment Satisfaction Questionnaire <sup>a</sup> , median (IQR)	55.5 (45.3–58.8)	56 (53–60)	52 (43.5–56)	0.06
Symptom score, median (IQR)	20 (13–27)	16 (9–21)	22 (11–26.5)	0.10

<sup>a</sup>A higher score indicates better quality of life.

MCS, mental component summary; PCS, physical component summary; SF-12, short form 12.

Table 4. Multivariate analysis using generalized linear models

Outcome variable	Predictors	Exp B (95% CI)	P
SF12 PCS	Age	1.01 (0.99–1.03)	0.10
	Female gender	0.89 (0.78–1.02)	0.10
	Dialysis vintage	1.00 (1.00–1.00)	0.52
	Stoke comorbidity score	1.02 (0.96–1.07)	0.57
	<b>Frailty score</b>	<b>0.87 (0.83–0.93)</b>	<b>&lt;0.01</b>
	<b>aPD versus CKM</b>	<b>1.20 (1.00–1.45)</b>	<b>0.05</b>
	HD versus CKM	1.08 (0.89–1.29)	0.45
SF12 MCS	Age	1.00 (0.99–1.01)	0.94
	Female gender	0.91 (0.81–1.03)	0.14
	Dialysis vintage	1.00 (0.99–1.00)	0.97
	Stoke comorbidity score	0.99 (0.94–1.04)	0.72
	Frailty score	0.95 (0.91–1.00)	0.07
	aPD versus CKM	1.07 (0.90–1.27)	0.44
	HD versus CKM	1.03 (0.87–1.22)	0.71
HADS depression score	Age	0.94 (0.81–1.10)	0.44
	<b>Female gender</b>	<b>5.82 (1.52–22.3)</b>	<b>0.01</b>
	Dialysis vintage	1.03 (0.99–1.06)	0.11
	Stoke comorbidity score	1.25 (0.72–2.19)	0.43
	<b>Frailty score</b>	<b>2.59 (1.45–4.62)</b>	<b>&lt;0.01</b>
	aPD versus CKM	0.86 (0.86–1.12)	0.24
	<b>HD versus CKM</b>	<b>0.70 (0.52–0.92)</b>	<b>0.01</b>
IIRS	<b>Age</b>	<b>0.98 (0.96–0.99)</b>	<b>0.04</b>
	Female gender	1.06 (0.90–1.24)	0.50
	Dialysis vintage	1.00 (0.99–1.00)	0.97
	<b>Stoke comorbidity score</b>	<b>0.93 (0.87–0.99)</b>	<b>0.03</b>
	<b>Frailty score</b>	<b>1.20 (1.12–1.28)</b>	<b>&lt;0.01</b>
	aPD versus CKM	1.11 (0.86–1.42)	0.42
	HD versus CKM	1.17 (0.93–1.48)	0.19
Symptom score	Age	1.00 (0.97–1.02)	0.70
	Female gender	1.12 (0.90–1.40)	0.32
	Dialysis vintage	1.00 (0.99–1.01)	0.45
	Stoke comorbidity score	1.03 (0.92–1.14)	0.61
	Frailty score	1.07 (0.97–1.19)	0.17
	<b>aPD versus CKM</b>	<b>0.62 (0.43–0.90)</b>	<b>0.01</b>
	HD versus CKM	0.90 (0.66–1.21)	0.48
RTSQ	Age	1.00 (0.99–1.01)	0.75
	Female gender	0.94 (0.88–1.02)	0.12
	Dialysis vintage	1.00 (1.00–1.00)	0.11
	Stoke comorbidity score	0.99 (0.96–1.03)	0.68
	Frailty score	0.99 (0.96–1.03)	0.47
	aPD versus CKM	0.98 (0.88–1.10)	0.75
	HD versus CKM	0.90 (0.80–1.00)	0.06

All adjusted for age, gender, dialysis vintage, Stoke-Davies comorbidity score, frailty and dialysis modality.

CI, confidence interval. Bold value indicates statistically significant.

had a lower comorbidity score than the dialysis cohorts, but this is similar to a recent Canadian study in which patients choosing conservative care for ESKD had fewer comorbidities than those on dialysis [24]. There was a non-significant trend for conservative care patients to be living on their own; this may have influenced their decision to choose CKM and not to have dialysis.

A major strength of our study is that each CKM patient was matched to both a patient managed by aPD and with a patient receiving in-centre HD requiring hospital-supplied transport. In the UK, although dialysis treatments and medications are free of charge, transport to and from dialysis centres is restricted to only those with impaired mobility. There was no difference in length of time on dialysis comparing aPD and HD patients; it was not possible to record how long the CKM patients had had

an eGFR  $<10$  mL/min/1.73 m<sup>2</sup>. In the multivariate analysis, CKM patients were compared with those on aPD and those on HD independently. Compared with those managed by aPD, CKM patients had a lower SF12 PCS and a higher symptom score. CKM patients also had a higher depression score compared with those on HD, though it needs to be pointed out that the HD self-reported depression scores in our study were lower than most previously published in the literature. There was a non-significant trend for RTSQ scores to be lower for patients on HD compared with those on CKM. The other key factor related to outcomes was frailty, which was associated with lower SF12 PCS, higher depression score and higher illness intrusiveness, irrespective of modality choice.

Only one study has previously directly compared patients choosing conservative care for ESKD with those receiving PD [25]; this study was conducted in Hong Kong, which has a 'PD first' policy resulting in an unselected PD population. Baseline renal function was similar in the conservative care and PD populations (mean eGFR 6.8 and 6.3 mL/min/1.73 m<sup>2</sup>, respectively). In this retrospective observational study, the primary outcome was patient survival and there were no measures of QoL. Survival with conservative care was similar to that of PD patients who required assistance for activities of daily living, comparable to studies comparing survival of conservative care for ESKD to patients predominantly managed by HD [5–7].

Symptom burden has been reported to be high for ESKD patients following conservative care pathways [26]. There are however, very few data about QoL for patients on conservative care pathways compared with those receiving dialysis. The first report related to a small cohort of 11 patients from Verona [27]; QoL was measured in only six patients on CKM who were still alive at the time of the study; similar to our study, these CKM patients had a lower PCS on SF36 compared with five patients on HD and mental component scores were similar. In the study of Da Silva-Gane *et al.* [10], 30 patients choosing conservative care for ESKD were compared with those having dialysis, predominantly HD. In this study, conservative care patients were older, had more comorbidities and had poorer physical health than those on dialysis; life satisfaction scores were similar at baseline and remained stable in those receiving CKM but decreased in the dialysis cohort. A more recent Australian study included 122 ESKD patients choosing conservative care, but only half completed QoL questionnaires [11]; they were also considerably older than the patients in the comparison dialysis cohort. Neither of these latter two studies provided the eGFR of the patients in the conservative care groups. A study from Singapore, where all patients have to pay for dialysis treatments, suggested that QoL was similar for older and multiply comorbid patients on conservative care compared with those on dialysis, but the burden of kidney disease is higher in the dialysis group [28]. However, this study could be confounded by social and financial differences between the groups.

Our study has some notable limitations. The number of patients receiving CKM who were recruited to the study was lower than anticipated and may have introduced a selection bias. Most of the UK centres taking part in the study had specific conservative care clinics, but few centres could identify patients with eGFR of  $\leq 10$  mL/min/1.73 m<sup>2</sup>. Discussions about dialysis or conservative care are usually undertaken at higher eGFR levels, so many patients were not therefore eligible for the study. Some patients with sufficiently low eGFR were deemed by their nephrologist to be too unwell to be included in the study or did not

give consent. This, plus the observation that a higher proportion of CKM patients lived on their own, could explain the surprising observation of a lower comorbidity score and lower prevalence of peripheral vascular disease and left ventricular dysfunction compared with patients established on dialysis. The bias, therefore, is that the CKM patients in the study were fitter than otherwise to be expected; this makes the finding of some worse aspects of QoL compared with those on dialysis even more striking.

Previous studies have reported an initial high mortality rate when elderly patients first start dialysis, particularly HD, and as we only recruited patients after 90 days of dialysis, this may have the potential to introduce a survivor bias. A further potential bias is the apparently low prevalence of self-reported depression in the HD patients selected by the matching process. The study design, and therefore accompanying ethical approval, did not permit extracting information about those patients who did not provide study consent. The study was also of cross-sectional design, which limits results to associations and not causality. In addition, although the largest study to date, our study may have been underpowered as a result of the relatively small sample size. Finally, our study findings need to be interpreted in light of the UK healthcare system, which provides universal coverage. QoL outcomes will vary depending on financial burden of healthcare and extent of social and family support related to cultural beliefs and customs.

In summary, this study shows that for patients with ESKD whose renal function has fallen to a level when dialysis is likely to be considered (eGFR  $\leq 10$  mL/min/1.73 m<sup>2</sup>), many aspects of QoL (mental component score and illness intrusiveness) will be similar whether managed conservatively or with dialysis. However, physical QoL appears to be higher and symptom score lower for those opting for aPD compared with conservative care. Treatment satisfaction was similar for both conservative care and aPD, but probably lower for HD. Shared decision-making is a key component of comprehensive conservative care of ESKD [18]. This study does provide information that can be provided to older and/or frail patients, and their families, who are making decisions whether to have conservative care for ESKD or dialysis—and which dialysis modality to choose.

## ACKNOWLEDGEMENTS

Authors would like to thank FEPOD investigators and centres: Peter Maxwell, Belfast HSC Trust, Northern Ireland; John Stoves, Bradford Teaching Hospitals, Bradford; Anand Vardhan, Central Manchester University Hospitals, Manchester; Richard Fluck, Derby City General Hospital, Derby; Edwina Brown, Hammersmith Hospital, London; Helen Collinson, Hull Royal Infirmary, Hull; Sally Krause, Kent & Canterbury Hospital, Canterbury, Kent; Maxine Keddo, Kings College Hospital, London; Graham Warwick, Leicester General Hospital, Leicester; Ken Farrington, Lister Hospital, Stevenage, Hertfordshire; Richard Fielding, Newcastle Hospitals, Newcastle; Camille Harron, Northern HSC Trust, Northern Ireland; Sarah Jenkins, Northern General Hospital, Sheffield; Andrew Davenport, Royal Free Hospital, London; Stan Fan, Royal London Hospital, London; David Lewis, Salford Royal Hospital, Manchester; Neal Morgan, Southern HSC Trust, Northern Ireland; Steve Nelson, St George's Hospital, London; Anne-Marie Habib, St Helier Hospital, Carshalton, Surrey; Graham Woodrow, St James University Hospital, Leeds; Michael Quinn, Western HSC Trust, Northern Ireland; and Simon Davies, University Hospitals of North Staffordshire, Stoke on Trent.

## FUNDING

This work was supported by The Dunhill Medical Trust (grant numbers: R202/0511 and R377/0714); Baxter Clinical Evidence Council (grant number 11CECPDEU1006); Imperial NIHR Biomedical Research Centre and National Institute for Health Research, through the Comprehensive Clinical Research Network.

## CONFLICT OF INTEREST STATEMENT

E.A.B. has had research funding from Baxter Healthcare. The other authors have no conflicts to declare. The results presented in this paper have not been published previously in whole or part, except in abstract format.

## REFERENCES

1. Murtagh FE, Burns A, Moranne O et al. Supportive care: comprehensive conservative care in end-stage kidney disease. *Clin J Am Soc Nephrol* 2016; 11: 1909–1914
2. Jassal SV, Chiu E, Hladunewich M. Loss of independence in patients starting dialysis at 80 years of age or older. *N Engl J Med* 2009; 361: 1612–1613
3. Johansen KL, Chertow GM, Jin C et al. Significance of frailty among dialysis patients. *J Am Soc Nephrol* 2007; 18: 2960–2967
4. Roshanravan B, Khatri M, Robinson-Cohen C et al. A prospective study of frailty in nephrology-referred patients with CKD. *Am J Kidney Dis* 2012; 60: 912–921
5. Chandna SM, Da Silva-Gane M, Marshall C et al. Survival of elderly patients with stage 5 CKD: comparison of conservative management and renal replacement therapy. *Nephrol Dial Transplant* 2011; 26: 1608–1614
6. Hussain JA, Mooney A, Russon L. Comparison of survival analysis and palliative care involvement in patients aged over 70 years choosing conservative management or renal replacement therapy in advanced chronic kidney disease. *Palliat Med* 2013; 27: 829–839
7. Verberne WR, Geers AB, Jellema WT et al. Comparative survival among older adults with advanced kidney disease managed conservatively versus with dialysis. *Clin J Am Soc Nephrol* 2016; 11: 633–640
8. Okamoto I, Tonkin-Crine S, Rayner H et al. Conservative care for ESRD in the United Kingdom: a national survey. *Clin J Am Soc Nephrol* 2015; 10: 120–126
9. Morton RL, Webster AC, McGeechan K et al. Conservative management and end-of-life care in an Australian Cohort with ESRD. *Clin J Am Soc Nephrol* 2016; 11: 2195–2203
10. Da Silva-Gane M, Wellsted D, Greenshields H et al. Quality of life and survival in patients with advanced kidney failure managed conservatively or by dialysis. *Clin J Am Soc Nephrol* 2012; 7: 2002–2009
11. Brown MA, Collett GK, Josland EA et al. CKD in elderly patients managed without dialysis: survival, symptoms, and quality of life. *Clin J Am Soc Nephrol* 2015; 10: 260–268
12. Iyasere OU, Brown EA, Johansson L et al. Quality of life and physical function in older patients on dialysis: a comparison of assisted peritoneal dialysis with hemodialysis. *Clin J Am Soc Nephrol* 2016; 11: 423–430
13. Office of National Statistics - Neighbourhood Statistics. 2007. <https://www.ons.gov.uk/help/localstatistics> (25 June 2018, date last accessed)

14. Davies SJ, Phillips L, Naish PF et al. Quantifying comorbidity in peritoneal dialysis patients and its relationship to other predictors of survival. *Nephrol Dial Transplant* 2002; 17: 1085–1092
15. Jakobsson U, Westergren A, Lindskov S et al. Construct validity of the SF-12 in three different samples. *J Eval Clin Pract* 2012; 18: 560–566
16. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67: 361–370
17. Helvik AS, Engedal K, Skancke RH et al. A psychometric evaluation of the Hospital Anxiety and Depression Scale for the medically hospitalized elderly. *Nord J Psychiatry* 2011; 65: 338–344
18. Devins GM, Binik YM, Hutchinson TA et al. The emotional impact of end-stage renal disease: importance of patients' perception of intrusiveness and control. *Int J Psychiatry Med* 1983; 13: 327–343
19. Murphy EL, Murtagh FE, Carey I et al. Understanding symptoms in patients with advanced chronic kidney disease managed without dialysis: use of a short patient-completed assessment tool. *Nephron Clin Pract* 2009; 111: c74–c80
20. Sexton DJ, Lowney AC, O'Seaghdha CM et al. Do patient-reported measures of symptoms and health status predict mortality in hemodialysis? An assessment of POS-S Renal and EQ-5D. *Hemodial Int* 2016; 20: 618–630
21. Barendse SM, Speight J, Bradley C. The Renal Treatment Satisfaction Questionnaire (RTSQ): a measure of satisfaction with treatment for chronic kidney failure. *Am J Kidney Dis* 2005; 45: 572–579
22. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965; 14: 61–65
23. Rockwood K, Song X, MacKnight C et al. A global clinical measure of fitness and frailty in elderly people. *CMAJ* 2005; 173: 489–495
24. Kamar FB, Tam-Tham H, Thomas C. A description of advanced chronic kidney disease patients in a major urban center receiving conservative care. *Can J Kidney Health Dis* 2017; 4: 2054358117718538
25. Shum CK, Tam KF, Chak WL et al. Outcomes in older adults with stage 5 chronic kidney disease: comparison of peritoneal dialysis and conservative management. *J Gerontol A Biol Sci Med Sci* 2014; 69: 308–314
26. O'Connor NR, Kumar P. Conservative management of end-stage renal disease without dialysis: a systematic review. *J Palliat Med* 2012; 15: 228–235
27. De Biase V, Tobaldini O, Boaretti C et al. Prolonged conservative treatment for frail elderly patients with end-stage renal disease: the Verona experience. *Nephrol Dial Transplant* 2008; 23: 1313–1317
28. Seow YY, Cheung YB, Qu LM et al. Trajectory of quality of life for poor prognosis stage 5D chronic kidney disease with and without dialysis. *Am J Nephrol* 2013; 37: 231–238