A Budget impact analysis of increasing home-based dialyses in the United Kingdom

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Abstract

Objectives: Approximately 53,000 patients received renal replacement therapy (RRT, about half of them on dialysis), for end-stage renal disease (ESRD) in the UK in 2011, resulting in a substantial economic burden. Evidence suggests that high dose hemodialysis (more frequent and/or longer duration hemodialysis (HD)) may be associated with better health outcomes and can be cost savings in the UK (if conducted at home with the current tariff) versus conventional in-center HD (ICHD). However, the current weekly tariff for home dialysis in the UK is not reflecting the increased production costs associated with an increased number of dialysis sessions per week. We investigated the financial impact of increasing the proportion of ESRD patients on home-based dialysis modalities, especially high dose HD at home with increased tariff, from the UK payer perspective.

Methods: A Markov model was constructed reflecting the natural history of dialysis patients; based on this, a budget impact analysis was performed over a 5-year time horizon from the perspective of the English National Health Service (NHS). Five scenarios were compared with the current UK dialysis modality distribution (prevalent patients, 14.1% PD, 82.0% ICHD, 3.9% conventional home HD; incident patients, 22.9% PD, 77.1% ICHD) with all increases to home modalities coming from the ICHD population: Scenario 1, 10% of prevalent patients receive high dose HD at home; Scenario 2, 10% of prevalent patients receive high dose HD at home at an increased payment by results (PbR) weekly tariff (£575); Scenario 3, 10% and 20% of prevalent patients receive high dose HD at home (£575 PbR tariff) and PD, respectively, and 31% of incident patients receive PD; Scenario 4, 10% and 25% of prevalent patients receive high dose HD at home (£575 PbR tariff) and PD, respectively, and 39% of incident patients receive PD; Scenario 5, 100% of patients receive ICHD.

Results: Performing high dose HD at home in 10% of the dialysis population resulted in a 0.63% savings (Scenario 1, £22 M) under the current home HD tariff of £456/week. With a hypothetical tariff of £575/week for high dose HD at home, the budget increase is minimal (Scenario 2, 0.43%, £15.4 M). Increasing the usage of PD to levels in the range of those seen in 2005-2008 in UK (i.e., 20-25%) totally offset the costs of high dose HD at home and generated savings of £40.3 M (Scenario 3, 1.1%) - £90.8 M (Scenario 4, 2.6%) over 5 years under the hypothetical tariff. On the other hand, having all patients treated in-center resulted in a 4.4% increase (Scenario 5, £155.5 M) in dialysis budget over 5 years.

Conclusions: This analysis shows that increasing the uptake of home-based dialysis regimens could reduce the financial burden associated with the increasing demand for dialysis services in England, without compromising patient outcomes.

Background

- Patients with end-stage renal disease (ESRD) need renal replacement therapy (RRT) – renal transplantation or dialysis, to save and sustain life. The two main types of dialysis are peritoneal dialysis (PD) and hemodialysis (HD).
- Evidence suggests that high dose HD (more frequent and/or longer duration HD) may be associated with better health outcomes with less costs versus conventional in-center HD (ICHD) in the UK, when it is conducted at home with the current tariff. However, the current weekly tariff for home dialysis in the UK is not reflecting the increased production costs associated with an increased number of dialysis sessions per week.
- Due to the aging population, extended life expectancy, and the global epidemic of diabetes mellitus, the number of patients with ESRD is rising rapidly across the globe.[1,2] It is estimated that more than 3.0 million people globally were affected by ESRD at the end of 2012.[3] That number includes 54,824 individuals in UK, about half of whom require dialysis.[4]
- The provision of dialysis to ESRD patients is very costly. More than 2% of the National Health Service (NHS) budget is spent on patients with ESRD.[5] NICE estimates that an increased uptake of PD in England will help generate savings for NHS.[5]

Objective

To investigate the 5-year budget impact of varying the current distribution of dialysis regimens, including PD and high dose HD at home, from the perspective of the England NHS.

- Increase the % of patients receiving home-based dialysis under current tariff;
- Explore increased tariff for high dose HD at home (£575/week, 5 times of NHS reference costs of £115 per session for home HD).
- Assess the financial consequences of no patients receiving home-based dialysis.

Methods

- An Excel-based Markov model was developed using Microsoft Excel® 2010 to estimate the dialysis-associated NHS costs assuming various dialysis modality distributions between home-based dialysis and ICHD over 5 years.
- The current scenario of dialysis modality distribution with 14.1% PD, 3.9% home HD, and 82% ICHD for prevalent dialysis patients and 22.9% PD and 77.1% ICHD for incident dialysis patients was compared to 5 hypothetical scenarios. The specific distribution for the five scenarios can be found in Figure 1 for prevalent patients and Figure 2 for incident patients.
- Model input data in terms of prevalent and incident dialysis population, survival, hospitalization, transition probabilities, were based on 2013 UK Renal Registry Report and published literature. (Details see Table 1)

Figure 1. Modality distribution among prevalent patients

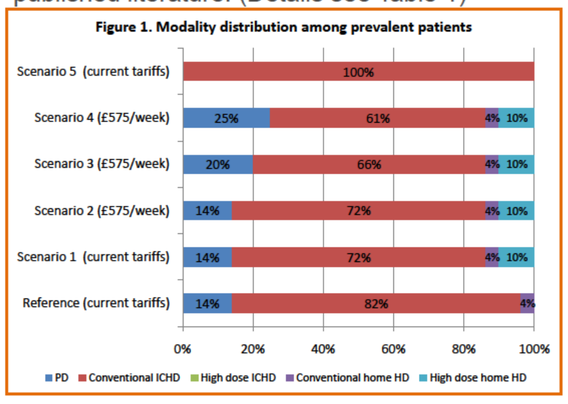
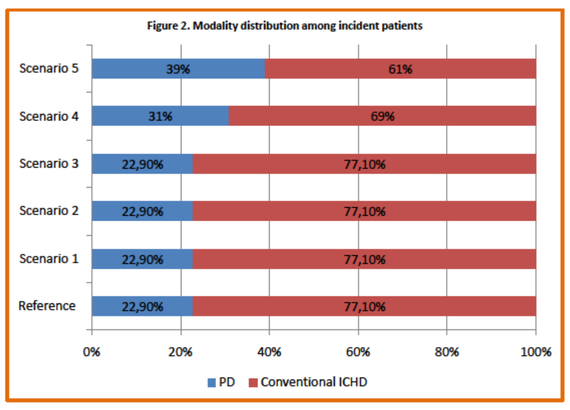


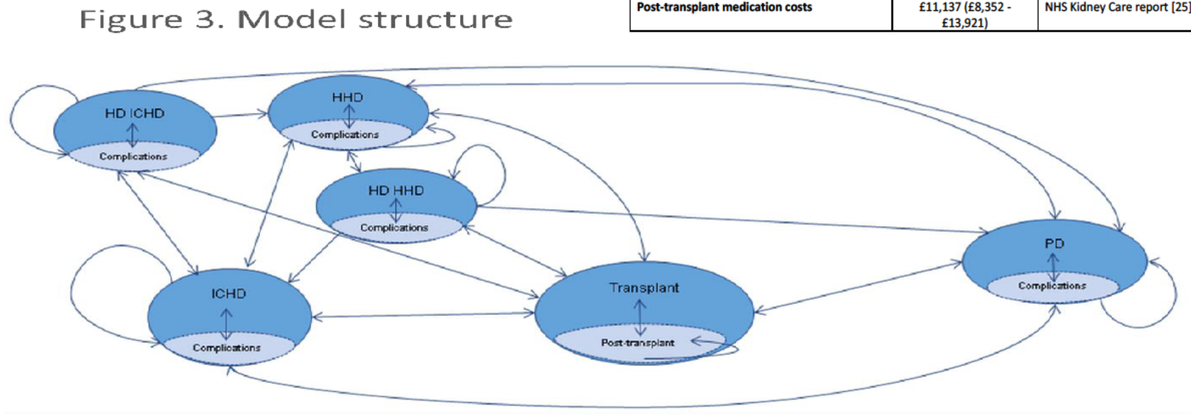
Figure 2. Modality distribution among incident patients



Methods (cont'd)

- The model comprises a number of discrete health states through which patients can transition, including PD, conventional home HD, high dose home HD, conventional ICHD, transplant, and death. People movement are indicated in Figure 3.

Figure 3. Model structure



- ICHD – Conventional in-centre haemodialysis
- HD ICHD – High dose in-centre haemodialysis
- HHD – Conventional home haemodialysis
- HD HHD – High-dose home haemodialysis
- PD – Peritoneal dialysis

Methods (cont'd)

- From NHS perspective, the cost data associated with ESRD treatment include dialysis access establishment and maintenance, dialysis services, patient monitoring, hospitalization, erythropoiesis-stimulating agents (ESAs), transportation to and from clinics, and kidney transplantation were sourced from PbR (Payment-by-Results) tariffs. (Details see Table 2)

Table 1: Model data inputs & sources

Parameter	Value (range)	Data sources
Mortality		
High dose HD mortality HR vs conventional HD	0.76 (0.57-0.95)	Johansen; Marshall; Nesrallah [6,7,8]
Home HD mortality HR	1.00	Assumption
Hospitalisations		
Conventional ICHD hospitalisation probability (28 days)	7.05% (5.29% - 8.81%)	Year 1: FHN trial [9]; subsequent years based on assumption
High dose ICHD hospitalisation probability (28 days)	6.49% (4.87% - 8.11%)	Year 1: FHN trial [9]; subsequent years based on assumption
Conventional home HD hospitalisation probability (28 days)	5.35% (4.01% - 6.68%)	Year 1: Rocco [10]; subsequent years based on assumption
High dose HD at home hospitalisation probability (28 days)	7.09% (5.32% - 8.86%)	Year 1: Rocco [10]; subsequent years based on assumption
All PD hospitalisation probabilities (28 days)	6.69% (5.02% – 8.36%)	Lafrance , USRDS 2012 report [11,12]
Transplant probabilities		
Transplant rate – all modalities (28 days)	0.007 (0.005 – 0.009)	UK Renal Registry reports [13,14],
Graft failure probability – all modalities (28 days)	0.004 (0.003 – 0.005)	NHS Blood and Transplant Activity Report for 2012-13 [15]
Transition probabilities		
Proportion moving from ICHD -> home HD (28 days)		
0 – 12 months	0.05% (0.04% - 0.06%)	Assumption
13 – 18 months	0.03% (0.02% - 0.04%)	
19+ months	0%	
Proportion moving from home HD -> ICHD (28 days)		
0 – 19+ months	0.38% (0.29% - 0.48%)	McFarlane [16]
Proportion moving from HD -> PD (28 days)		
0 – 6 months	1.95% (1.46% - 2.44%) (incident population) 1.08% (0.81% - 1.35%) (prevalent population)	Johnson, Haller [17,18]
7 – 12 months	0.20% (0.15% - 0.25%)	
13 – 18 months	0.07% (0.05% - 0.08%)	
19+ months	0.06% (0.04% - 0.07%)	
Proportion moving from PD -> HD (28 days)		
0 – 6 months	2.61% (1.96% - 3.26%) (incident population) 1.87% (1.40% - 2.34%) (prevalent population)	Johnson, Haller [17,18]
7 – 12 months	1.13% (0.85% - 1.41%)	
13 – 18 months	0.78% (0.59% - 0.97%)	
19+ months	0.31% (0.23% - 0.39%)	

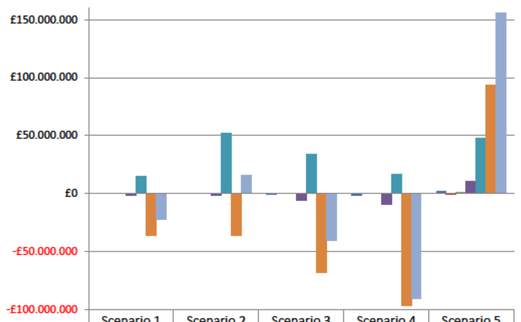
Table 2: Cost inputs & sources

Parameter	Value (range)	Data sources
Access costs		
Vascular access cost	£1,287 (£965 - £1,609)	PbR tariff 2013-2014 [19]
Peritoneal access costs (PD specific)	£1,233 (£854 – £1,423)	PbR tariff 2013-2014 [19]
ICHD cost per session		
Catheter access	£121 (£92 - £154)	PbR tariff 2013-2014 [19]
AV fistula/graft access	£152 (£115 - £191)	
Weighted	£147	Breakdown based on the target percentage set by the best practice tariff for 2013/14 [20]
Dialysis services costs		
Home HD cost per week	£456 (£342 - £570)	PbR tariff 2013-2014 [19]
PD cost per day		
APD	£52 (£39 - £65)	PbR tariff 2013-2014 [19]
CAPD	£46 (£35 - £58)	
ESA costs		
Conventional HD ESA cost (ICHD and home HD)		
Dose (units / week)	6,705 (5,029 – 8,381)	Rao, Chertow [9,21]
ESA cost per 1,000 units	£5.09 (£3.82 - £6.36)	BNF No. 64 [22]
High dose HD ESA cost (ICHD and home HD)		
Dose (units/week)	5,280 (3,960 – 6,600)	Rao, Chertow [9,21]
ESA cost per 1,000 units	£5.09 (£3.82 - £6.36)	BNF No. 66 [22]
PD ESA cost (all sub-modalities)		
Dose (units/week)	3,700 (2,775 – 4,625)	Rao, Chertow [9,21]
ESA cost per 1,000 units	£5.09 (£3.82 - £6.36)	BNF No. 66 [22]
Monitoring costs†		
Single professional	£132 (£99 - £165)	PbR tariff 2013-2014 [19]
Multi professional	£247 (£185 - £309)	
Weighted	£190	Equal weighting assumed.
Hospitalisation costs		
Cost per (HD) hospitalisation	£1,904 (£1,482 - £2,380)	Event costs from the PbR tariff 2013-2014 [19]. Event numbers from the National Schedule of Reference Costs 2011-12 [23]
Cost per (PD) hospitalisation	£1,596 (£1,197 - £1,995)	
Transport cost per visit (only applied to ICHD sessions)		
ICHD sessions‡	£46	Breakdown based on the National Kidney Care Audit, Patient Transport Survey 2010 [24]
Transplant costs		
Donor after brain death	£19,804 (£14,853 - £24,755)	National Schedule of Reference Costs 2012-13 [23]
Donor after cardiac death	£16,580 (£12,435 - £20,725)	
Living donor	£18,640 (£13,980 - £23,300)	
Weighted	£18,579	Breakdown based on the NHS Blood and Transplant Activity Report for 2012-13[15]
Post-transplant medication costs	£11,137 (£8,352 - £13,921)	NHS Kidney Care report [25]

Results

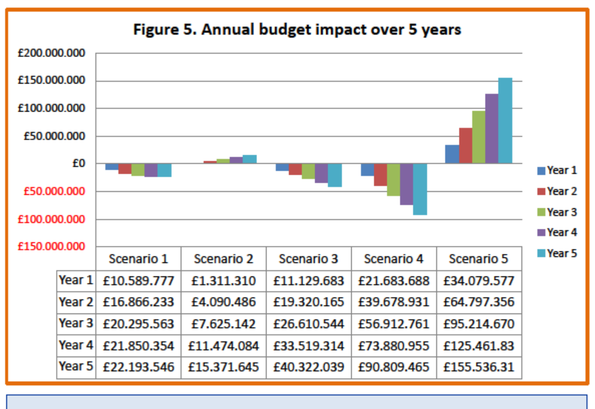
- Figures 4 & 5 presents the budget impact by cost type and year for each scenario respectively.
- With the current tariff, high dose HD at home is cost-saving. An increased tariff to £575/week would result in an increase in healthcare budget.
- Simultaneously developing both home modalities (high dose HD at home and PD) has the potential to generate savings of £40-90 million over 5 years.
- Treating all patients in-center would result in a £155 million increase in the dialysis budget over 5 years.

Figure 4. Five year cumulative budget impact by cost elements



	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Access costs	£59.624	£59.624	-£714.013	-£1.416.821	£1.996.640
Monitoring costs	£186.809	£186.809	£289.942	£383.231	-£249.753
Complication costs	£493.135	£493.135	£201.896	-£79.686	£1.458.905
ESA costs	-£1.426.159	-£1.426.159	-£5.537.057	-£9.261.407	£10.538.961
Treatment costs	£14.776.481	£52.341.672	£33.531.854	£16.533.121	£48.005.888
Transportation costs	-£36.283.437	-£36.283.437	-£68.094.662	-£96.967.902	£93.785.675
Cumulative difference	-£22.193.546	£15.371.645	-£40.322.039	-£90.809.465	£155.536.315

Figure 5. Annual budget impact over 5 years



	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Year 1	£10.589.777	£1.311.310	£11.129.683	£21.683.688	£34.079.577
Year 2	£16.866.233	£4.090.486	£19.320.165	£39.678.931	£64.797.356
Year 3	£20.295.563	£7.625.142	£26.610.544	£56.912.761	£95.214.670
Year 4	£21.850.354	£11.474.084	£33.519.314	£73.880.955	£125.461.83
Year 5	£22.193.546	£15.371.645	£40.322.039	£90.809.465	£155.536.31

Conclusions

- **Under the current England national tariff, increasing the proportion of patients on high dose home HD (10%) could help NHS reduce dialysis-associated costs.**
- **Increasing the high dose HD PbR tariff to £575/week will result in higher cost compared with current practice. But the increase in costs can be offset by simultaneously developing the home dialysis modality – PD, to the levels observed between 2005-2008.**
- The savings were mainly driven by the reduction of estimated transportation costs, which is the responsibility of the local budget holders.
- Our findings are consistent with the results from prior economic evaluations conducted by NICE.(5,26)
- This model was constructed from NHS's perspective and included only NHS costs. We did not include potential patient out-of-pocket payment for their dialyses. In addition, this model accommodated only hospitalization costs, not outpatient visit costs.

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