

Background

SC+ is a high performance and compact personal haemodialysis system, recently made available in the United Kingdom, for treating patients with kidney failure. The system has been shown to be safe and easy-to-use¹ by patients and health care professionals through several rounds of human factors testing, whilst not compromising on clinical performance. SC+ provides standard high flux dialysis using bicarbonate-buffered dialysate and widely available, off-the-shelf consumables with dialysate flow rates of up to 500 mL/min.

The incidence and prevalence of kidney failure is increasing worldwide, with the majority of patients receiving their life sustaining haemodialysis treatment thrice-weekly in-clinic. Home haemodialysis (HHD) enables patients to dialyse more frequently, at a time convenient to them, freeing them from the often rigid schedules of in-centre dialysis.

Health care payers often receive excellent value for money when using conventional haemodialysis machines for HHD, as it achieves equivalent or improved outcomes as well as improving the quality of life for patients². Using SC+ can provide the same advantages due to its patient-centric, easy-to-use design and ability to reduce barriers to treat. Studies have shown that patients receiving thrice-weekly dialysis in-centre are at risk of the “interdialytic gap”, commonly associated with significant increases in hospitalisation and emergency department visits following the two-day gap experienced over the weekend³. The primary aim of this study is to describe the associated costs of using SC+ for HHD, and in-centre on a 3x weekly and 3.5x weekly regimen in comparison to in-centre dialysis performed on a conventional dialysis machine.

Hypothesis

It is hypothesised that using SC+ for HHD or self-care in-centre will offer similar or improved costs when compared to traditional in-centre haemodialysis using conventional machines.

Method

This study is modelled from the perspective of the National Health Service England (NHS). All costs are presented in GBP (£) and inflated using the Consumer Price Index of Health for the UK. No discounting has been applied as data is limited to one year.

The total annual cost of maintenance dialysis for both 3x weekly and 3.5x weekly regimens for the following modalities was recorded:

- HHD with the Quanta SC+ Haemodialysis System
- Self-care in-centre with the Quanta SC+ Haemodialysis System
- Self-care in-centre with a conventional dialysis machine, used as a comparator

Cost estimates for NHS human resource and consumables were communicated by the device developer. Additional cost estimates were taken from available literature sources, and included dialysis-specific drugs, utilities, water, in-centre treatments for HHD patients and transportation.

Discussion

This analysis shows that lower costs are incurred when the SC+ Haemodialysis System is used on both a 3x weekly and 3.5x weekly regimen, for both self-care in-centre and HHD, when compared to the equivalent 3x weekly in-centre regimen using a conventional haemodialysis machine.

The evidence that HHD is safe and effective, offers equivalent or improved quality of life and is cost-effective when compared to traditional in-centre dialysis has been consistently demonstrated in the literature. HHD enables more frequent dialysis without the need to increase human resource, infrastructure or transport facilities. Its effect on the costs associated with reduced hospitalisation and emergency department visits should be explored in greater detail.

The perspective of the health payer is a limitation of this study. There is no heterogeneity as to what is covered by different health systems (e.g. transport and utilities). Consideration should be given to whether this burden is shifted to the patient or their caregivers.

Results

Quanta’s HHD offering is more cost-effective than that of traditional thrice-weekly, in-centre haemodialysis using conventional dialysis machines.

The annual cost of maintenance haemodialysis for a 3x weekly regimen performed at home using SC+ costs £34,981, increasing to £36,249 for a 3.5x weekly regimen. Self-care in-centre was marginally less expensive for a 3x weekly regimen, costing £34,866, and marginally more expensive for a 3.5x weekly regimen £38,573.

The biggest cost drivers were consumables, human resource and equipment expense. Despite higher clinic costs, and slightly higher human resource expense, the ability to amortize the machine over a greater number of patients doing self-care in-centre treatment produced only slightly higher costs to those patients doing HHD.

Transportation costs make up a significant portion of clinic-based dialysis costs (>10%) and should be factored into costing models that evaluate differing dialysis modalities.

Table 1
Annual Per-Patient Cost of Maintenance Dialysis by Modality and Regimen

	3x Weekly Conventional, In-Centre (£)	3x Weekly SC+ HHD (£)	3x Weekly SC+ Self-Care In-Centre (£)	3.5x Weekly SC+ HHD (£)	3.5x Weekly SC+ Self-Care In-Centre (£)
Human Resources	9,534.72	2,753.40	2,910.96	2,753.40	3,396.12
Benefits	1,906.94	550.68	582.19	550.68	679.22
Vacation, Relief and Sick Time	1,906.94	550.68	582.19	550.68	679.22
Consumables	7,595.33	13,557.96	13,557.96	13,557.18	13,557.18
Drugs (including EPO)	7,178.50	7,178.50	7,178.50	8,374.92	8,374.92
Equipment	2,123.79	7,166.86	2,211.40	7,165.82	2,736.26
Utilities (Electric)	included in clinic expenses	266.67	included in clinic expenses	311.11	included in clinic expenses
Utilities (Water)	included in clinic expenses	176.64	included in clinic expenses	206.07	included in clinic expenses
Clinic Expenses	5,311.80	N/A	3,984.24	N/A	4,648.28
In-Centre Runs	N/A	2,507.30	N/A	2,507.30	N/A
Transportation	3,858.29	272.06	3,858.29	272.06	4,501.34
TOTAL	£39,416	£34,981	£34,866	£36,249	£38,573

Conclusion

Using the Quanta SC+ Haemodialysis System demonstrates improved cost savings when used for both 3x and 3.5x weekly self-care in-centre and HHD modalities, versus dialysis provided with conventional machines, in-centre, on a traditional 3x weekly regimen.

Future analyses incorporating the additional benefits of 3.5x weekly or longer dialysis regimens and their influence on rates of hospitalisations and emergency department visits are warranted for both the Quanta SC+ Haemodialysis System and conventional dialysis machines.

SC+ is not yet cleared for sale or use in the USA.
¹Harasemiw O, Day C, Milad JE, Grainger J, Ferguson T, Komenda P. Human factors testing of the Quanta SC+ hemodialysis system: An innovative system for home and clinic use. Hemodialysis International 2019; DOI:10.0000/hdi.12757
²Bakris GL, et al. "Intensive Hemodialysis, Blood Pressure, and Antihypertensive Medication Use." American Journal of Kidney Disease 2016; 68(5)(suppl 1):S15-S23.
³Zhang, Sai, et al. "Emergency department visits and hospitalizations among hemodialysis patients by day of the week and dialysis schedule in the United States." PloS one 14.8 (2019).