Cost-effectiveness of high dose haemodialysis: a review of the literature

Poster No. MP562

Suzanne Laplante, Frank Xiaoqing Liu, Bruce Culleton

Baxter Healthcare Corporation, Deerfield, IL, USA

Abstract:

OBJECTIVES: There is increasing evidence that more frequent and/or longer duration haemodialysis (High Dose HD) is associated with better patient outcomes. This review was performed to identify the current knowledge on the cost-effectiveness of such regimen.

METHODS: A search of PubMed, Embase, the Cochrane Library, University of York Center for Reviews and Dissemination databases as well as websites of health technology assessment agencies (Canada, UK, Australia) was performed (2000 to December 2013). Key words included: short daily dialysis, nocturnal dialysis, quotidian dialysis, intense dialysis, and frequent dialysis, in combination with cost-effectiveness analysis, cost-utility analysis, and economic evaluation. All cost-effectiveness/cost-utility analyses published in English language were reviewed for methods and results.

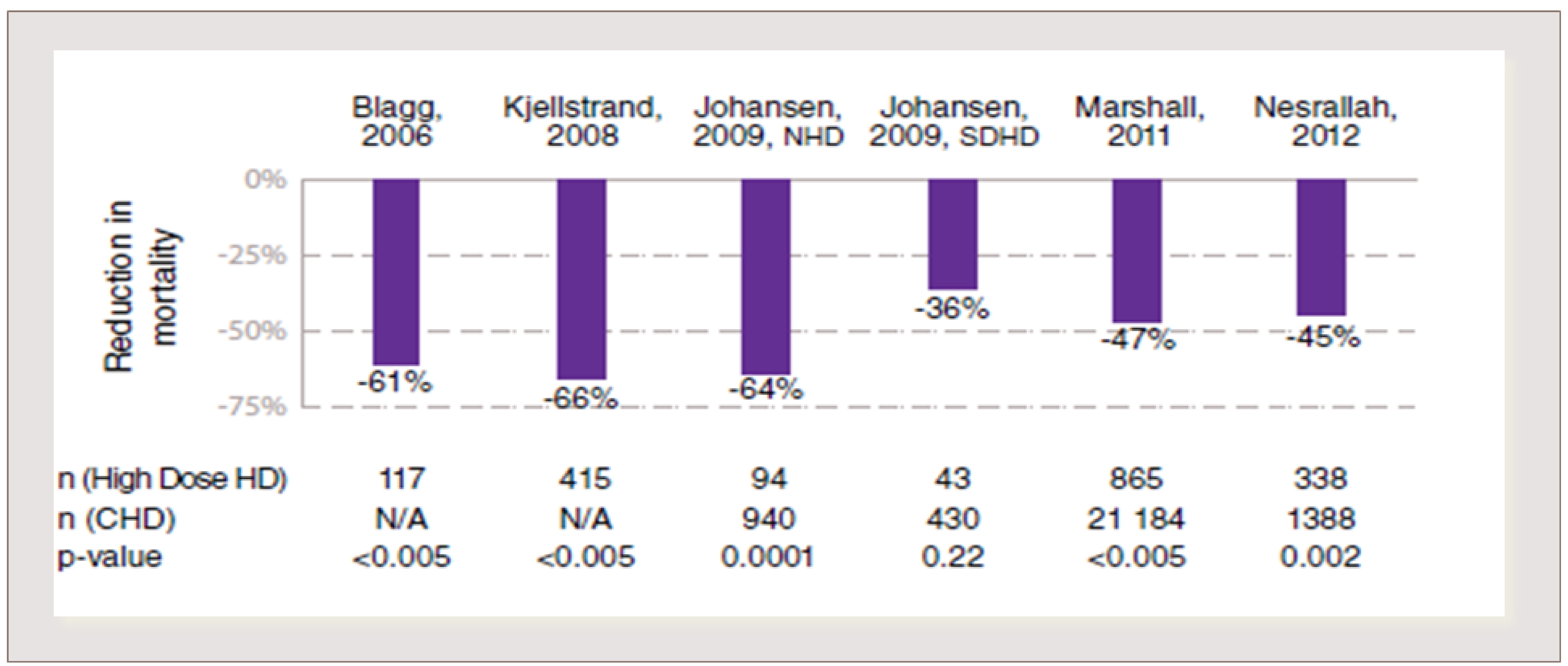
RESULTS: Seven analyses were identified (Canada=4; USA=1: UK=2), including 2 health technology assessments (HTA) where High Dose HD was evaluated in the sensitivity analyses only. High Dose HD (in-center=1; home=6) was compared to conventional in-center HD. Models included: decision-tree (1), microsimulation (1), and Markov chain (5). Peritoneal dialysis was included in the two HTAs only, but as absorptive state (i.e., not contributing to the costs and the benefits). Complications costs were included in all models; transplant in all but two and transport costs in 3 (sensitivity analysis only). Costs were collected in a small sample of patients in 3 analyses. Time horizons varied from 14-18 months (n=2), 10 years (n=2) and lifetime (n=3). High Dose HD was assumed to have a survival benefit in 3 analyses (sensitivity analysis only), while all models assumed a higher utility for High Dose HD (base case=6; sensitivity analysis=1). High Dose HD at home was found either cost-saving (n=5) or cost-effective (n=1), while High Dose HD in-center was not found cost-effective (although the willingness-to-pay threshold used by the authors was somewhat low for the USA). The most important cost drivers were: technique failure, dialysis costs and utility scores. Limitation to previously published analyses include: lack of inclusion of most recent clinical evidence on High Dose HD; using data from small short-term clinical trials; using a time horizon largely superior to the usual expected survival in the target population; not including all renal replacement therapies (e.g., peritoneal dialysis); not considering the extended survival observed with High Dose HD. All these could all have a significant impact on healthcare costs and the cost-effectiveness of High Dose HD.

CONCLUSION: Although High Dose HD appears cost-effective or cost-savings, there is a need to develop a new model to reflect recent scientific evidence and have a more comprehensive approach to treatment pathways and costs. Such a model should also be flexible to meet the needs of various healthcare jurisdictions.

Background

There is increasing evidence that more frequent and/or longer duration haemodialysis (High Dose HD) is associated with better patient outcomes (Fig 1). This review was performed to identify the current knowledge on the cost-effectiveness of such regimen.

Figure 1: Impact of high dose HD on survival of dialysis patients [1-5]



Objectives

Identify, review and critically appraise the available evidence on the cost-effectiveness of high dose HD vs. conventional, thrice-weekly, hemodialysis.

Methods

A search of PubMed, Embase, the Cochrane Library, University of York Center for Reviews and Dissemination databases as well as websites of health technology assessment agencies (Canada, UK-NICE, UK-Center for Evidence-based Purchasing, Australia) was performed (2000 to December 2013). Key words included: short daily dialysis, nocturnal dialysis, quotidian dialysis, intense dialysis, and frequent dialysis, in combination with cost-effectiveness analysis, cost-utility analysis, and economic evaluation. All cost-effectiveness/cost-utility analyses published in English language were reviewed for methods and results.

Information extracted included:

- Authors
- Year of publication
- Journal
- Country
- Type of analysis (e.g., cost-utility vs cost-effectiveness)
- Perspective (e.g., Minister of Health, healthcare provider, societal)
- Time horizon
- Model structure (e.g., decision-tree, Markov, micro-simulation, etc)
- Parameters included in the model, in particular:
  - Dialysis modalities
  - Complications
  - Transplant
  - Transport costs
  - Source of costs
  - Survival benefit and utility for High Dose HD
- Results
- Sensitivity analyses

Results

The search identified 137 titles. Of these only 7 met the selection criteria.

Of the 7 analyses identified, 4 were performed for Canada, 1 for the USA, and 2 for the UK. The 2 for the UK were done as part of health technology assessments (HTA) where High Dose HD was evaluated in the sensitivity analyses only. Details of the analyses identified are shown on Table 1.

Type of analysis:
All were cost-utility analyses
Perspective:
All used a Ministry of Health/public payer perspective.
Model structure:
Models were either decision-trees (2), Markov (4) or micro-simulation (1)
Time horizon:
Time horizons varied from 14-18 months (n=2), 10 years (n=2) and lifetime (n=3).
Model parameters:
Modalities:
High Dose HD (in-center=1; home=6) was compared to conventional in-center HD. Peritoneal dialysis was included in the two HTAs only, but as absorptive state (i.e., not contributing to the costs and the benefits).
Complications:
Complications costs were included in all models.
Transplantation:
Transplantion was included in all but two models.
Transport:
Transport costs were included in the sensitivity analysis only (i.e., not in the base case) of 3 models.
Survival benefit of High Dose HD:
High Dose HD was assumed to have a survival benefit in 3 analyses (sensitivity analysis only).
Utility of High Dose HD:
All models assumed a higher utility for High Dose HD (base case=6; sensitivity analysis=1).

Sensitivity analyses:
2 models used univariate, probabilistic and scenario analysis; one did not do any sensitivity analysis; all others used at least one method of sensitivity analysis.

Model conclusions:
High Dose HD at home was found either cost-saving (n=5) or cost-effective (n=1), while High Dose HD in-center was not found cost-effective (although the willingness-to-pay threshold used by the authors was somewhat low for the USA). The most important cost drivers were reported to be: technique failure, dialysis costs and utility scores

Critical appraisal:

Limitation to previously published analyses include:

- lack of inclusion of most recent clinical evidence on High Dose HD
- using data from small short-term clinical trials
- using a time horizon largely superior to the usual expected survival in the target population
- not including all renal replacement therapies (e.g., peritoneal dialysis)
- not considering the extended survival observed with High Dose HD.

All these could all have a significant impact on healthcare costs and the cost-effectiveness of High Dose HD.

Conclusions

Although High Dose HD appears cost-effective or cost-savings, there is a need to develop a new model to reflect recent scientific evidence and have a more comprehensive approach to treatment pathways and costs. Such a model should also be flexible to meet the needs of various healthcare jurisdictions.

Table 1: Details of the Cost-Effectiveness analyses identified

Study (Year)	Currency/ Year/ Discounting	Model	Horizon	High dose HD survival RR (vs conventional)	ICER	Sensitivity analyses	Costs	Regimens
Klarenbach et al (2013)[6]	CDN$/ 2012/ 5% costs; 5% benefits	Markov	Lifetime 1, 5, 10 years in sensitivity analyses	1.0 (0.75 in sensitivity analyses)	dominant	Multiple univariate deterministic; multivariate probabilistic; scenario analyses	collected alongside clinical trial: dialysis, nursing, MD, medications, training, vascular access, hospitalization, (transport, productivity loss, patient out-of-pocket costs in sensitivity analyses	In-home NHD (ave: 6-9 hr, 5.7 nights/wk vs CHD (4 hr, 3 times/wk) delivered in-center (61%), in satellite units (14%), or at home (25%)
Lee et al (2008)[7]	USD/ NA/ 3% costs; 3% benefits	Patient-level simulation	lifetime	0.81 (0.83*.975) for 5 x 4hours	USD 100-125,000/LYG	multivariate probabilistic simulation	dialysis, ESA and other medications, transplantation, hospitalizations, outpatient visits.	Frequent in-center HD (2-4.5 hr, 3.5-6 times/wk vs In-center CHD (3.5 hr, 3 times/wk)
McFarlane et al (2006)[8]	CDN$/ 2003/ 3% costs; 3% benefits	Markov	lifetime	1.0	dominant	multiple univariate deterministic; multivariate probabilistic simulation	from a previously published prospective matched cohort study: dialysis, MD, medications, labs, hospitalizations/procedures	NHD vs in-center CHD
McFarlane et al (2003)[9]	CDN$/ 2001/ not applicable	Decision-tree	14 months	1.0 (although not clearly stated in the publication)	dominant	bootstrapping to estimate confidence interval around ICER	from a previously published prospective matched cohort study: dialysis, MD, medications, labs, hospitalizations/procedures	In-home NHD vs in-center CHD
Kroeker et al (2003)[10]	CDN$/ 2001/ not applicable	Decision-tree	18 months	not applicable as HUI measured during the study	No incremental analysis performed	none	dialysis, outpatient visits, ER visits, hospitalizations, labs, medications	In-home SDHD vs in-home NHD vs in-center CHD
NHS CEP10063 (2010)[11]	GBP/ 2009/ 3.5% costs; 3.5% benefits	Markov	10 years	0.44 in sensitivity analysis only	dominant	univariate, probabilistic, scenario analyses	vascular access, dialysis, medications, complications, other healthcare services (transport, productivity loss, informal care in sensitivity analysis only)	In-center HD vs in-home HD (in-home High Dose HD in sensitivity analyses)
NHS TA48 (2002)[12]	GBP/ 2001/ 6.0% costs; 1.5% benefits	Markov	10 years	not applicable (QALY benefit rather than survival)	GBP 8,694/QALY vs in-center CHD; GBP 29,269/QALY vs satellite CHD	scenario analyses	vascular access, training, dialysis, complications (transport and informal care in sensitivity analysis only)	In-center HD vs satellite HD vs in-home HD (SDHD and NHD in sensitivity analyses)

CDN$= Canadian dollar; CHD = conventional hemodialysis; ER=emergency room; ESA: epoietin stimulating agents; GBP= Great Britain Pound; HD=hemodialysis; HUI = health utility index; ICER=incremental cost-effectiveness ratio; MD=medical doctor; NA=not available; NHD = nocturnal hemodialysis; QALY: quality-adjusted life-year; SDHD = short daily hemodialysis; UK = United Kingdom; USD=US dollar

References

1. Nesrallah et al. J Am Soc Nephrol 2012;23: 695-705
2. Marshall et al. Am J Kidney Dis 2011; 58: 782-293
3. Johansen et al. Kidney Int 2009; 76: 984-990
4. Kjellstrand et al. NDT 2008; 23: 3283-3289
5. Blagg et al. Hemodial Int 2006; 10:371-274
6. Klarenbach et al. J Am Soc Nephrol. 2013:Nov 14. [Epub ahead of print].
7. Lee et al. J Am Soc Nephrol. 2008;19:1792-1797.
8. McFarlane et al. Kidney Int. 2006;69:798-805
9. McFarlane et al. Kidney Int. 2003;64:1004-1011
10. Kroeker et al. Am J Kidney Dis. 2003;42:49-55
11. Purchasing and Supply Agency.Centre for Evidence-based Purchasing. Economic Report: Home Haemodialysis. 2010; Publication CEP10063
12. Mowatt et al. Health Technol Assess. 2003;7:1-174

Presented at the Annual Meeting of ERA-EDTA, June 2, 2014, Amsterdam, NL

Request information to: suzanne_laplante@baxter.com

DOI: 10.3252/pso.eu.51era.2014