Peritoneal Dialysis vs. In-center Hemodialysis: A Systematic Review of the Economic Literature

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Abstract

INTRODUCTION AND AIMS:
The incidence of end stage renal disease (ESRD) continues to increase globally due to an aging population, extended life expectancy, and complications from diabetes. As a result, the demand for dialysis therapy to treat patients with ESRD places a heavy burden on the global health care system. The purpose of this study is to comprehensively review existing peer-reviewed publications comparing the costs for patients receiving any type of peritoneal dialysis (PD) vs. in-center hemodialysis (ICHD).

METHODS:
We queried PubMed and EMBASE (2004 to Oct 2011) using a combination of MeSH headings related to healthcare economics, costs, reimbursement, pricing, and the various dialysis modalities. Original research publications with text and/or abstracts in English which reported costs associated with PD and ICHD were included in our review.

RESULTS:
Our search identified 23 original research articles comparing the costs of PD vs. ICHD. Most of these studies considered the costs of PD vs. ICHD in Western Europe, North America, Australia/New Zealand, and/or Asia. A few studies presented information for countries in Africa, Eastern Europe, the Middle East, or Latin America. The reported utilization of PD varied greatly between countries; for example, an estimated 80% of dialysis patients in Hong Kong use PD compared with only 8% in the United States. In most developed countries, patients on PD experienced lower total overall health care expenditures. In Australia, for instance, the estimated health system expenditure per patient per year (PPPY) was $53,112 for PD vs. $79,072 for ICHD (2008-2009 AUD). In the United Kingdom, a 2008 study found that the least costly dialysis modality was continuous ambulatory peritoneal dialysis (CAPD, £20,764/year), followed by automated PD (APD, £21,655) vs. ICHD (£35,023). In the United States, a study using 2009 USRDS data estimated the PPPY cost of PD and ICHD at $53,446 and $73,008, respectively. However, in Japan, national health expenditures were lower for ICHD ($42,098) vs. PD ($49,215; 2003 USD). Furthermore, there are a number of reports that patients receiving PD (vs. ICHD) are more likely to continue workforce participation.

CONCLUSIONS:
Our results are consistent with prior published reviews which found that patients with PD were associated with lower overall healthcare expenditures compared with ICHD in most developed countries. However, variations in equipment, dialysis solution, and labor costs may make PD a more expensive alternative, especially in less developed areas. Available published studies vary widely in terms of methodology (including economic perspective and cost-years), as do country-specific reimbursement and cost structures for dialysis, making specific comparisons difficult. More high-quality studies with consistent parameters are needed in order to make robust comparisons of total healthcare costs associated with PD vs. ICHD.

Introduction

- The incidence of end stage renal disease (ESRD) continues to increase globally due to an aging population, extended life expectancy, and complications from diabetes (Li et al., 2011).
- As a result, the demand for dialysis therapy to treat patients with ESRD places a heavy financial burden on the global health care system.
- In-center hemodialysis (ICHD) still remains the most commonly used mode of dialysis worldwide, although in certain countries such as Hong Kong, New Zealand, and certain regions in Mexico, peritoneal dialysis (PD) utilization is relatively high (USRDS 2010).
- An understanding of the economic costs associated with dialysis treatment alternatives will allow for more informed policy development and clinical decision-making.

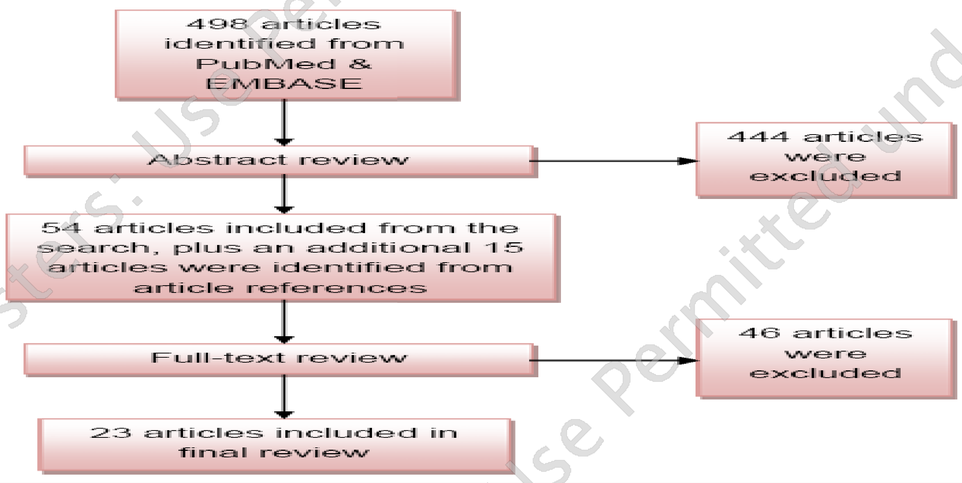
Aims

- The purpose of this study is to assess the global evidence describing the costs and/or cost-effectiveness of PD as compared to ICHD.
- The research questions of interest are as follows:
  1. What are the relative costs (direct and indirect) of PD and ICHD?
  2. What is the cost-effectiveness, cost-benefit, or cost-utility of PD vs. ICHD?

Methods

- We conducted a systematic review of peer-reviewed economic evaluations of dialysis treatment modalities indexed in MEDLINE and EMBASE.
- PD included all subtypes of PD: assisted automated PD (aAPD), assisted continuous ambulatory PD (aCAPD), automated PD (APD), assisted PD (aPD), and continuous ambulatory PD (CAPD).
- ICHD included ICHD and satellite hemodialysis.
- Databases were limited to articles published between January 2004 and March 2012.
- Articles were included if they contained the terms “peritoneal dialysis or continuous ambulatory peritoneal dialysis” and “renal dialysis or hemodialysis” and “economics or health economics or cost or costs or expenditures”.
- Articles were excluded if they did not include primary cost data for both PD and ICHD or were of the following publication types: Editorials, Letters, Case Reports, Comments, Review Articles, non-English studies, and Conference Abstracts.
- Two reviewers agreed on the final set of articles selected for this review.

Search Results



Results

Table 1. Studies Reporting Higher Annual Costs for ICHD vs. PD

Author, Year	Country	Currency/ Year	Perspective (I) = implied (S) = stated	Costs Included	Costs (in local currency) PD	CAPD	APD	Satellite HD	ICHD
Ashton & Marshall, 2007	New Zealand	2002-2004 NZ$	(S) = National Health System, Society	Direct	-	36,615	45,686	48,172	64,318
Baboolal et al., 2008	UK	£, year not specified	(S) = Payer, National Health Service	Direct	-	15,570	21,655	32,669	35,023
Benain et al., 2007	France	2005 €	(S) Payer, Health Insurance System	Direct, Indirect	-	49,953	49,676	-	81,449
Berger et al., 2009	US	US$, year not specified	(I) = Payer, Insuror	Direct	129,997	-	-	-	173,507
Durand- Zaleski et al., 2007	France	2003 €	(S) National Health System, Society	Direct	23,926	-	-	-	Public : 97,696 Private : 61,959
Erek et al., 2004	Turkey	2001 US$	(I) = Payer, Various	Direct		22,350	-	-	22,759
Hallinen et al., 2009	Finland	€, year not specified	(S) = Payer	Direct, Indirect	55,743	-	-	-	77,126
Kleophas & Reichel, 2007	Germany	2002 €	(S) National Health System, Society	Direct	53,613	-	-	-	53,613
Kontodimopoulos et al., 2005	Greece	€, year not specified	(I) = Payer	Direct, Indirect	38,359	-	-	-	45,479
Neil et al., 2009a	UK	2007 £	(S) = Hospital	Direct		16,355	22,350	-	35,023
	Singapore	2006 SGD	(S) = Government	Direct		14,880	21,336	-	24,720
	Mexico	2006 US$	(S) = Government	Direct	15,724	-	-	-	24,032
	Chile	2005 US$	(I) = Government	Direct, Indirect	17,031	-	-	-	18,885
	Romania	2006 €	(S) = Government	Direct	12,700	-	-	-	18,400
	Thailand	2005 Baht	(I) = Government	Direct, Indirect	461,541	-	-		519,047
	China	2005 RMB	(S) = Hospital	Direct, Indirect	84,141	-	-		98,204
	Columbia	2006 US$	(I) = Government	Hospital Costs Only	-	775	884	-	2,144
Neil et al., 2009b	US	2005 US$	(S) = Payer, Medicare	Direct	50,847	-	-	-	69,758
Pacheco et al., 2007	Chile	2005 US$	(I) = Payer, Society	Direct, Indirect	20,742	-	-	-	20,803
Pontoriero et al., 2007	Italy	2001 €	(S) = National Health System, Society	Direct	-	16,790	20,075	26,208	33,322
Shih et al., 2005	US	2004 US$	(S) = Payer, Medicare	Direct	53,277	-	-	-	72,189

Table 2. Studies Reporting Higher Annual Costs for PD vs. ICHD

Author, Year	Country	Currency/Year	Perspective (I) = implied (S) = stated	Costs Included	Costs (in local currency) PD	CAPD	APD	Satellite HD	ICHD
Fukuhara et al., 2007	Japan	2003 Yen converted to 2003 US$ using PPP	(S) = National Health System, Society	Direct	49,215	-	-	-	42,098
Lamas Barreiro et al., 2011	Spain	2010 €	(I) = National Public Health System, Society	Direct	25,664	-	-	-	21,595

Table 3. PD and ICHD Cost-effectiveness Studies

Author, Year	Country	Currency/ Year	Perspective	Outcome measure	PD Costs	ICHD Costs	Findings
Haller et al., 2011	Austria	€, year not specified	Payer, Public Health Perspective	QALYs	25,900	43,600	Increasing assignment to PD of 20% incident patients over 10 years saves €26 million and gains 839 QALYs
Hooi et al., 2005	Malaysia	2001 RM	Payer, Ministry of Health	LYs	31,635	33,642	Cost per life year saved is RM33,642 for ICHD and RM31,635 for CAPD
Howard et al., 2009	Australia	2004 A$	Payer, Society	LYs, QALYs	56,828	82,764 (Hospital) 48,630 (Satellite)	Increasing rate of PD by switching patients from ICHD saves A$122.1 million assuming equivalent outcomes
Kontodimopoulos & Niakas, 2008	Greece	€, year not specified	Payer, Health System	QALYs	30,719	36,247	Cost per QALY was higher for ICHD (€60,353) compared to PD (€54,504)
Salonen et al., 2007	Finland	1997 US$	Payor, Service Providers	LYs	57,845	64,463	If modality changes and cadaveric transplantations were ignored, annual first three years' CERs varied between $41,220–61,465 on CAPD and $44,540–85,688 on ICHD.
Teerawattanon et al., 2007	Thailand	2004 Baht	Society	LYs, QALYs	356,000	380,000	Compared to palliative care, initial treatment with PD was 672,000 Baht per QALY gained and initial treatment with ICHD was 806,000 Baht per QALY gained
Villa et al., 2012	Spain	2010 €	Society	QALYs	25,971 - 26,023	36,314 - 36,444	Calculated ICER's for 4 scenarios Scenario 1: Spain's current situation Scenario 2: ↑ proportion of scheduled incident patients Scenario 3: ↑ scheduled incident patients on PD Scenario 4: both Scenarios 2 & 3 ICERs for Scenarios 2, 3, and 4 compared to Scenario 1 were –€83,150; –€354,977; and –€235,886 per QALY

Discussion and conclusion

Published economic studies of alternative dialysis modalities vary widely in terms of methodology, including perspective, data and cost sources, time horizon, and inclusion of all relevant costs. Nevertheless, in general:

- Most studies find PD to be a less expensive dialysis treatment alternative than ICHD. As a result, patients treated with PD were associated with lower overall healthcare system costs (i.e., dialysis procedure, transport, complications/hospitalizations, ambulatory costs), which could help countries facing with growing healthcare budget for patients with ESRD.
- While PD procedure costs may not always be lower compared to ICHD procedure costs, for example, PD procedure costs were reported to be higher than ICHD procedure costs in two studies, one from Japan and one from Spain, patient’s overall total healthcare costs (i.e., including transport, complications/hospitalizations, ambulatory costs) tend to be lower for those on PD vs. ICHD.
- PD is more cost-effective – and potentially cost-saving over time – compared to ICHD.
- Policies that encourage the use of PD may help address the growing global financial burden of providing dialysis treatment.
- Our findings that PD is less costly and more cost-effective vs. ICHD in most countries are consistent with prior research.
- More rigorous studies comparing the overall health care expenditures and benefits of PD vs. ICHD should be considered in the future healthcare planning.

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Note:
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