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International Congress of Nephrlogy, Dialysis, and Transplantation

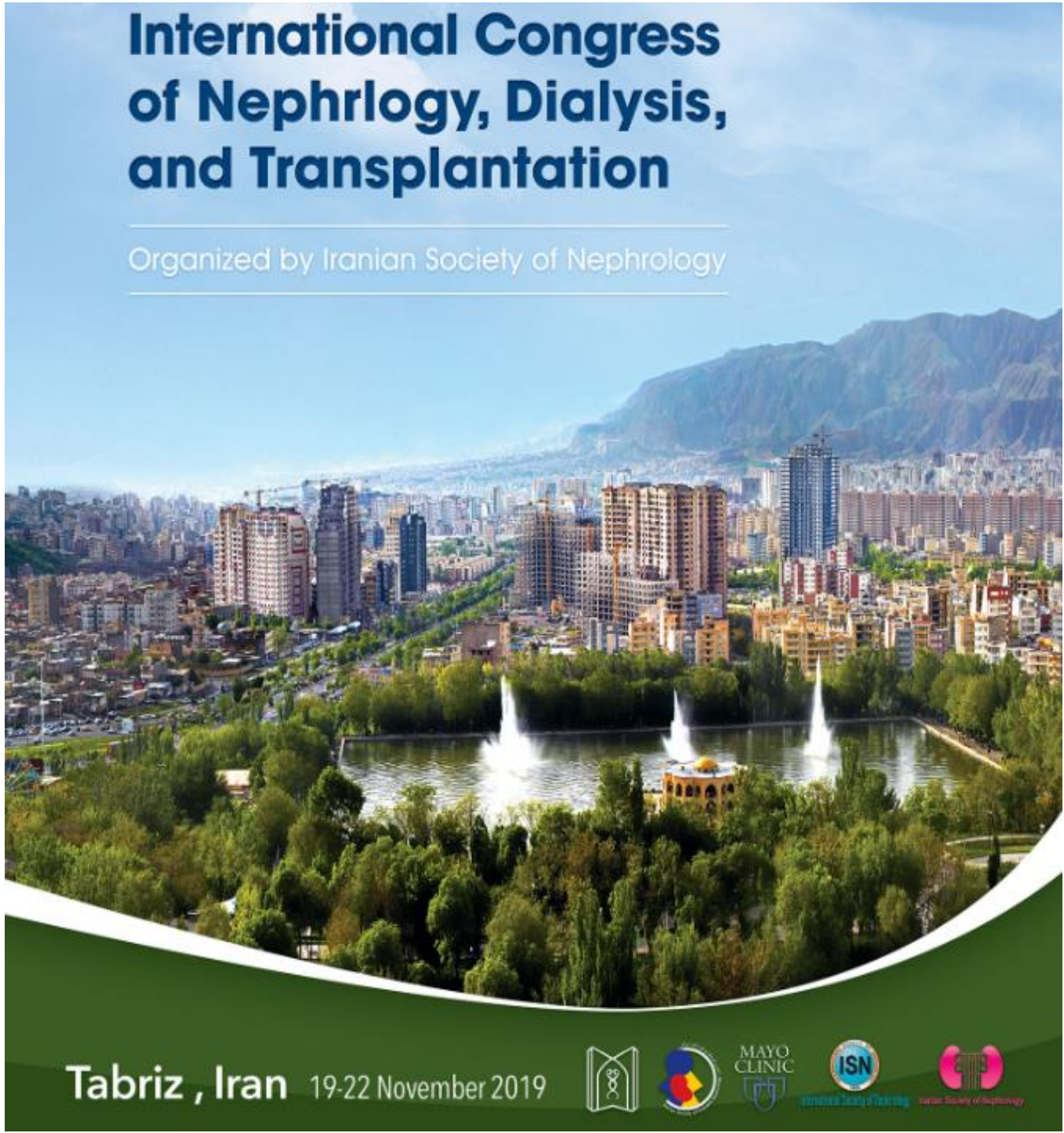
Organized by Iranian Society of Nephrology

Dear colleagues you are very welcome to this congress

Tabriz , Iran 19-22 November 2019

Home Hemodialysis

Iraj Najafi MD



Treatment of ESRD should provide the following

1) The maximum medical, social, economic, and psychological rehabilitation
2) Few ill effects
3) The highest possible quality of life
4) Excellent patient compliance
5) Maximum opportunity for employment and education
6) Maintenance or "repair" of family dynamics
7) The least possible stress on patients, families, and the health care team
8) **The best possible patient outcomes**

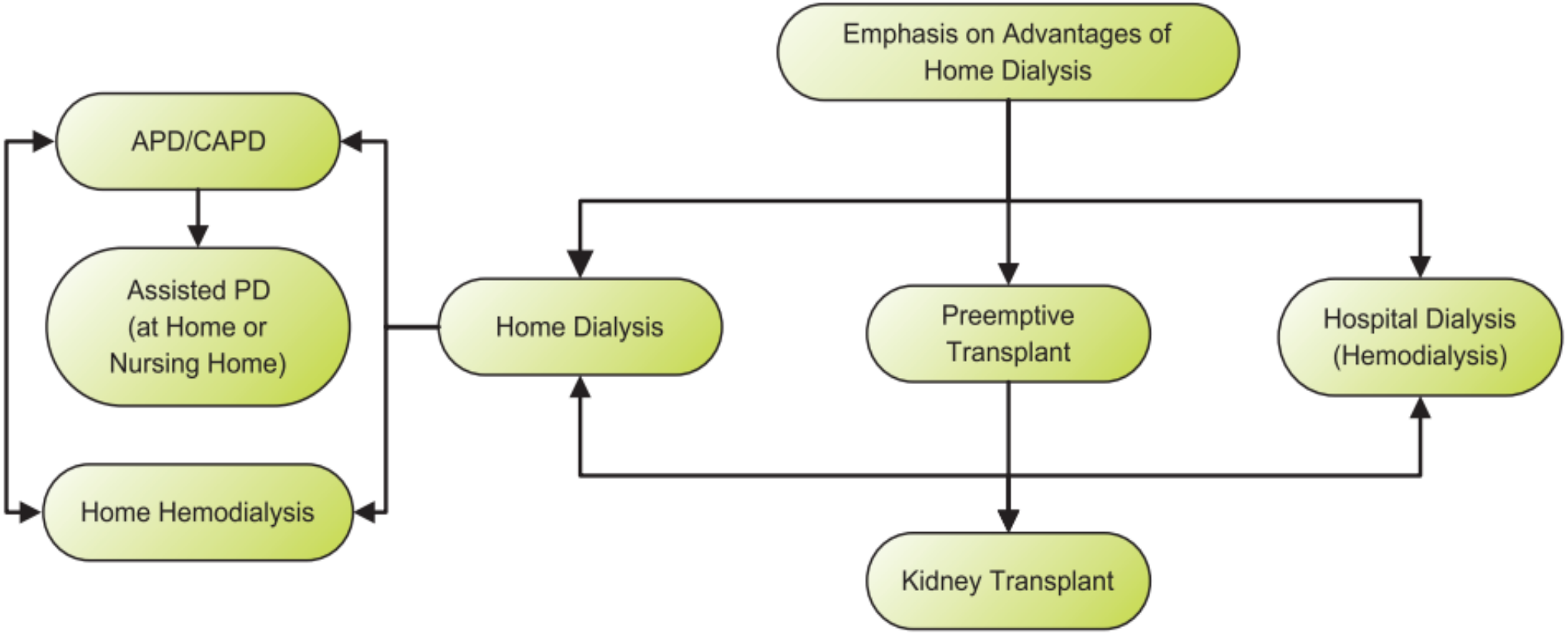


Figure 3. Integrated end-stage renal disease care. APD indicates ambulatory peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; and PD, peritoneal dialysis.

Home hemodialysis

Iranian Society of Nephrology

Nov. 2019

Hemodialysis International

Hemodialysis International 2015; **19**:S112–S127

Prescriptions for home hemodialysis

Robert LOCKRIDGE,[1] Tom CORNELIS,[2] Carolyn VAN EPS[3]

[1]Lynchburg Nephrology Physicians, Lynchburg, Virginia, USA; [2]Department of Internal Medicine, Division of Nephrology, Maastricht University Medical Center, Maastricht, The Netherlands; [3]Princess Alexandra Hospital, Brisbane, New South Wales, Australia

Abstract

Prescribing a regimen that provides "optimal dialysis" to patients who wish to dialyze at home is of major importance, yet there is substantial variation in how home hemodialysis (HD) is prescribed. Geographic location, patient health status and clinical goals, and patient lifestyle and preferences all influence the selection of a prescription for a particular patient—there is no single prescription that provides optimal therapy for all patients, and careful weighing of potential benefit and burden is required for long-term success. This article describes how home HD prescribing patterns have changed over time and provides examples of commonly used home HD prescriptions. In addition, associated clinical outcomes and adequacy parameters as well as criteria for identifying which patients may benefit most from these diverse prescriptions are also presented.

Home hemodialysis

Included

All forms of HD performed in a home setting

conventional

long

frequent

long/frequent

sessions

Table 8 Home HD modality prescriptions

Modality	Sessions per wk	Session duration (h)	QB (mL/min)	QD (mL/min)	Base (mmol/L)	K^+ (mmol/L)	Ca^{2+} (mmol/L)	PO_4 added
Traditional (standard-hours)	3–3.5	3–5	300–400	500–800	HCO_3, 32–36	2	1.25	None
Alternate-night nocturnal	3.5	6–8	250–350	300–500	HCO_3, 28 – 35	2	1.25	Rare
Traditional short daily	5–6	2.5–3.5	350–400	350–600	HCO_3, 32–36	2	1.25	None
Traditional nocturnal	4–6	6–8	250–350	300	HCO_3, 28–35	3	1.5–1.75	20–30% of time
Low-flow dialysate short daily	5–6	2.5–4	300–400	90–300	Lactate, 40–45	2	1.5	None
Low-flow dialysate nocturnal	4–6	6–8	300–350	83–166	Lactate, 40–45	2	1.75	None

Ca^{2+} = calcium; HCO_3 = bicarbonate; K^+ = potassium; PO_4 = phosphate; QB = blood flow rate; QD = dialysis fluid flow rate.

Hemodialysis International 2015; **19**:S112–S127

Prescriptions for home hemodialysis

Robert LOCKRIDGE,[1] Tom CORNELIS,[2] Carolyn VAN EPS[3]
[1]*Lynchburg Nephrology Physicians, Lynchburg, Virginia, USA;* [2]*Department of Internal Medicine, Division of Nephrology, Maastricht University Medical Center, Maastricht, The Netherlands;* [3]*Princess Alexandra Hospital, Brisbane, New South Wales, Australia*

- Instead of providing **adequate dialysis**, we should strive for **"optimal dialysis"** defined in terms of:

- Excellence in quality of life, control of symptoms, and normalization of risk factors, including blood pressure, cardiac structure and function, mineral balance, nutrition, hormonal status, and survival

- If we, as clinicians, accept this:
  it is unlikely that any single dialysis prescription will be optimal for all patients

Table 9 Comparative efficacy across prescriptions relative to renal transplant

Renal replacement therapy	Regimen intensity		Efficacy relative to transplant (5 = transplant, 0 = no treatment)			
	Sessions per wk	Session duration (h)	Controls volume	Controls PO_4	Minimum adequacy[a]	Optimal adequacy[b]
Transplant	—	—	5	5	4	5
CAPD and CCPD without residual renal function	—	—	1	1	4	0
Traditional HD (standard hours)	3	3–5	2	1	4	1
	3.5	3–5	3	2	4	2
Traditional short daily HD	5–6	2.5–3.5	5	3	4	3
Traditional nocturnal HD	3.5	6–8	4	4	4	4
	5–6	6–8	5	5	4	5
Low-flow dialysate short daily HD	5–6	2.5–4.0	5	2	4	3
Low-flow dialysate nocturnal HD	5–6	6–8	5	4	4	4

Daily Home Hemodialysis: Value Proposition

- **Improves Quality of Life**
  - Travel and Recovery Time Greatly Reduced
  - Improved Sleep, Appetite, and Diet
- **Clinically Superior to 3X/Week In-Center Treatment**
  - B/P Crashes ↓71%
  - Cramps ↓76%
  - Irregular heartbeat ↓90%
  - Heart enlargement ↓29%
  - Inflammation ↓42%
  - EPO resistance ↓46%

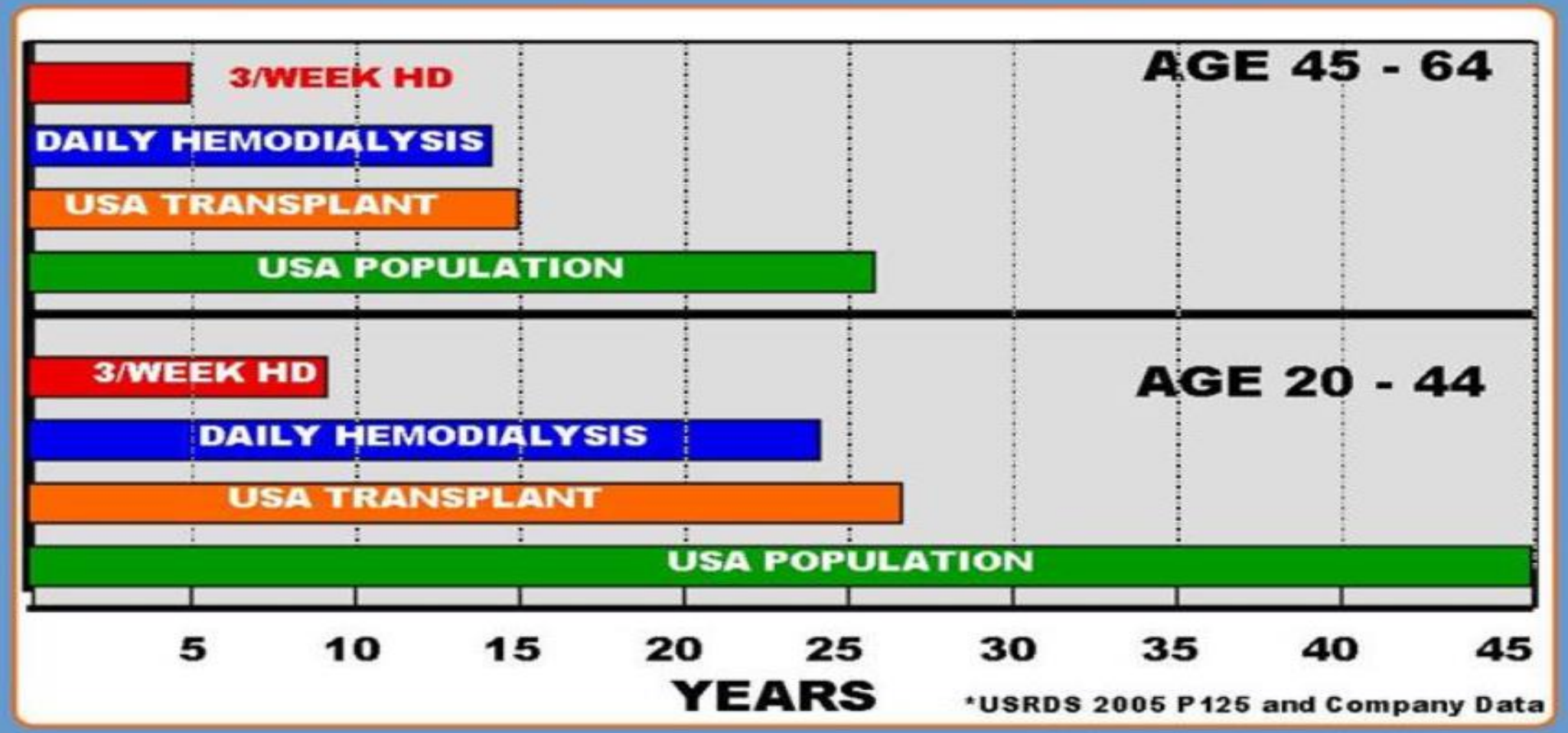
Advantages of Home Hemodialysis

- Hemodialysis while sleeping.
- Better blood pressure management—less need for medications.
- Avoidance of intradialytic hypotension, something common in IHD.
- More energy and less 'wash-out' syndrome.
- Decreased prevalence of sleep apnea.

Advantages of Home Hemodialysis

- Less dietary restrictions—e.g., phosphate binders and food restrictions.
- Control over the dialysis treatment schedule and greater life satisfaction.
- Improve ejection fraction and regression in left ventricular hypertrophy.
- Live longer, according to randomized clinical studies.

Daily Hemodialysis Life Expectancy



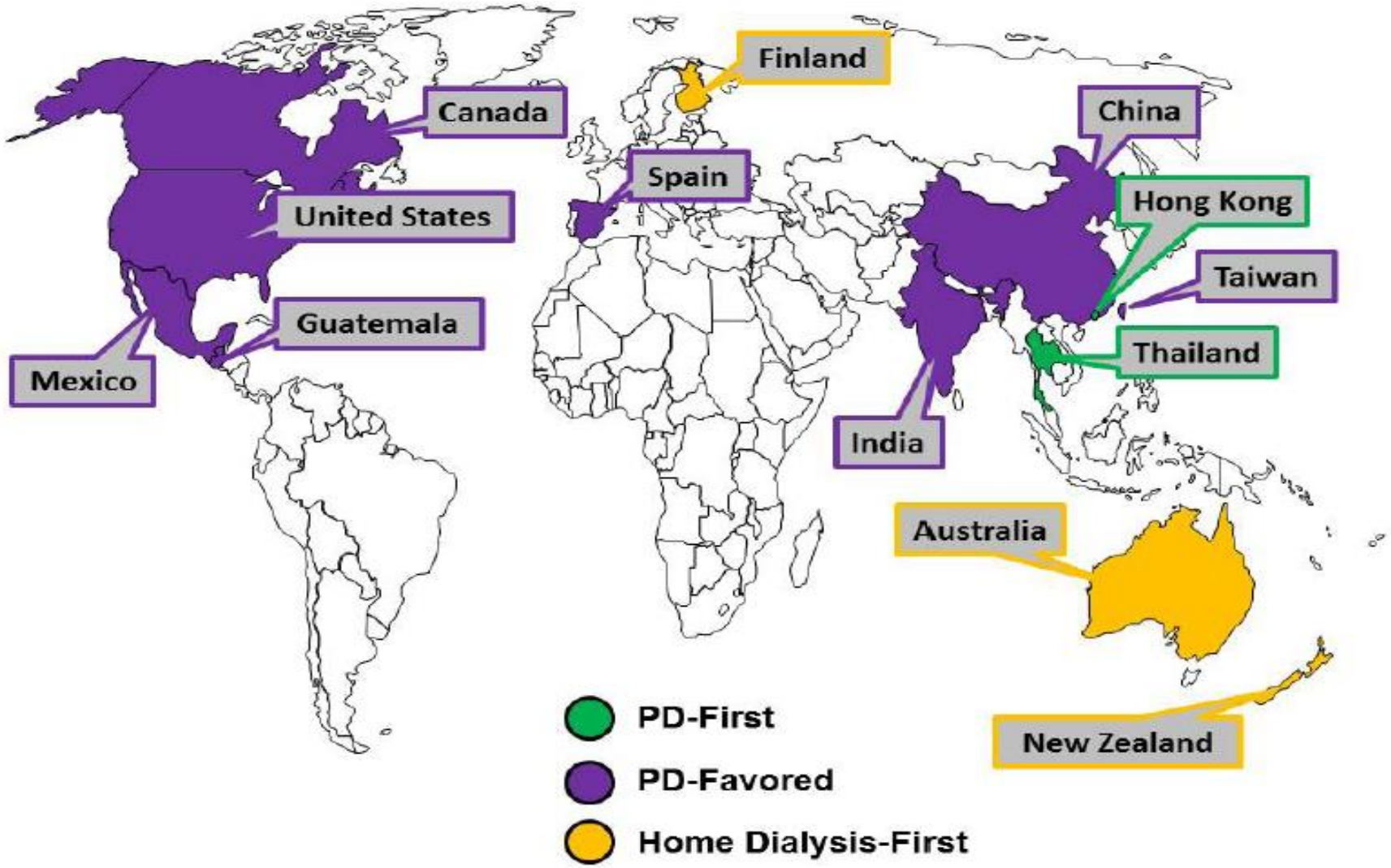
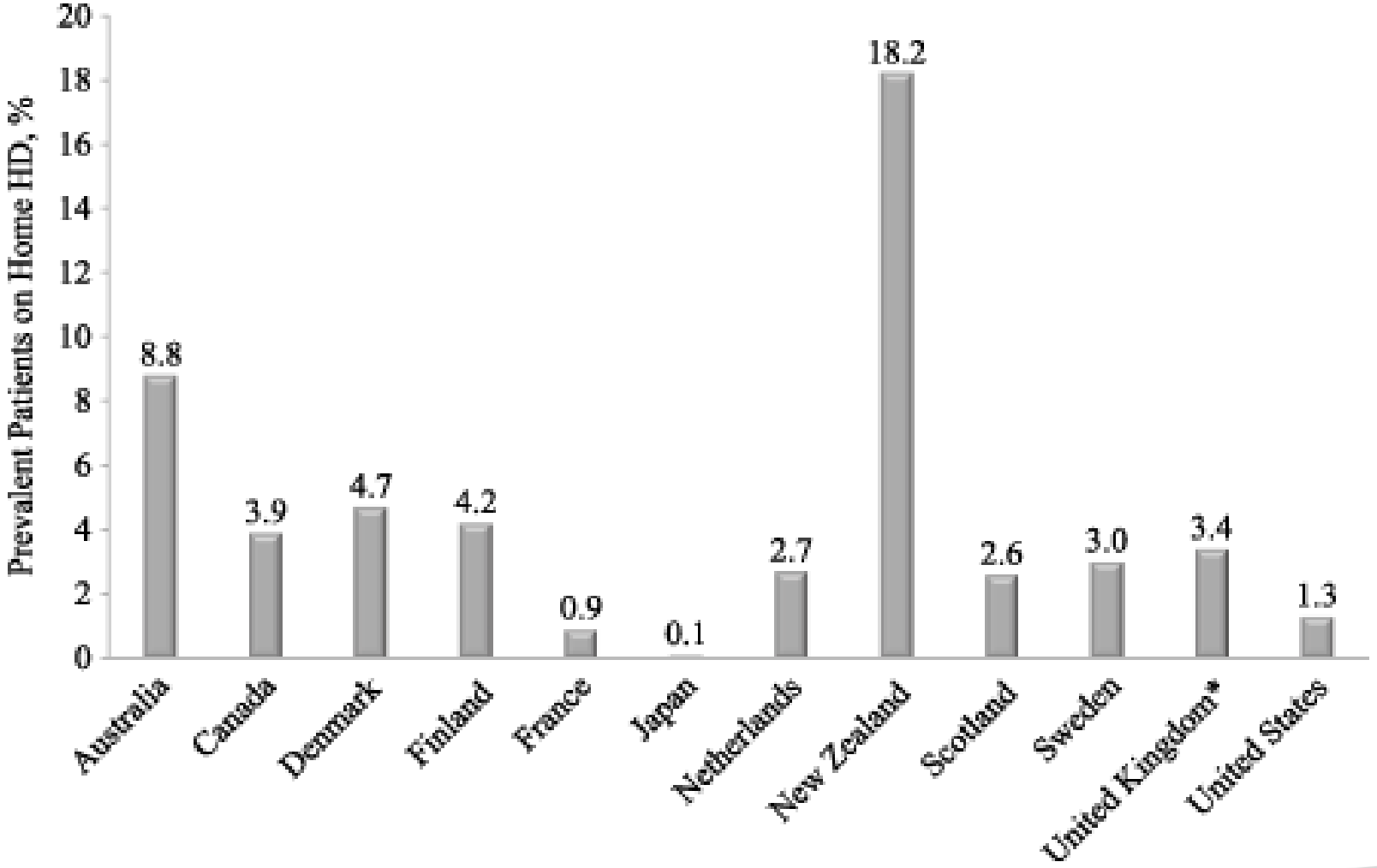


Figure 1 — Geographic summary of country-specific policy types. PD = peritoneal dialysis.

Worldwide Prevalence of Home HD, %

Prescriptions for home hemodialysis



Hemodialysis International
pages 112-127, 29 APR 2015 DOI: 10.1111/hdi.12279
http://onlinelibrary.wiley.com/doi/10.1111/hdi.12279/full#hdi12279-fig-0001

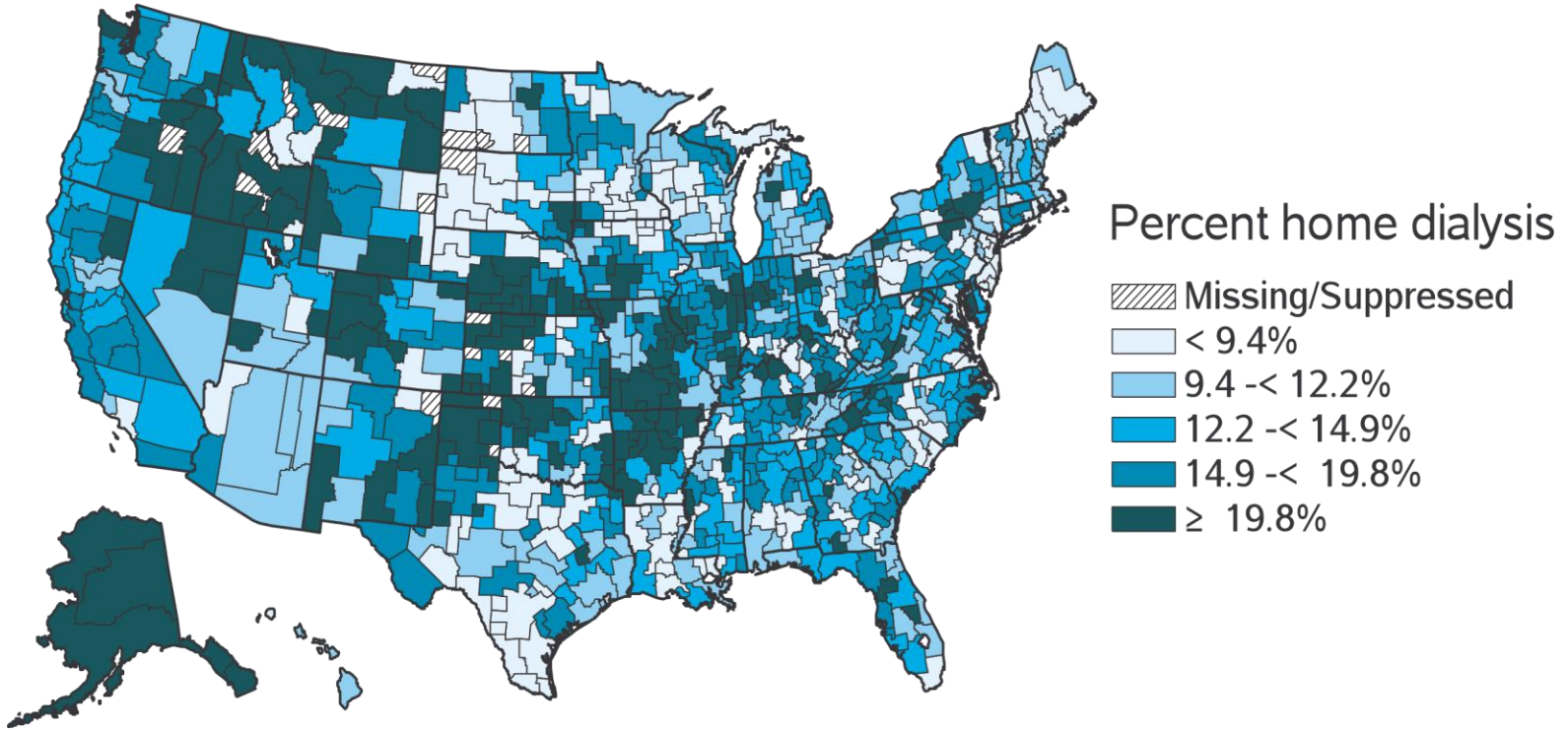
USRDS

UNITED STATES RENAL DATA SYSTEM

2018 Annual Data Report
Volume 2: End-Stage Renal Disease

Chapter 1: Incidence, Prevalence, Patient Characteristics, and Treatment Modalities

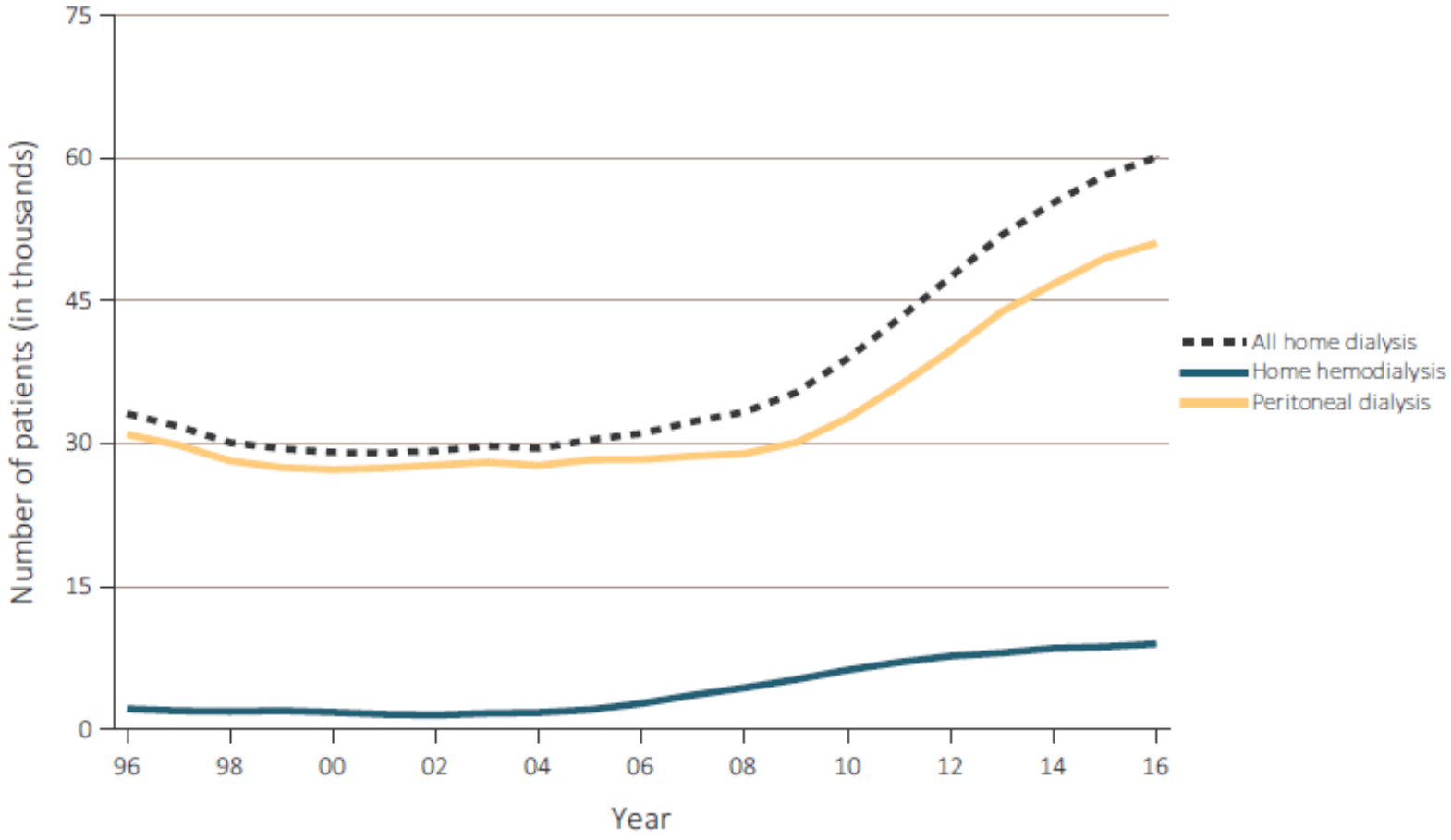
Vol 2 Figure 1.17 Map of the percentage of prevalent dialysis cases using home dialysis, by Health Service Area, 2012-2016



Data Source: Special analyses, USRDS ESRD Database. Values for cells with 10 or fewer patients are suppressed.

2018 Annual Data Report
Volume 2 ESRD, Chapter 1

Vol 2 Figure 1.16 Trends in number of prevalent ESRD cases using home dialysis, by type of therapy, in the United States, 1996-2016



2018 Annual Data Report
Volume 2 ESRD, Chapter 1

Home hemodialysis History in USA

- When HHD was first attempted, it was difficult because the equipment was large and complicated.
- Scribner worked to make the process easier for patients, and by the 1970s, nearly 40% of the dialysis patient population in the United States was doing HHD.
- The percentage of patients on HHD dropped over the following 20 years due to different reasons, but in the 1990s, HHD began to gain favor in the dialysis community once again.

REASONS FOR THE DECLINE IN HOME HEMODIALYSIS

- Increasing elderly , seriously ill, diabetes
- Increase in the number of outpatient dialysis units
- Concern that patients should not dialyze without a nurse
- Lack of explanation of the advantages of modalities
- Risk of social isolation
- Lack of attention to HHD by nephrology training programs
- The small number of experienced dialysis programs in HHD
- Lack of patient and/or family motivation
- Technical aspects of hemodialysis,

Technical aspects of hemodialysis

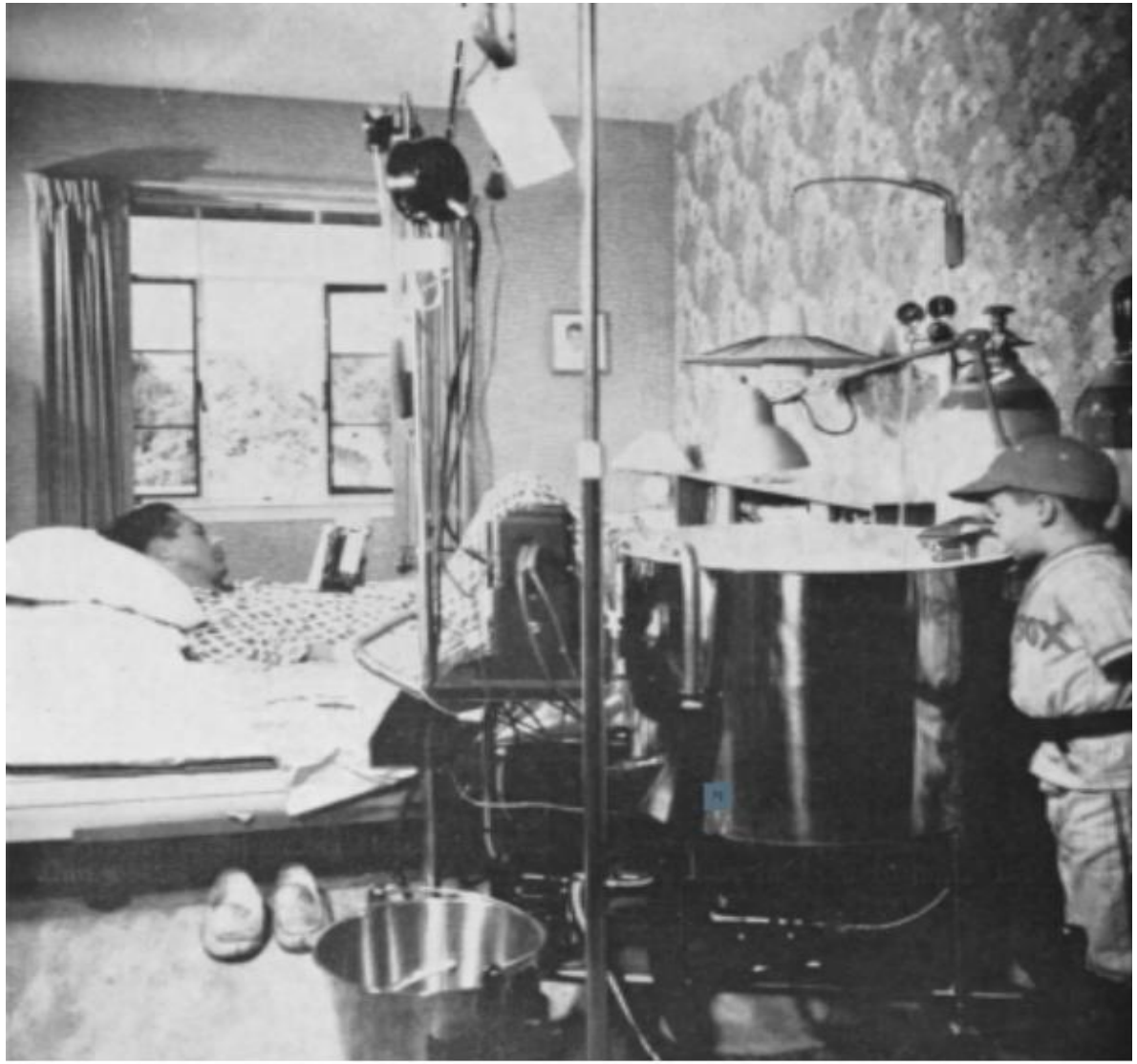
Conventional machines for home hemodialysis

- Such machines generally employ a high dialysis flow rate
- High flow rates potentially increase water and electrical costs
- Mandating home electrical and/or plumbing modifications that render the use of such machine impractical for some patients

Annals of Internal Medicine in 1966

Hampers and Merrill from Boston, MA

They concluded that home dialysis was a “safe and practical way” of performing hemodialysis, with “long term feasibility” established with the program lasting more than a year. This was one of the earliest studies published on home hemodialysis.



A picture from the Hampers and Merrill study:
Patient having dialysis at home with 5-year-old son looking on.

New dialysis technology designed to be more user-friendly for patients, staff

January 6, 2016

Review

Haemodialysis at home: review of current dialysis machines

Sabrina Haroon & Andrew Davenport

Pages 337-347 | Received 16 Jan 2018, Accepted 13 Apr 2018, Accepted author version posted online: 14 Apr 2018, Published online: 26 Apr 2018

Download citation https://doi.org/10.1080/17434440.2018.1465817 Check for updates

REQUIREMENTS OF
HOME HEMODIALYSIS MACHINE

❖ **A home hemodialysis machine should have the following characteristics:**

- Easy to use
- Require minimal storage space
- No electrical or plumbing modification to the home
- Energy and water efficient not increase water and electricity costs
- Portable for travel

Water Treatment innovations

- Conventional water treatment systems use standard, portable, reverse osmosis systems.
- Production of ultra-pure dialysate using small tanks.
- Sorbent regeneration of dialysate.
- Using premixed sterile dialysate bags.

Volumetric fluid balancing system provides unique benefits

Hemodial Int. 2010 Jan;14(1):39-46. doi: 10.1111/j.1542-4758.2009.00399.x. Epub 2009 Sep 16.

Solute kinetics with short-daily home hemodialysis using slow dialysate flow rate.

Kohn OF[1], Coe FL, Ing TS.

Author information

[1]University of Chicago, Chicago, Illinois, USA. okohn@medicine.bsd.uchicago.edu

❖NxStage System One

- The ultrapure dialysate volumes are typically between 15 L and 30 L per dialysis
- Standard Kt/V 2.5+/-0.3 per week, beta(2)M, phosphorus, and urea nitrogen removal in patients dialyzing 6 d /17.5 hours /wk **compared favorably** with:

✓ Thrice weekly conventional

✓ Short-daily hemodialysis performed with machines using much higher dialysate flow rates

NxStage Medical's System One gains FDA clearance for home nocturnal haemodialysis

(Ref: StreetInsider, MarketWatch)

December 22nd, 2014

By: Katie Bell

Tags: Marketing & Sales Regulatory Affairs NxStage Medical System One FDA

NxStage Medical announced Monday that its System One received FDA clearance to perform home nocturnal haemodialysis. The company said that the device is the "only haemodialysis machine cleared by the FDA for this indication."

CEO Jeffrey Burbank remarked "we are delighted with this milestone achievement, which we believe will open home haemodialysis therapy to new segments of patients, and improve patient care for [end-stage -renal disease] patients by expanding therapeutic options and flexibility."

The NxStage® System One™ S with NxView™

Improving the SIMPLICITY of acute renal replacement therapy.

The System One is currently **used by leading US hospitals** including **15 of the top 20 renal care hospitals** as ranked by US News & World Report.[1]

The NxStage System One S with NxView is designed to be simple, yet versatile enough to allow you to deliver the prescribed dose to your patients.

- Broad range of flow rates allows you to individualize the therapy based on the condition of the patient, whether you choose CRRT, IHD, SLEDD/SHIFT, UF or TPE

Nat Rev Nephrol

Intensive home hemodialysis: benefit and barrier

Tennankore KK[1], Chan CT, Curran SP , 2012

A resurgence of interest in HHD in Past decade

- Simple-to-operate systems
- Similar or better outcomes
- Low dialysate volumes with slow dialysate flow
- The NxStage machine have the potential for home short daily hemodialysis, as well as for **home nocturnal hemodialysis**.

HOME HEMODIALYSIS MACHINE

❖ **At least four additional systems are in development**

- A second-generation AKSYS machine
- A machine using sorbent technology by Fresenius Medical Care,
- A portable machine by the University of Oregon
- Portable machine by Quanta SelfCare Plus.
- Additionally, a wearable artificial kidney is also being tested at several institutions in the United States.

These easier-to-use systems would help patients surmount the barrier associated with machine complexity.

Editorial

Creating a wearable artificial kidney: where are we now?

Jeroen P Kooman ✉, Jaap A Joles & Karin GF Gerritsen

Pages 373-376 | Published online: 15 Jun 2015

Review

From portable dialysis to a bioengineered kidney

Maaike K. van Gelder, Silvia M. Mihaila, Jitske Jansen, Maarten Wester, Marianne C. Verhaar, Jaap A. Joles, ...show all

Pages 323-336 | Received 15 Jan 2018, Accepted 05 Apr 2018, Accepted author version posted online: 10 Apr 2018, Published online: 20 Apr 2018

Download citation https://doi.org/10.1080/17434440.2018.1462697 Check for updates


aksys
www.aksys.com

Aksys PHD System

Clean-in-place blood circuit
- Reduces inflammatory cascade
- Improves outcomes
- Lower cost to operate

Automates time-consuming manual functions
- Set-up
- Priming
- Dialysis
- Rinsing
- Disinfection
- No chemicals; hot water
- Includes integrated water purification

Produces the ONLY injectable-quality dialysate

Regular backflushes (Hemodiafiltration)

Lower utilization cost allows 5-7x per week
- Fixed cost

Aksys' Generation 2 Machine

>All the Advantages of the PHD and:

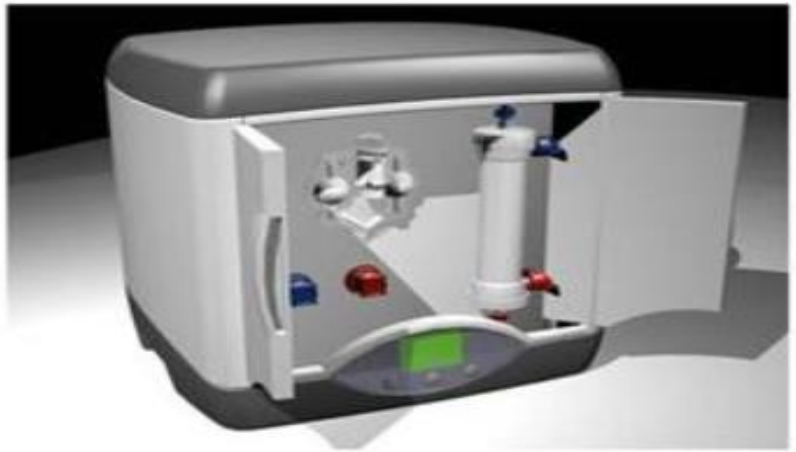
>Smaller

>Transportable

>Lighter

>Quieter

>More Reliable



Low Cost to:

>Manufacture

>Install

>Maintain

G2's Advantages Will Stimulate Demand

	Safety	Cost of Consum-ables	Bio-compati-bility	Ease of Use	Cost to Clinic	Cost to Make	Portability	Reliability
AKSYS G2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
AKSYS PHD	🟢	🟢	🟢	🟢	🔴	🔴	🔴	🔴
NxStage System One	🟢	🔴	🔴	🟡	🟡	🟡	🟢	🟢
Fresenius 2008K @home	🟢	🟡	🔴	🔴	🟢	🟢	🔴	🟢

Home hemodialysis

❖ **Today, home hemodialysis (HHD) is growing in popularity due to:**

- Developments in equipment
- Self-cannulation
- Training programs

Daily Hemodialysis: A Systematic Review

Rita S. Suri,* Gihad E. Nesrallah,† Rahul Mainra,* Amit X. Garg,*‡ Robert M. Lindsay,* Tom Greene,§ and John T. Daugirdas‖

*Division of Nephrology and ‡Department of Epidemiology and Biostatistics, University of Western Ontario, London, Ontario, and †Division of Nephrology, Humber Regional Hospital, Toronto, Ontario, Canada; §Department of Quantitative Health Sciences, Cleveland Clinic Research Foundation, Cleveland, Ohio; and ‖Department of Medicine, University of Illinois, Chicago, Illinois

Several studies have reported improved outcomes with daily hemodialysis (DHD), but the strength of this evidence has not been evaluated. The published evidence on DHD was synthesized and its quality rated to inform need and sample size calculations for a randomized trial. Citations were identified in MEDLINE and EMBASE using validated search strategies. Dialysis journals that were not indexed and bibliographies of relevant articles were hand-searched. Two authors reviewed all citations. Articles that reported original data on five or more adults who were receiving DHD (1.5 to 3 h, 5 to 7 d/wk) for ≥3 mo were included. Twenty-five articles reporting 14 unique populations with 268 patients (five to 72 per study) met inclusion criteria. Of the 14 cohorts, 13 were studied with an observational design, 10 were studied prospectively, and four had parallel control groups. Mean age ranged form 41 to 64 yr, mean time on dialysis was 2 to 11 yr, 0 to 28% of patients had diabetes, >90% had arteriovenous fistulae, and >50% were dialyzed at home. Most data were described at ≤12 mo of follow-up. Outcomes included quality of life, cardiovascular disease, erythropoiesis, nutritional status, hospitalizations, and vascular access failures. Reporting was too heterogeneous to allow pooling of data. Ten of 11 studies suggested improvements in blood pressure; findings for other outcomes varied. Discontinuation of DHD occurred in 0 to 57% in-center and 0 to 15% home patients. Studies of DHD are limited by small sample size, nonideal control groups, selection and dropout biases, and paucity of data on potential risks. Randomized trials with adequate statistical power are required to establish the efficacy and the safety of DHD.

Clin J Am Soc Nephrol 1: 33–42, 2006. doi: 10.2215/CJN.00340705

Daily Hemodialysis: A Systematic Review

Rita S. Suri*, Gihad E. Nesrallah Rahul Mainra*, Amit X. Garg* ‡, Robert M. Lindsay*
John T. Daugirdas

- Studies of DHD are limited by small sample size, non ideal control groups, selection and dropout biases, and paucity of data on potential risks.

- Randomized trials with adequate statistical power are required to establish the efficacy and the safety of DHD

Survival benefit with home hemodialysis

Weinhandl et al

Study	Year of publication	Conventional Dialysis	Home hemodialysis	Adjustment technique	Comparison of all-cause mortality	P value
Woods et al	1996	3 times a week (N = 3102)	Not described(N= 70)	Indirect standardization	RR: 0.56 (0.34 – 0.92)[a]RR: 0.58 (0.35 – 0.95)[b]	0.020.03
Blagg et al	2006	3 times a week (N = 19)	Short Daily(N = 98)	Indirect standardization	SMR: 0.39 (0.19 – 0.51)[a]	<0.005
Kjellstrand et al	2008	3 times a week (N = 150)	Short Daily(N = 265)	Indirect standardization	RR: 0.34 (0.20 – 0.54)[c]	<0.001
Johansen et al	2009	3 times a week (N = 430)	Short Daily(N = 43)	Propensity score matching	HR: 0.64 (0.31 – 1.31)[d]	0.22
Johansen et al	2009	3 times a week (N = 940)	Nocturnal Daily(N = 94)	Propensity score matching	HR: 0.36 (0.22 – 0.61)[d]	0.0001
Weinhandl et al	2012	3 times a week (N = 9365)	Short Daily(N = 1873)	Propensity score matching	HR: 0.87 (0.78–0.97)[e]	0.01

CJASN ePress. Published on January 10, 2013 as doi: 10.2215/CJN.04810512

Article

Comparing Mortality of Peritoneal and Hemodialysis Patients in the First 2 Years of Dialysis Therapy: A Marginal Structural Model Analysis

Lilia R. Lukowsky,† Rajnish Mehrotra,‡ Leeka Kheifets,† Onyebuchi A. Arah,†§‖ Allen R. Nissenson,¶** and Kamyar Kalantar-Zadeh*†¶*

22,360 hemodialysis and 1,358 peritoneal dialysis in

Davita

- Peritoneal dialysis was associated with **persistently greater survival independent of the known confounders**, including dialysis modality switch (i.e., death hazard ratio of 0.52 [95% confidence limit 0.34–0.80])

Home Dialysis

HD vs PD

Iraj Najafi

November 2019

CLINICAL | HOME DIALYSIS

New data shows home hemodialysis superior to PD for patient and technique survival, hospitalizations

Results of a new study conducted by the Chronic Disease Research Group show daily home hemodialysis patients have a 16% lower risk of death, 8% lower risk of hospitalization, and 38% lower risk of therapy attrition than peritoneal dialysis patients/p>

MARK E. NEUMANN — NOVEMBER 19, 2014

Home Hemodialysis vs Peritoneal Dialysis 2014

- Match 4,460 **frequent daily home hemodialysis** patients from a registry of NxStage Medical System One users with 4,460 peritoneal dialysis patients

- 13% lower risk of cardiovascular-related **death**
  20% lower risk of infection-related **death**

- **Frequent daily home hemodialysis** patients were
  16% less likely to be **hospitalized** for cardiovascular
  11% less likely for infection-related diagnoses

Home Hemodialysis vs Peritoneal Dialysis 2014

- Cumulative incidence of **technique failure** for daily home hemodialysis vs. peritoneal dialysis

- 9.1% vs. 17.3% at six months
- 17.9% vs. 27.3% at one year
- 27.5% vs. 37.5% at two years
- 31.9% vs. 44.7% at three years

http://www.kidney-international.org

OPEN

The risk of hospitalization and modality failure with home dialysis

Rita S. Suri[1,2], Lihua Li[2] and Gihad E. Nesrallah[3,4]

[1]Department of Medicine, Section of Nephrology, Centre de Recherche, Centre Hospitalier de l'Université de Montréal (CHUM), Montréal, Québec, Canada; [2]Division of Nephrology, Western University, London, Ontario, Canada; [3]Department of Nephrology, Humber River Regional Hospital, Toronto, Ontario, Canada and [4]The Li Ka Shing Knowledge Institute, Keenan Research Centre, St. Michael's Hospital, Toronto, Ontario, Canada

- We matched 1116 **daily home hemodialysis** (DHD) patients by propensity scores to 2784 USRDS patients receiving **home peritoneal dialysis** (PD), and compared **hospitalization rates** from cardiovascular, infectious, access-related or bleeding causes (prespecified composite), and **modality failure risk**

- We performed similar analyses for 1187 **DHD** patients matched to 3173 USRDS patients receiving in-center conventional hemodialysis **(CHD)**

	No of events		Unadj hazard ratio (95% CI)	*P*-value
	Home DHD (*n*=1187)	In-center CHD (*n*=3173)		
All hospitalization	1503	7562	0.92 (0.85–1.00)	0.053
All infection	730	2905	1.15 (1.04–1.29)	0.006
Cardiac	555	3717	0.68 (0.61–0.77)	<0.001
Access related	373	1358	1.25 (1.08–1.43)	0.002
Access non infection	150	668	1.04 (0.86–1.27)	0.669
Access infection	223	690	1.43 (1.20–1.71)	<0.001
Bleeding	89	317	1.19 (0.86–1.63)	0.292

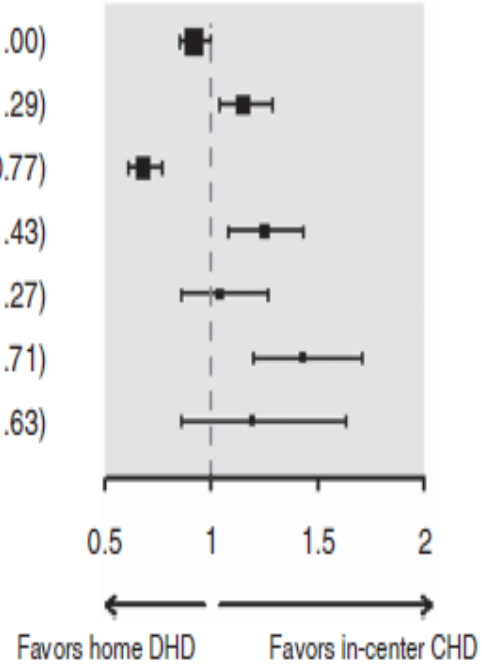


Figure 3 | Relative hazard of hospitalization associated with daily home hemodialysis (DHD) versus in-center conventional hemodialysis (CHD). CI, confidence interval; No, number.

	No of events		Unadj hazard ratio (95% CI)	P-value
	Home DHD (*n*=1116)	PD (*n*=2784)		
All hospitalization	1414	6689	0.73 (0.67–0.79)	<0.001
All infection	681	2898	0.81 (0.73–0.90)	<0.001
Cardiac	524	2897	0.66 (0.58–0.74)	<0.001
Access related	363	1858	0.60 (0.52–0.69)	<0.001
Access non infection	139	630	0.67 (0.54–0.84)	<0.001
Access infection	224	1228	0.56 (0.48–0.66)	<0.001
Bleeding	87	288	0.89 (0.67–1.17)	0.385

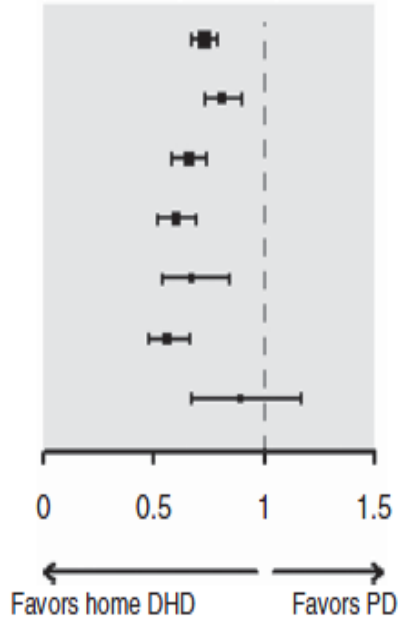


Figure 2 | Relative hazard of hospitalization associated with home daily home hemodialysis (DHD) versus peritoneal dialysis (PD).
CI, confidence interval; No, number.

DHD patients spent significantly fewer days in hospital than PD patients
(5.2 vs. 9.2 days/patient-year)
significantly more DHD patients remained admission-free
(52% DHD vs. 32% PD)

The risk of hospitalization and modality failure with home dialysis

,2015 Rita S. Suri1,2, Lihua Li2 and Gihad E. Nesrallah

- **Hospitalization risk** is equal between home DHD and in-center CHD, but higher in PD
- **Modality failure risk** is higher in PD

1% of DHD patients switched to PD, whereas **25%** of PD patients switched to home HD

15% of the DHD compared with **44%** of the PD switched back to in-center CHD

The hazard of switching back to in-center CHD with PD relative to DHD was 3.4 (2.9–4.0, P 0.001)

Well-conducted prospective studies are needed to confirm these findings

CJASN ePress. Published on June 11, 2015 as doi: 10.2215/CJN.00840115

Article

An Incident Cohort Study Comparing Survival on Home Hemodialysis and Peritoneal Dialysis (Australia and New Zealand Dialysis and Transplantation Registry)

Annie-Claire Nadeau-Fredette,[†‡] *Carmel M. Hawley,*[*†§] *Elaine M. Pascoe,*[‖] *Christopher T. Chan,*[¶] *Philip A. Clayton,*[†**] *Kevan R. Polkinghorne,*[*†††‡‡§§‖‖‖] *Neil Boudville,*[*¶¶] *Martine Leblanc,*[‡] *and David W. Johnson*[*†§]

Abstract

Background and objectives Home dialysis is often recognized as a first-choice therapy for patients initiating dialysis. However, studies comparing clinical outcomes between peritoneal dialysis and home hemodialysis have been very limited.

*Department of Renal Medicine, University of Queensland at Princess Alexandra Hospital, Brisbane, Australia;

All Australian and New Zealand adult patients receiving home dialysis on day 90 after initiation of RRT between 2000 and 2012

Table 1. Baseline characteristics

Characteristic	Peritoneal Dialysis (n=10,710)	Home Hemodialysis (n=706)	P Value
Age (yr)	62 (50, 71)	50 (42, 58)	<0.001
Men	6082 (57)	531 (75)	<0.001
Race			<0.001
White	7389 (69)	590 (84)	
Asian	1236 (12)	47 (7)	
Aboriginal/Torres Strait Islander	601 (6)	7 (1)	
Maori	899 (8)	33 (5)	
Pacific Peoples	468 (4)	24 (3)	
Other	117 (1)	5 (1)	
Primary kidney disease			<0.001
GN/autoimmune	2662 (25)	273 (39)	
Diabetes	3739 (35)	126 (18)	
Hypertension/renovascular	1526 (14)	47 (7)	
Polycystic kidney disease	593 (6)	132 (19)	
Reflux	338 (3)	39 (6)	
Other/unknown	1852 (17)	89 (13)	
Cigarette use (current)	1458 (14)	85 (12)	0.23
Comorbidities at dialysis entry			
Chronic lung disease	1606 (15)	54 (8)	<0.001
Coronary disease	4060 (38)	122 (17)	<0.001
Periphery vascular disease	2585 (24)	61 (9)	<0.001
Cerebrovascular disease	1594 (15)	32 (5)	<0.001
Diabetes	4648 (43)	159 (23)	<0.001
Body mass index (kg/m^2)			<0.001
<20	823 (7)	32 (5)	
20–24.9	3451 (32)	177 (25)	
25–29.9	3712 (35)	248 (35)	
≥30	2682 (25)	243 (35)	
Late referral (<3 months)	2128 (20)	45 (6)	<0.001
eGFR	7.5 (5.6–9.9)	7.5 (5.8–9.4)	0.59
RRT initiation era			0.12
2000–2005	4843 (45)	298 (42)	
2006–2012	5876 (55)	408 (58)	
Country			<0.01
Australia	8090 (76)	565 (80)	
New Zealand	2620 (24)	141 (20)	

Baseline Characteristics

Overall

Patients treated with HHD

were younger and healthier

than

patients treated with PD

Australia and New Zealand
Dialysis and Transplantation Registry study

- All Australian and New Zealand adult patients receiving home dialysis on day 90 after initiation of RRT between 2000 and 2012.
- The primary outcome:

  Overall survival

- The secondary outcomes:

  On-treatment survival

  Patient and technique survival

  Death-censored technique survival

- Adjusted with three prespecified models:

  Multivariable Cox proportional hazards model (main model)

  Propensity score quintile–stratified model

  propensity score–matched model

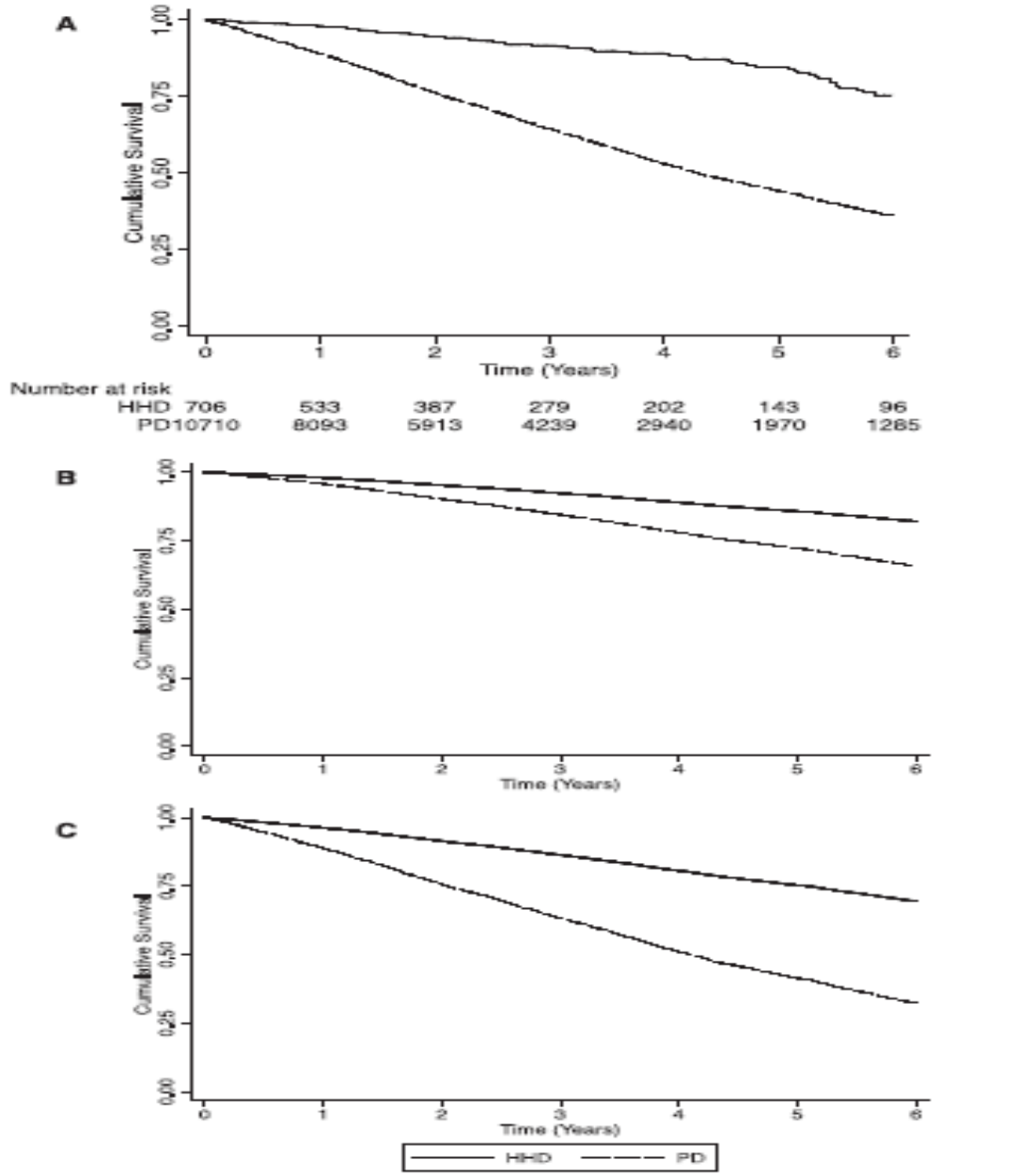
Figure 1. | Survival curves for primary outcome.

A)Unadjusted Kaplan–Meier surviva curve

(log-rank P,0.001)

B) Adjusted survival curve for a 50-year-old non- indigenous man with non glomerular kidney disease and **without** diabetes, coronary disease, peripheral vascular disease and late referral (P,0.001)

(C) Adjusted survival curve for a 60-year-old non-Indigenous woman wit nonglomerular kidney disease,and **with** diabetes, and coronary disease and without peripheral vascular disease and late referral (P,0.001



Survival curves for secondary outcomes

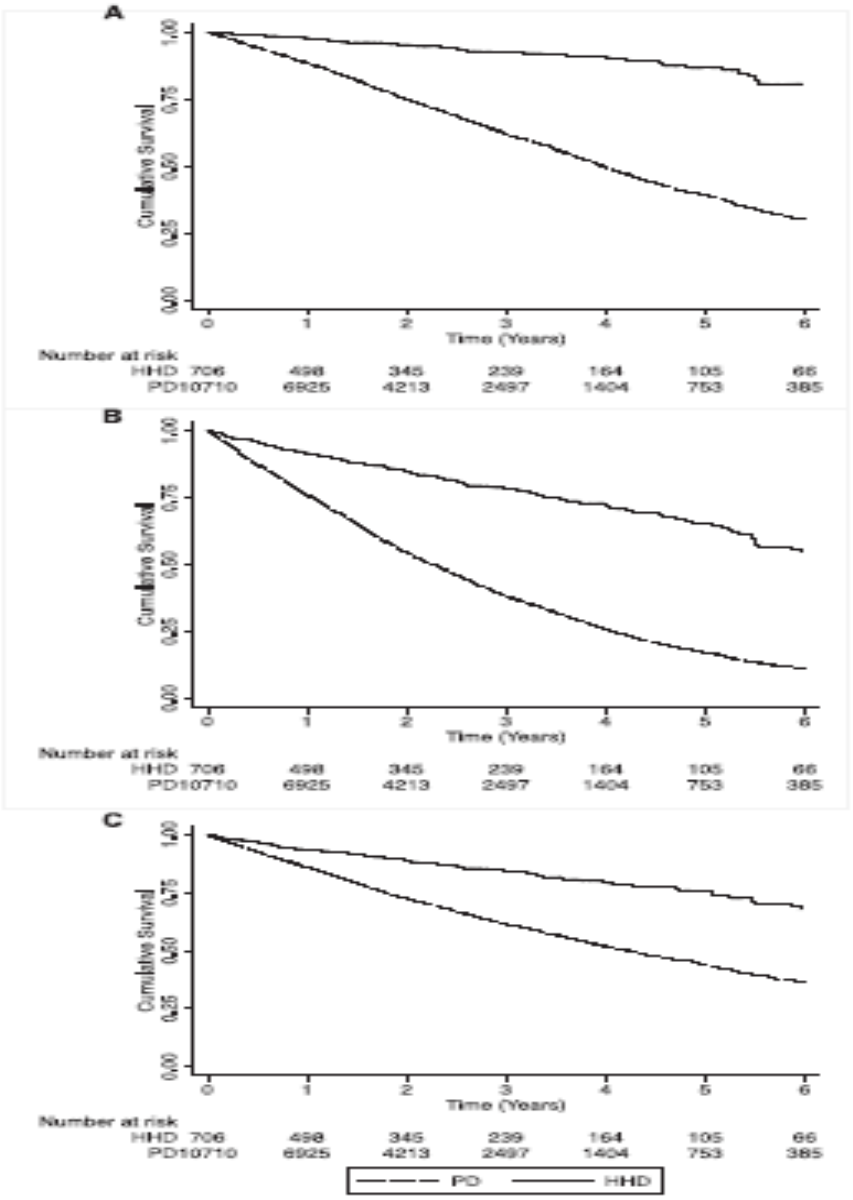
Unadjusted Kaplan–Meier curves for

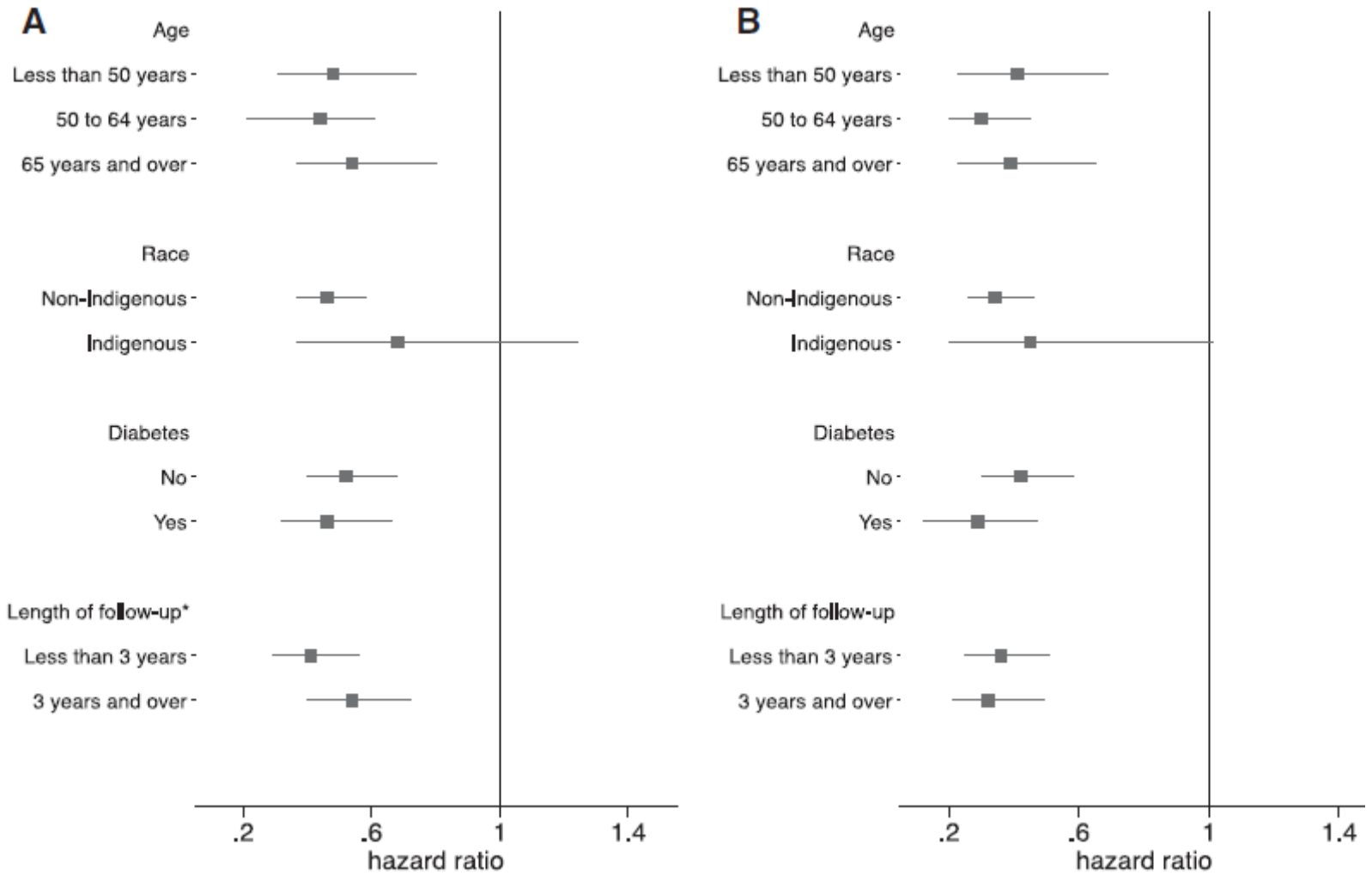
(A) on-treatment survival,

(B) patient and technique survival,

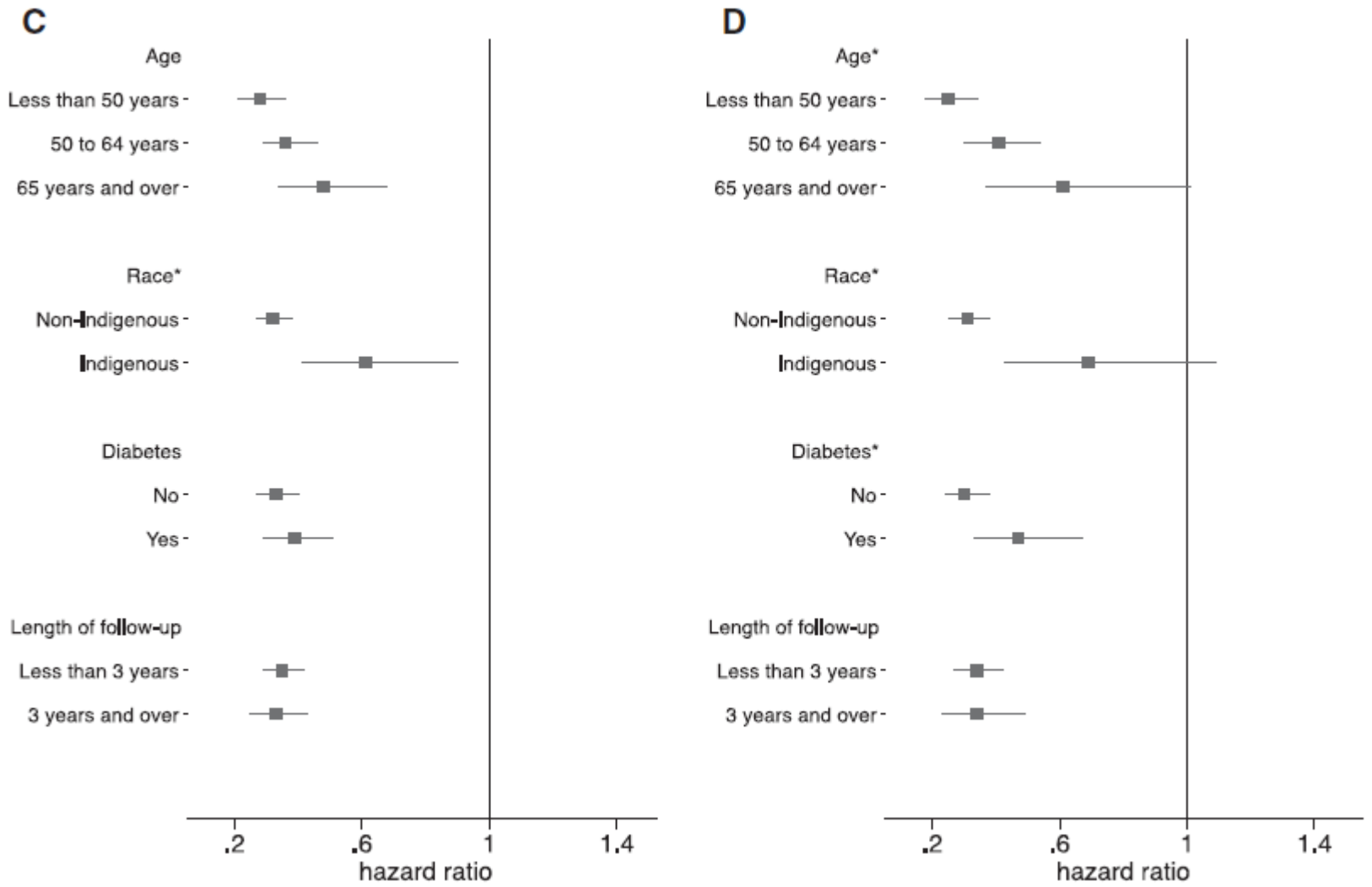
(C) death-censored technique survival ,

Log-rank P,0.001 for panels (A), (B), and (C). HHD



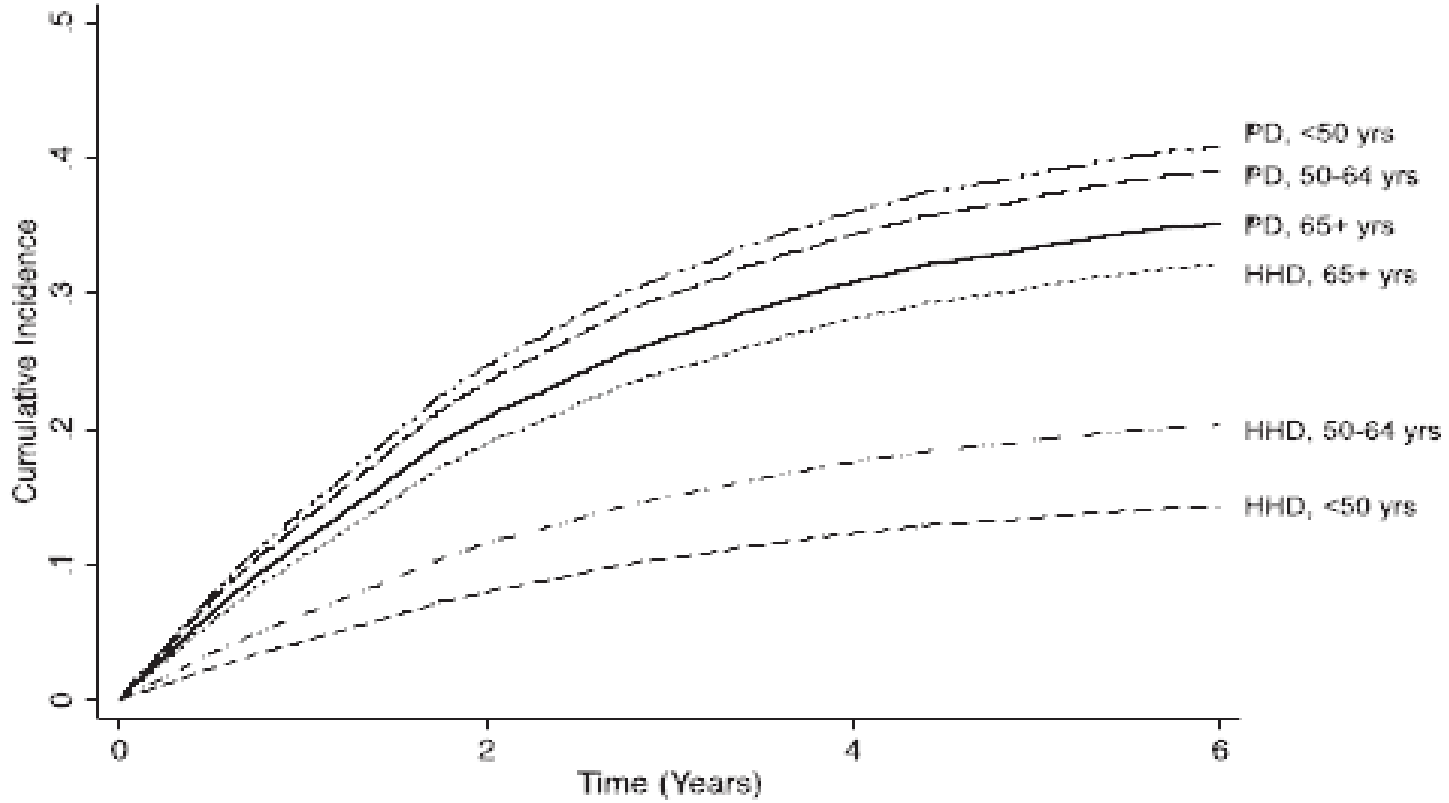


Subgroup analyses for primary and secondary outcomes.
Hazard ratios for home hemodialysis relative to peritoneal dialysis (adjusted in multivariable models) by age group, race, and diabetes status for **(A) overall mortality**, **(B) on-treatment mortality**



Subgroup analyses for primary and secondary outcomes.
Hazard ratios for home hemodialysis relative to peritoneal dialysis (adjusted in multivariable models) by age group, race, and diabetes status for **C) composite of mortality and technique failure**, and **(D) technique failure only**

Australia and New Zealand Dialysis and Transplantation Registry study



stratified by age group **Cumulative incidence function of technique failure** censored for death and and modality in competing risk model.

Transplantation and death defined as competing events

Conclusions

Home hemodialysis

was associated with superior patient and technique survival compared with

peritoneal dialysis

Baseline Characteristics

Overall

Patients treated with HHD

were younger and healthier

than

patients treated with PD

Limitations

- Clin J Am Soc Nephrol 10: ccc–ccc, 2015. doi: 10.2215/CJN.00840115

AJKD

Original Investigation

Mortality, Hospitalization, and Technique Failure in Daily Home Hemodialysis and Matched Peritoneal Dialysis Patients: A Matched Cohort Study

Eric D. Weinhandl, PhD,[1] David T. Gilbertson, PhD,[1] and Allan J. Collins, MD[1,2]

University of Minnesota,

4460 daily home HD and 46400 PD patients from USRDS data base from January, 1, 2007 to December 31, 2010 were enrolled the study.

This study evaluated risk of death, hospitalization and technique failure between two groups of patients.

Am J Kidney Dis. 2016;67(1):98-110

Am J Kidney Dis. 2016;67(1):98-110

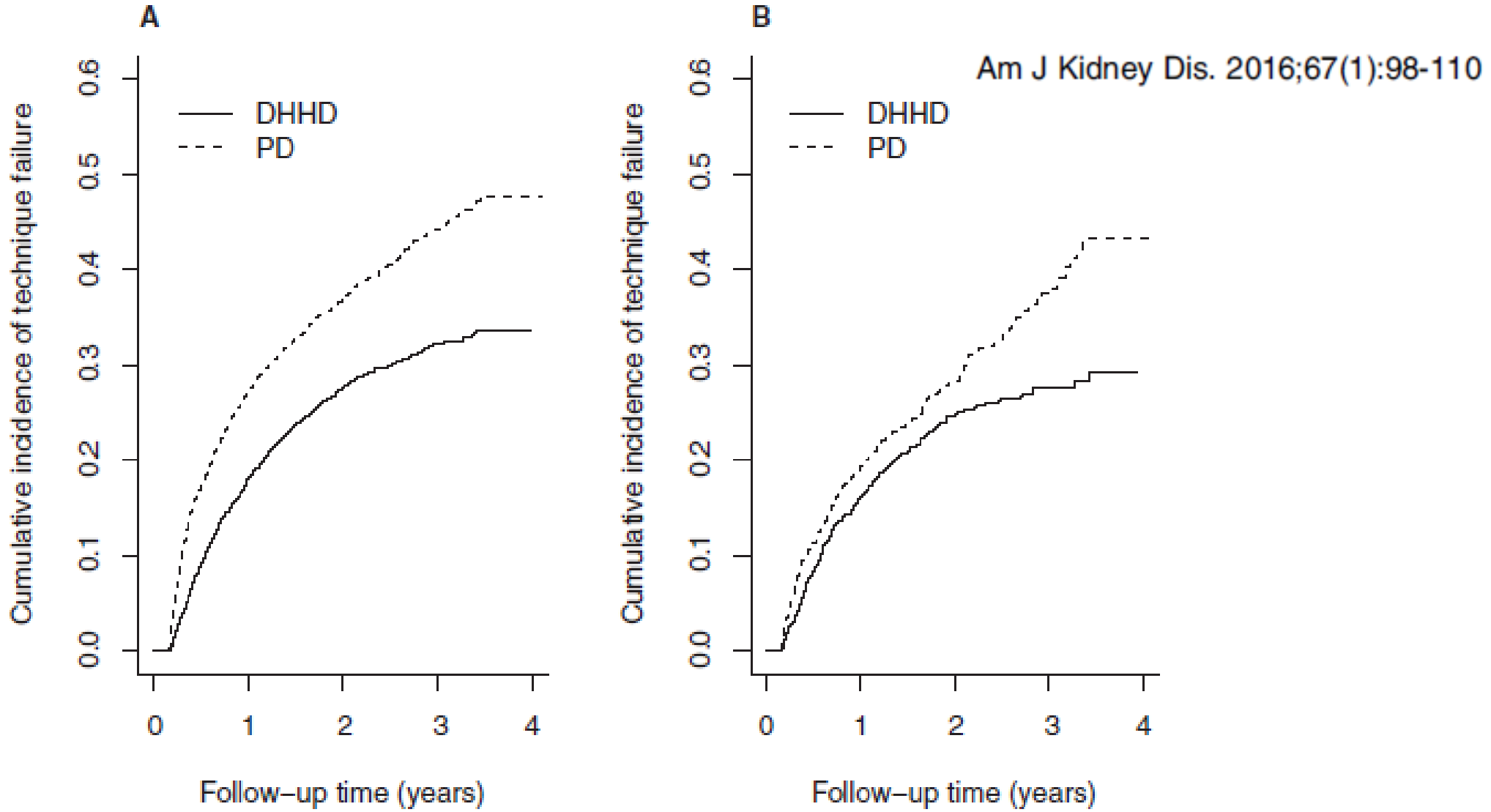


Figure 3. Cumulative incidence estimates of technique failure in (A) all patients and (B) the subset with end-stage renal disease duration less than 6 months on the index date. Abbreviations: DHHD, daily home hemodialysis; PD, peritoneal dialysis.

AJKD
Original Investigation

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Eric D. Weinhandl, PhD,[1] David T. Gilbertson, PhD,[1] and Allan J. Collins, MD[1,2]

Am J Kidney Dis. 2016;67(1):98-110

Conclusion:

- **Daily HHD** had: lower risk of mortality, hospitalization and technique failure.

Limitations:

Observational

Difference in RRF

Lack of data on dose and frequency and type of PD

Hemodialysis International 2014; **18**:481–487

Vascular access-related infection in nocturnal home hemodialysis

Wesley N. HAYES,[1] Karthik TENNANKORE,[2] Marisa BATTISTELLA,[2]
Christopher T. CHAN[2]

[1]Division of Nephrology, Hospital for Sick Children, Toronto, Canada; [2]Division of Nephrology, Toronto General Hospital, Toronto, Canada

Hemodialysis International 2014; 18:481–487

Vascular access-related infection in nocturnal home hemodialysis

Wesley N. HAYES,[1] Karthik TENNANKORE,[2] Marisa BATTISTELLA,[2]
Christopher T. CHAN[2]

[1]*Division of Nephrology, Hospital for Sick Children, Toronto, Canada;* [2]*Division of Nephrology, Toronto General Hospital, Toronto, Canada*

- 187 patients receiving NHHD in a single-center between January 1, 2006 and June 30, 2012.
- Four to seven overnight home hemodialysis treatments per week
- Follow up was 605 patient years.
- Initial vascular access was AVF in seventy-eight (42%) patients,
  AVG in eleven (6%) patients, and
  CVC in ninety-eight (52%) patients

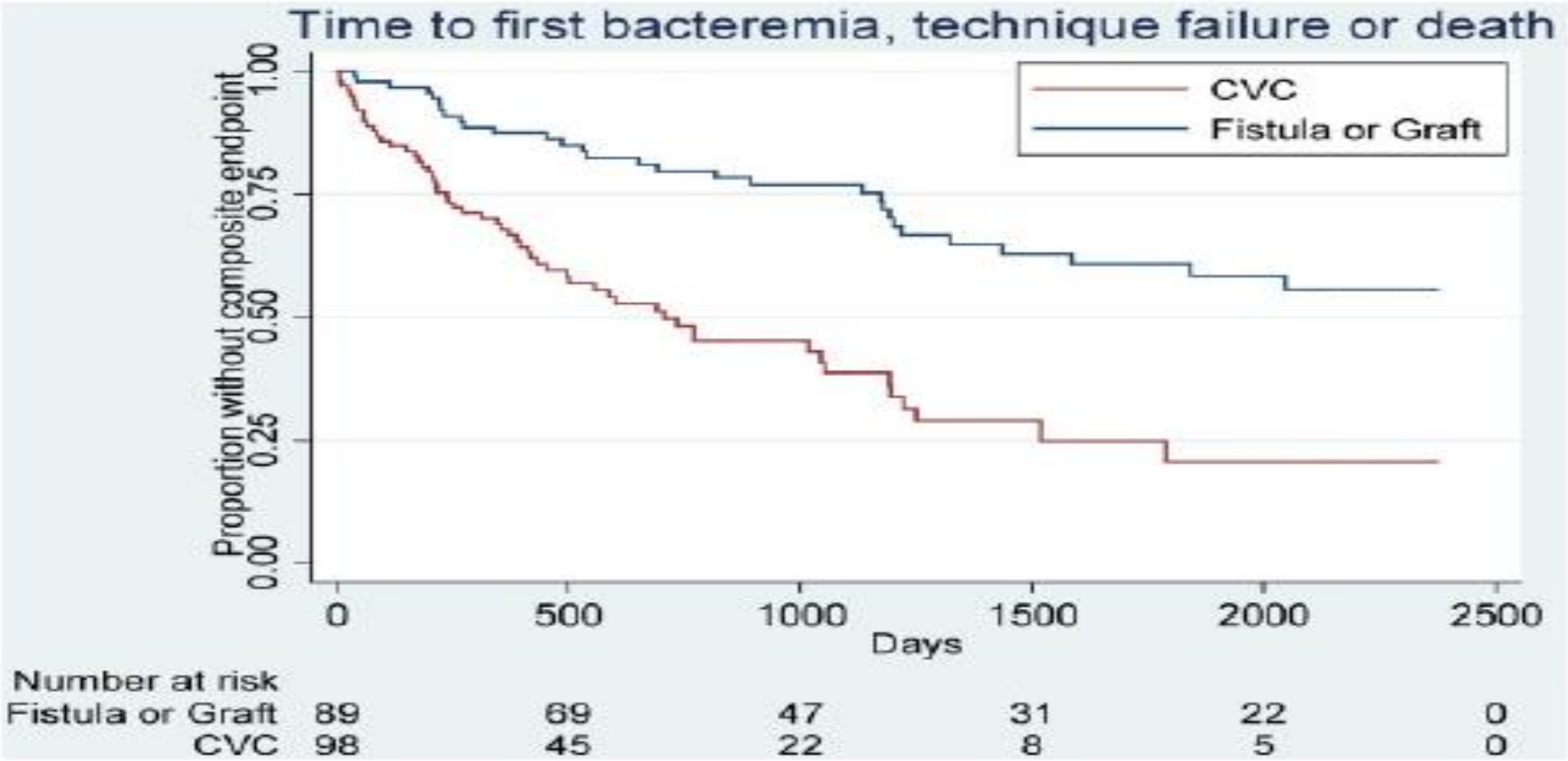
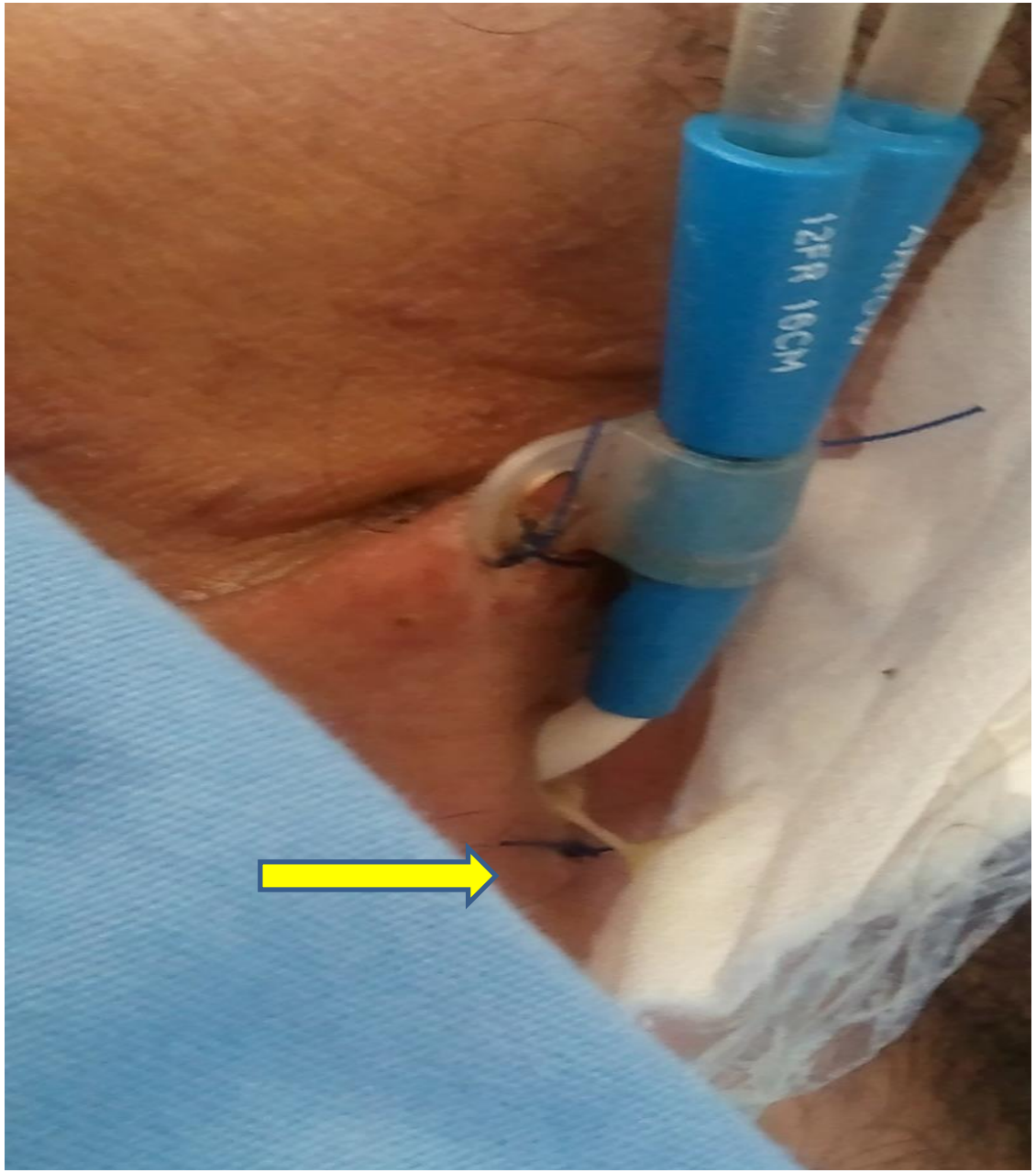
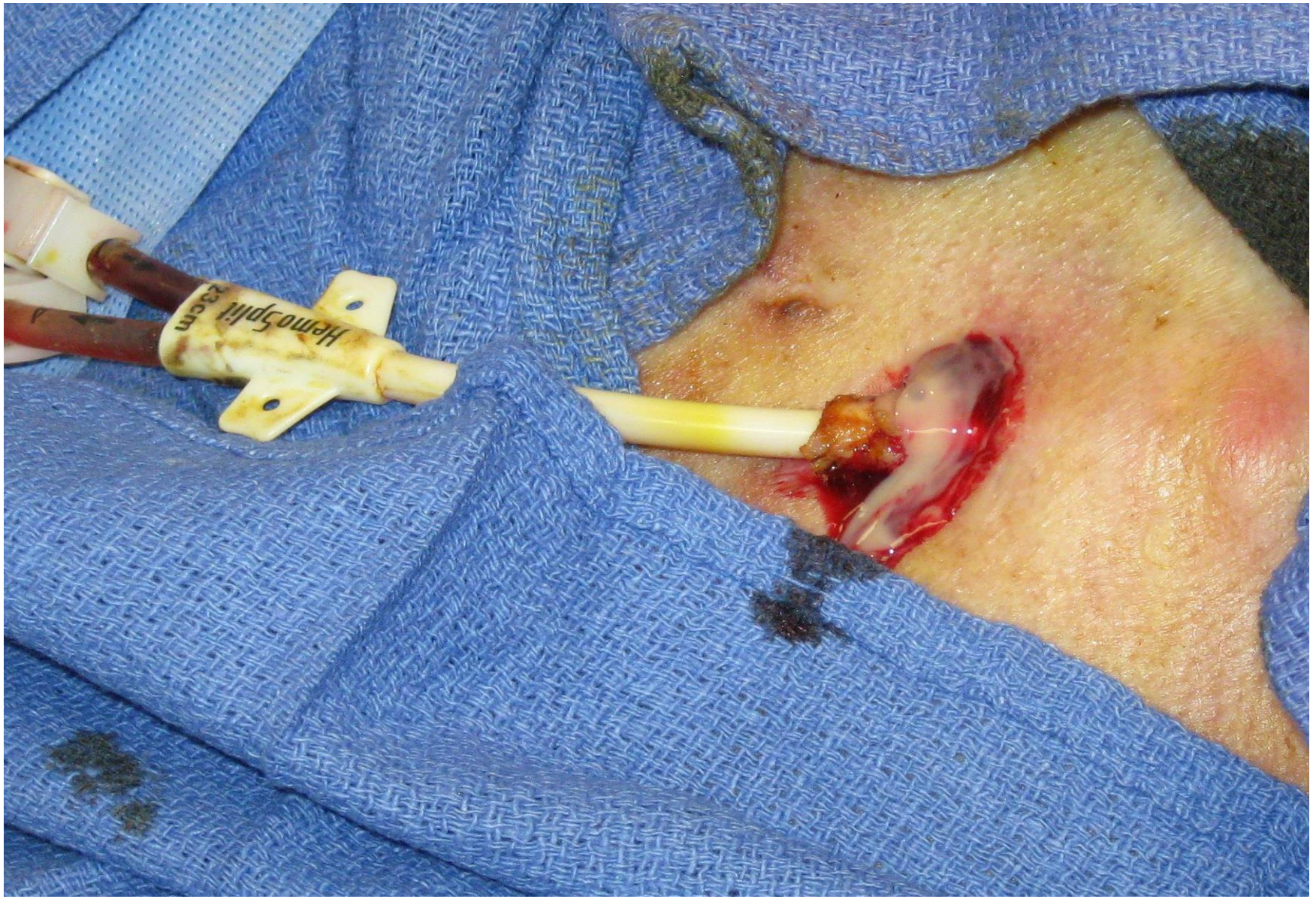


Figure 1 Kaplan–Meier survival curve showing the probability of remaining free of the composite endpoint of bacteremia, technique failure, or death over time stratified by initial vascular access (CVC = central venous catheter) ($p < 0.001$).


12FR 16CM

CATH ZILLA on the loose

- High catheter rates
- Increased hospitalization
- Increased mortality
- Increased Cost
- What can we do??


Hemosplit 23cm

Rydell *et al. BMC Nephrology* (2019) 20:52
https://doi.org/10.1186/s12882-019-1245-x

BMC Nephrology

RESEARCH ARTICLE Open Access

Improved long-term survival with home hemodialysis compared with institutional hemodialysis and peritoneal dialysis: a matched cohort study

Helena Rydell[1*], Kerstin Ivarsson[2], Martin Almquist[3], Mårten Segelmark[1] and Naomi Clyne[1]

HHD vs IHD vs PD Survival

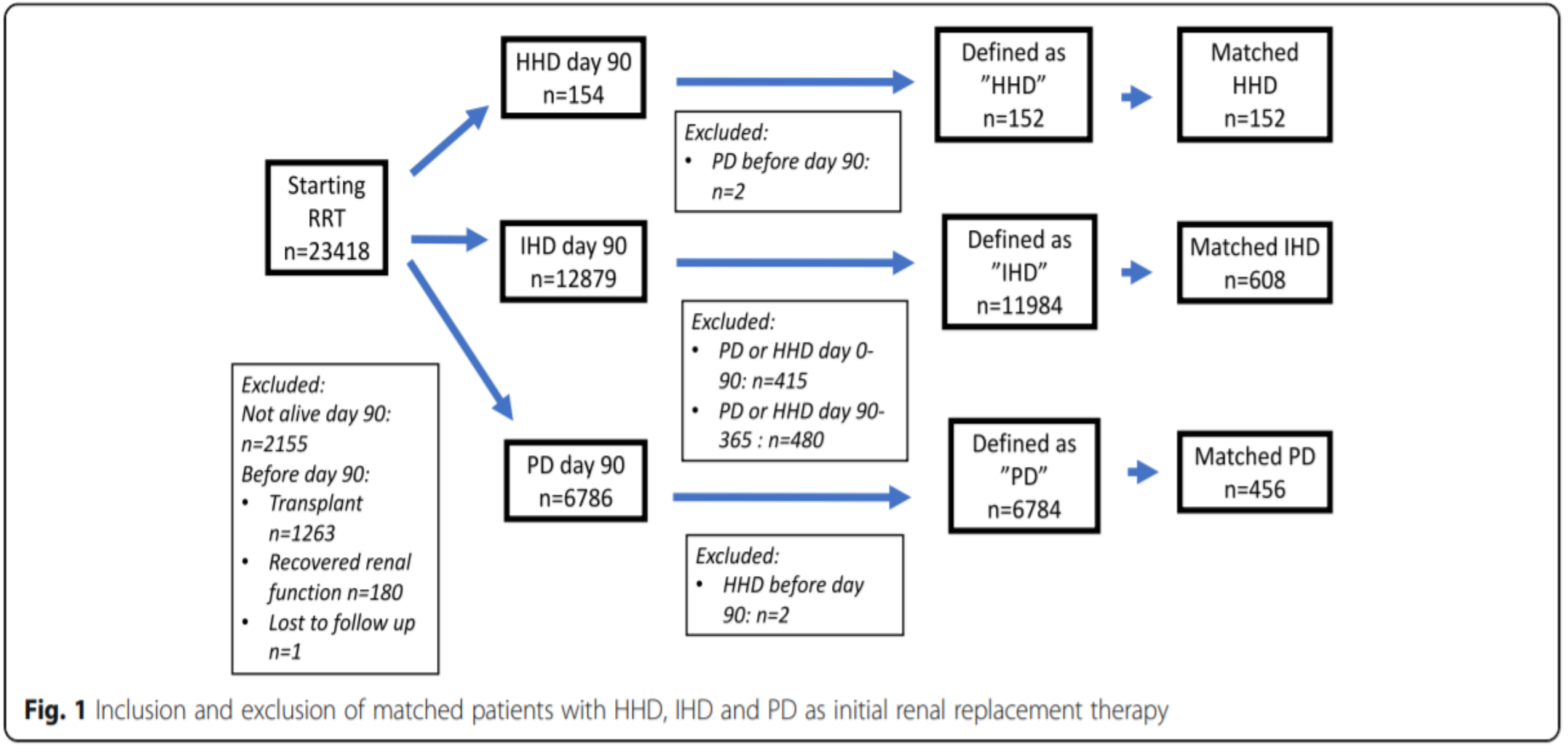
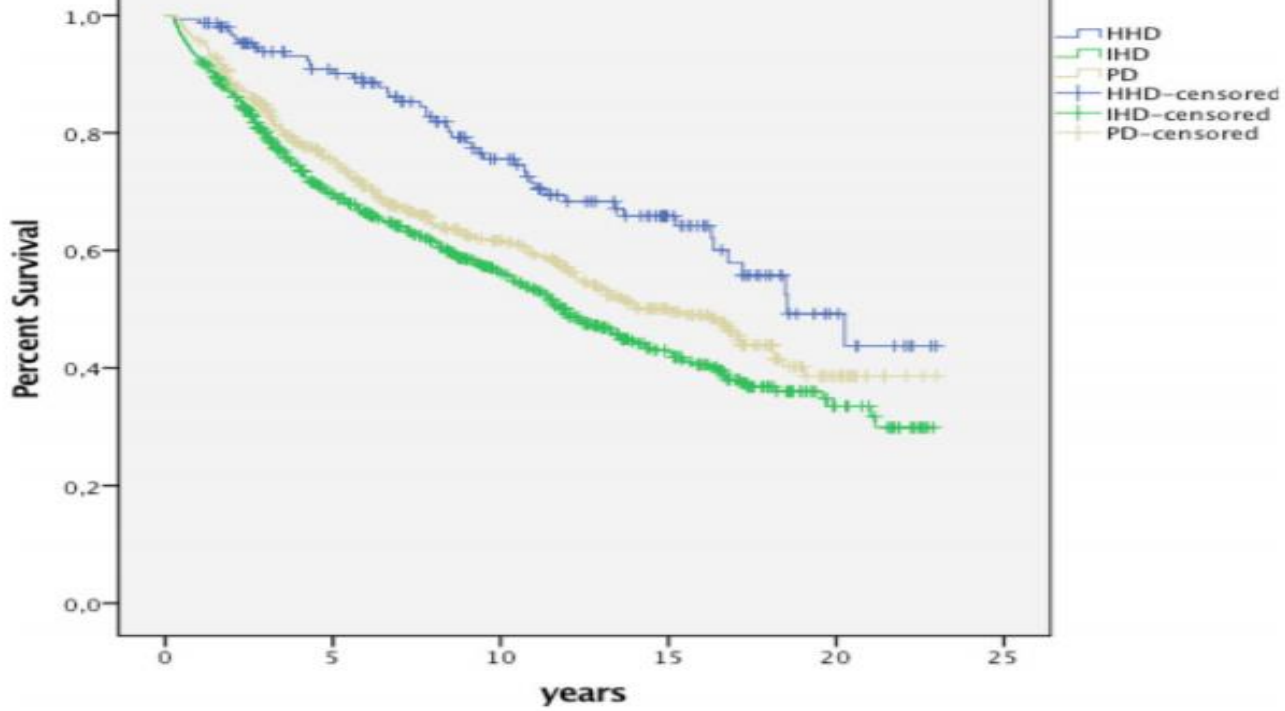


Fig. 1 Inclusion and exclusion of matched patients with HHD, IHD and PD as initial renal replacement therapy

Overall survival

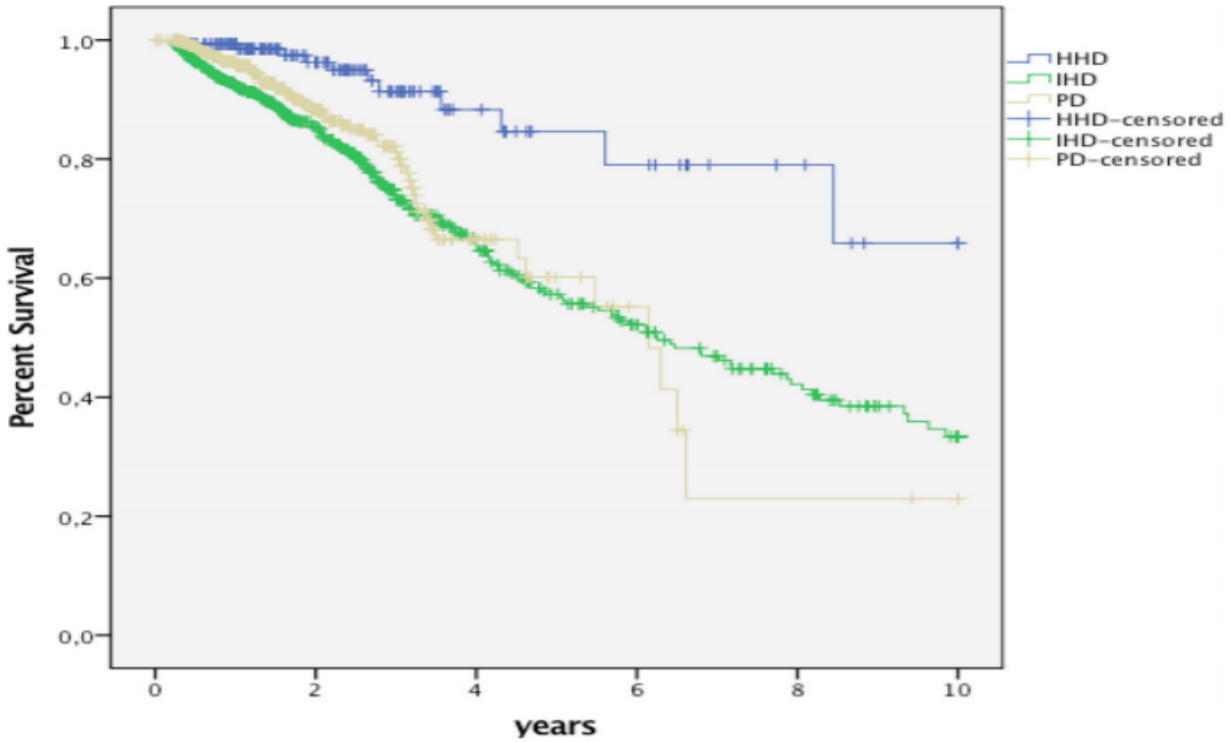
intention-to-treat analysis for incident patients



HHD (n)	152	120	78	41	10
IHD (n)	608	359	228	108	23
PD (n)	456	209	184	94	17

Fig. 2 Overall survival. Superior overall survival (intention-to-treat analysis) for incident patients with HHD ($n = 152$) as first renal replacement therapy (RRT) compared with matched patients with IHD ($n = 608$; $p < 0.001$) and PD ($n = 456$; $p = 0.002$) as first RRT. In the analyses, changes to other modalities were not considered and censoring was only performed at the end of the study

Survival on initial RRT



HHD	152	80	25	14	7	3
IHD	604	334	147	84	49	25
PD	456	149	28	8	2	1

Fig. 3 Survival on initial RRT. Superior survival during the first renal replacement therapy (RRT) for patients with HHD (n = 152) compared with matched patients with IHD (n = 608; p < 0.001) and PD (n = 456; p = < 0.001). In these analyses, censoring was performed at all changes to other modalities

Conclusion

- This study showed a significant long-term survival advantage for patients on HHD as initial RRT compared with IHD and PD.
- Subsequent renal transplantation was more common among patients starting HHD.
- But there was no difference in subsequent renal graft survival between HHD and IHD or PD as initial RRT.

REVIEW

Home hemodialysis: a comprehensive review of patient-centered and economic considerations

Abstract | Fulltext | Metrics | Get Permission

Authors Walker RC, Howard K, Morton RL

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DOI https://doi.org/10.2147/CEOR.S69340

Perit Dial Int. 2019 Nov-Dec;39(6):553-561. doi: 10.3747/pdi.2018.00268. Epub 2019 Oct 3.

Home Dialysis Is Associated with Lower Costs and Better Survival than Other Modalities: A Population-Based Study in Ontario, Canada.

Krahn MD[1,2,3,4], Bremner KE[5], de Oliveira C[1,2,4,6], Dixon SN[4,7], McFarlane P[8], Garg AX[4,9], Mitsakakis N[1,2], Blake PG[10,11], Harvey R[10], Pechlivanoglou P[12].

Author information

Abstract

*Background:*How and where to initiate dialysis are policy challenges with enormous economic and health consequences. Initiating with home hemodialysis (HD) or peritoneal dialysis (PD) may reduce costs and improve outcomes but evidence is conflicting.*Methods:*We conducted a population-based study in patients aged ≥ 18 years who initiated chronic dialysis in the province of Ontario, Canada from 2006 to 2014 (*N* = 12,691) using linked administrative data. Patients were grouped by initial modality: facility HD, facility short daily or slow nocturnal (SD/SN) HD, PD, home HD. We estimated publicly-paid healthcare costs (2015 Canadian dollars; 1 = 0.947 US dollar) and survival, from dialysis initiation to March 2015.*Results:*By 5 years after dialysis initiation, mean 30-day costs (as-treated) for patients receiving PD and home HD were 50% and 64% lower, respectively, than for facility HD patients ($11,011). Approximately 50% of costs were unrelated to dialysis, reflecting high comorbidity in these patients. With covariate adjustment, mean 5-year cumulative costs were similar for initiators of home HD and PD ($304,178 and $349,338) and higher for facility HD initiators ($410,981). The highest 5-year unadjusted survival was for home HD patients (80%), followed by PD (52%), SD/SN HD (50%), and facility HD (42%).*Conclusions:*This study in a large cohort over 9 years provides new population-based evidence suggesting that initiating dialysis at home is cost-effective, with lower costs and better survival, than starting with facility HD. Survival differences persisted after adjustment for baseline characteristics but we could not adjust for functional status or severity of comorbidities.

Perit Dial Int. 2019 Nov-Dec;39(6):553-561. doi: 10.3747/pdi.2018.00268. Epub 2019 Oct 3.

Home Dialysis Is Associated with Lower Costs and Better Survival than Other Modalities: A Population-Based Study in Ontario, Canada.

Krahn MD[1,2,3,4], Bremner KE[5], de Oliveira C[1,2,4,6], Dixon SN[4,7], McFarlane P[8], Garg AX[4,9], Mitsakakis N[1,2], Blake PG[10,11], Harvey R[10], Pechlivanoglou P[12].

- With covariate adjustment, **mean 5-year cumulative costs** were:
- Home HD $304,178
- PD $349,338
- Facility HD $410,981
- The highest 5-year unadjusted **patient survival** was for
- Home HD patients (80%), followed by
- PD (52%),
- SD/SN HD (50%),
- Facility HD (42%)

Exploring Barriers and Potential Solutions in Home Dialysis: An NKF-KDOQI Conference Outcomes Report

Christopher T. Chan[1], Eric Wallace[2], Thomas A. Golper[3], Mitchell H. Rosner[4], Rebecca Kurnik Seshasai[5], Joel D. Glickman[5], Martin Schreiber[6], Patrick Gee[7], Michael V. Rocco[8,*]

DOI: https://doi.org/10.1053/j.ajkd.2018.09.015 |

Conclusions

Cost of Home HD

- ❖ **Many studies worldwide have shown that overall home HD costs are 20%–50% less than those of in-center HD**

- ➢ The greatest reason for this cost differential is **staffing** and **facility overhead.**

- ➢ There are also expense reductions from the potential for **decreased hospitalizations and reduced use of medications** (antihypertensive agents and phosphate binders).

- ➢ **Travel** to and from the dialysis facility also creates lost time and financial costs that are not experienced with home dialysis.

Conclusions

Home HD

❖ **Home HD has the potential to allow patients to enjoy**

- increased freedom,
- quality of life,
- greater ability to travel, and
- tangible improvements in several domains of medical outcomes.

❖ **Increased physician and patient education can eliminate barriers to home HD and increase its use.**

Conclusions

Home HD

- In **most countries**, patients treated with **HHD** still comprise **less than 5%** of the entire dialysis population.

- The **results of these studies** should encourage **increased use of HHD** in order to **improve the long-term prognosis** for dialysis patients.


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واجب نموده است
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