



# Building a home hemodialysis program and the role of new and emerging technologies

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Provincial Medical Director, Home Hemodialysis (BC)*

# Declaration of Conflict

I am currently a member of a Scientific Advisory Board for  
NxStage Medical Inc.

I have recently completed a tenure with Baxter Global  
Healthcare

I will not speak about off-label uses of NxStage System One  
or other products during this talk

# Objectives

- To review the benefits of home-based hemodialysis treatments
- To understand the process by which British Columbia built a successful home hemodialysis program, with attention to both intake and maintenance of program numbers
- To consider new technologies that may facilitate home hemodialysis for a wider group of patients by reducing the ‘technology barrier’

# Why home hemodialysis?



# Benefits of intensive hemodialysis

- Reduction of medication utilization
  - Phosphate binders
  - Anti-hypertensives
- Fewer dietary restrictions
- Fewer fluid restrictions
- Improved quality of life measurements:
  - QoL proper
  - Illness intrusiveness scoring

# Benefits of intensive hemodialysis



## Traveling-to-Receive-Care Time Saved

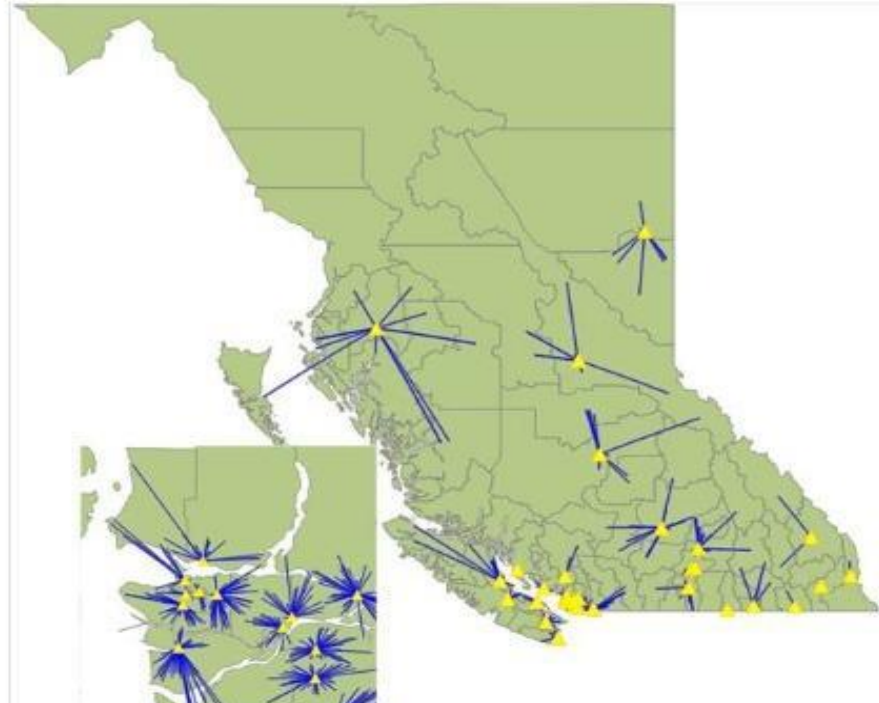
- 32% of BC patients on independent dialysis, at home
- Consistently the highest % in Canada\*

If these ~1,000 patients were **not** on home dialysis:

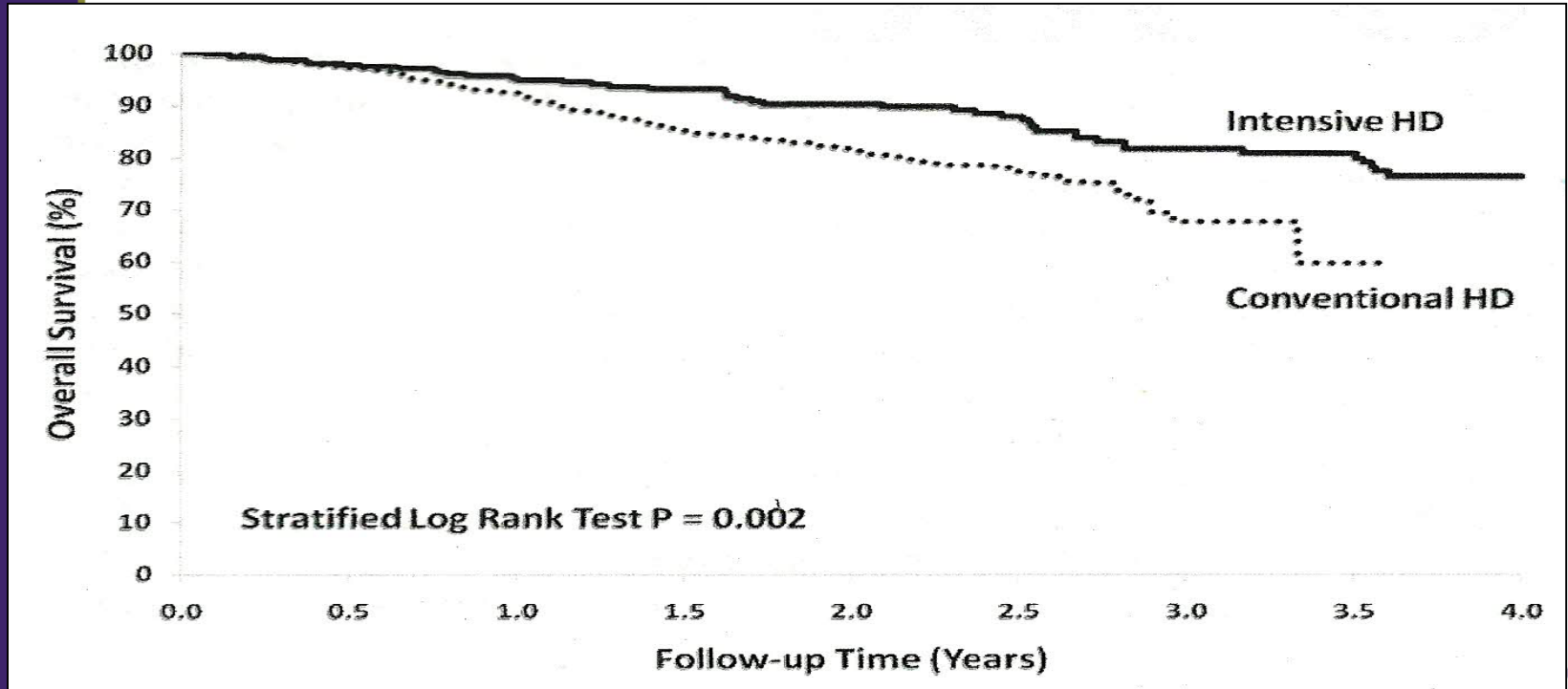
- They would travel to community or hospital units to receive dialysis  
3 times a week
- This amounts to a total annual travel distance of:  
7.05 – 12.23 million km
- Based on these figures, home dialysis saves

20 – 35 years

of transit time for dialysis patients



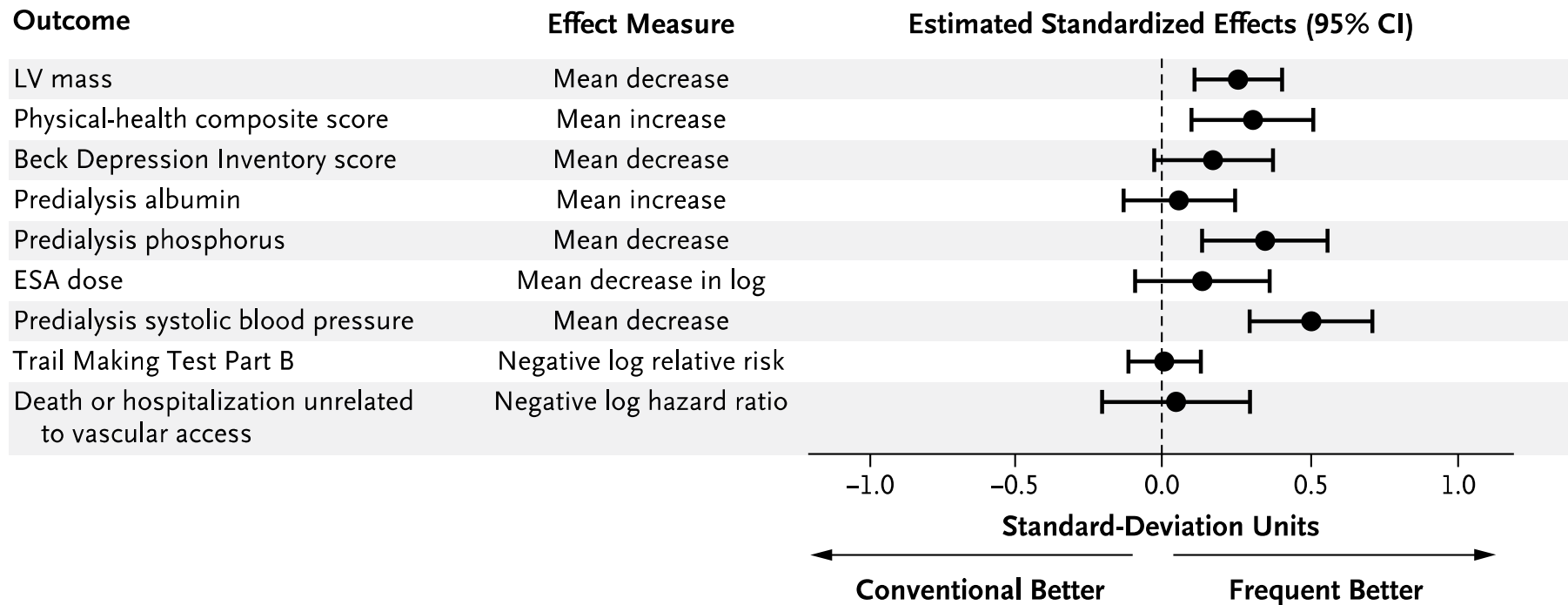
# Survival, Intensive vs Conventional Hemodialysis



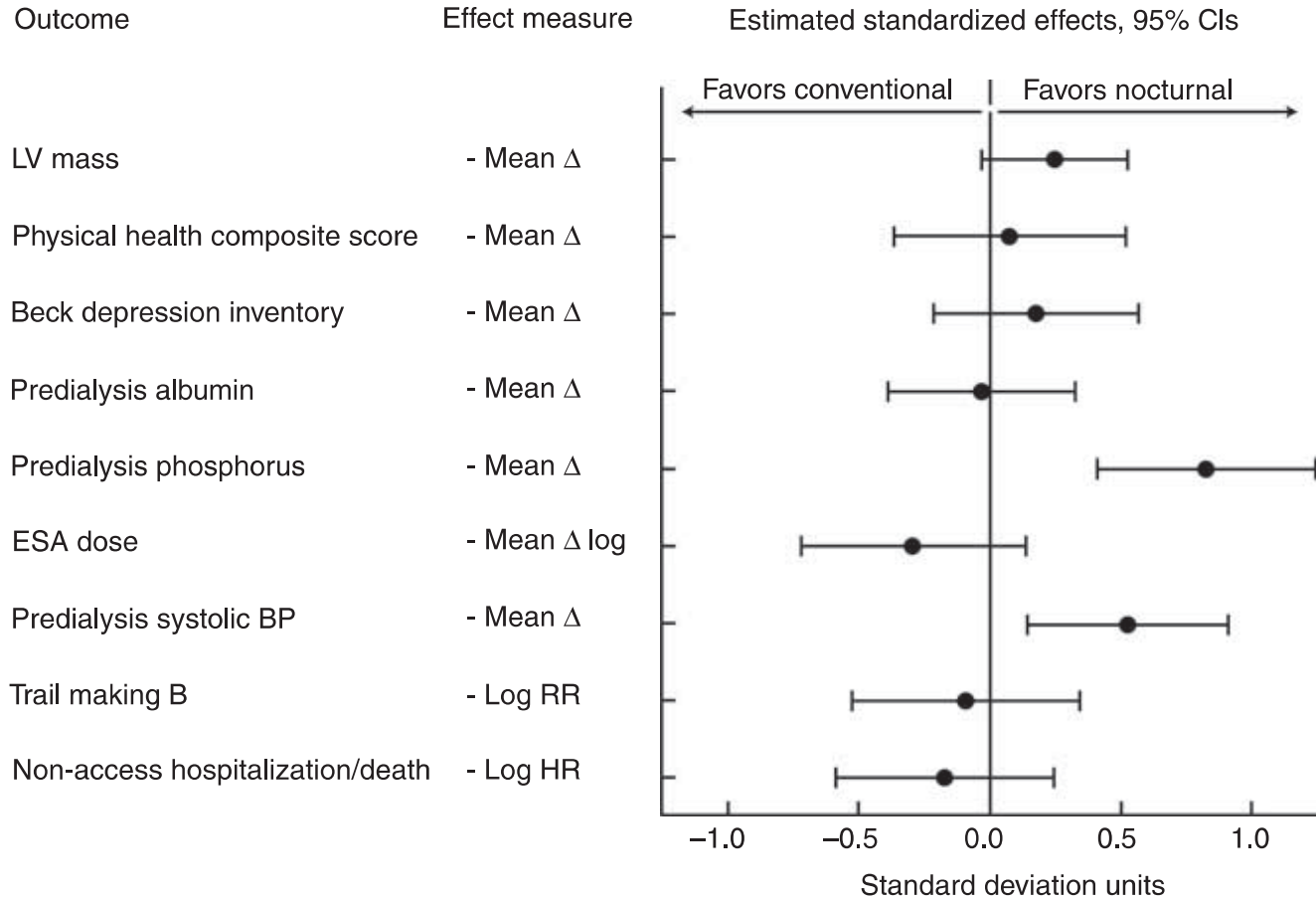
JASN, April 1, 2012, vol 23(4), 696-705



### C Main Secondary Outcomes







# Based on this....

- Evidence suggests benefit of FREQUENCY to be more important than DURATION of dialysis
  - Positive co-primary end-points for SDHD Arm
  - Negative co-primary end-point for NHD Arm
- Rationale for frequency?



**kidney**  
INTERNATIONAL

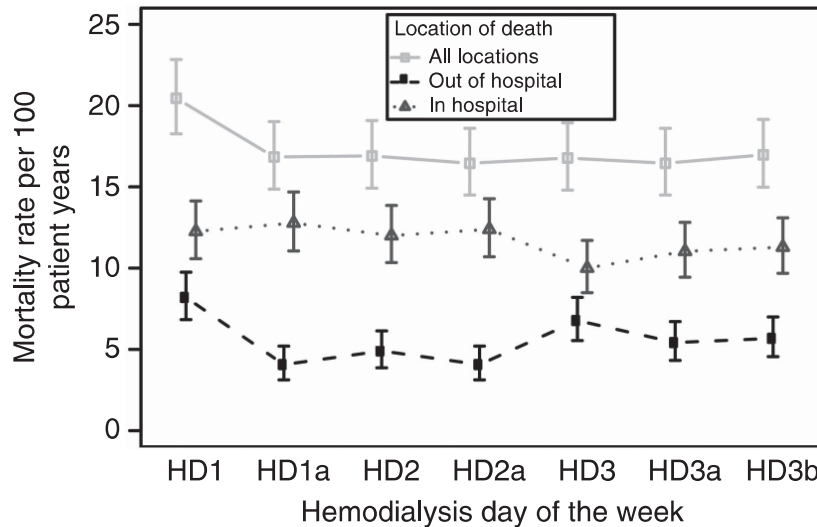
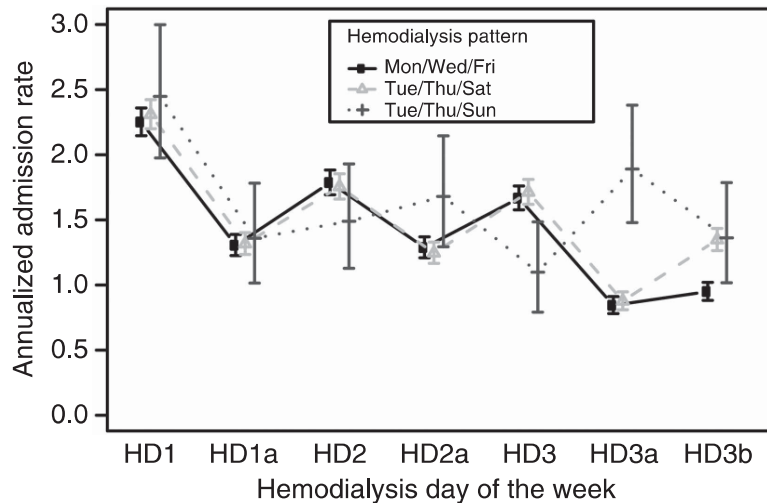
OFFICIAL JOURNAL OF THE INTERNATIONAL SOCIETY OF NEPHROLOGY

# The mortality and hospitalization rates associated with the long interdialytic gap in thrice-weekly hemodialysis patients

James Fotheringham<sup>1,2</sup>, Damian G. Fogarty<sup>3,4</sup>, Meguid El Nahas<sup>5</sup>, Michael J. Campbell<sup>2</sup> and Ken Farrington<sup>6</sup>

<sup>1</sup>Sheffield Kidney Institute, Northern General Hospital, Sheffield, UK; <sup>2</sup>School of Health and Related Research, University of Sheffield, Sheffield, UK; <sup>3</sup>UK Renal Registry, Southmead Hospital, Bristol, UK; <sup>4</sup>Belfast Health and Social Care Trust, Belfast, UK; <sup>5</sup>Global Kidney Academy, Sheffield, UK and <sup>6</sup>Renal Unit, Lister Hospital, Stevenage, Herts, UK

# The mortality and hospitalization rates associated with the long interdialytic gap in thrice-weekly hemodialysis patients

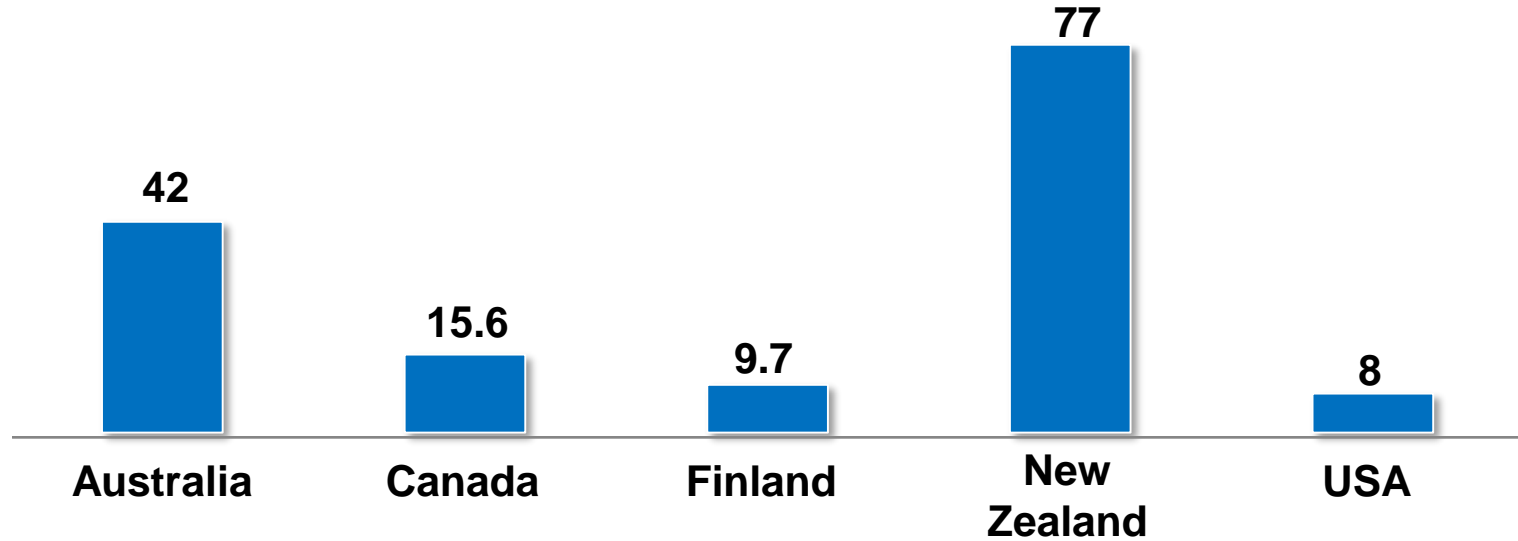




# **GROWTH OF HOME HD: BRITISH COLUMBIA**

# International Statistics

Prevalence per million population



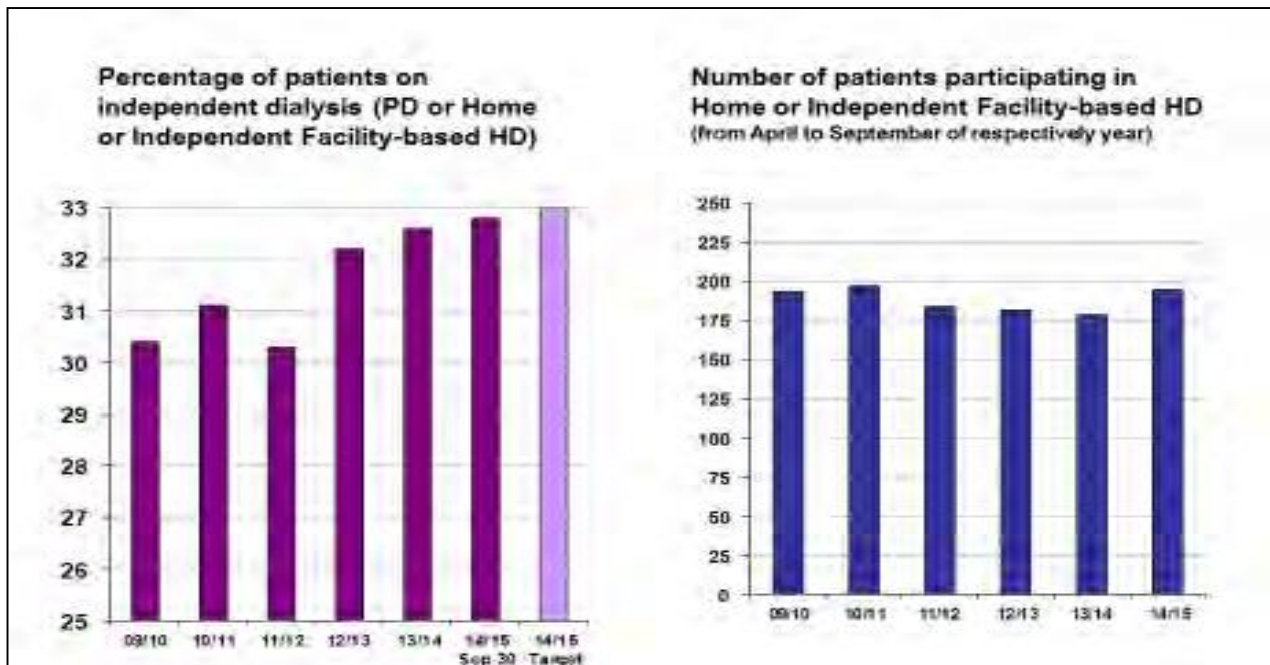
# Prevalent Treatment Modality, Canada

Table 14: Prevalent End-Stage Kidney Disease Patients by Type of Treatment, Canada, 2004 to 2013 (Number, Rate per Million Population, Percentage of Total)

Type of Treatment†		2004	2005	2006	2007	2008	2009	2010	2011*	2012*	2013*
HD Home	N	369	485	572	638	717	785	842	925	969	1,042
	RPMP	11.6	15.0	17.5	19.4	21.5	23.3	24.7	26.5	27.8	29.6
	%	1.2	1.5	1.7	1.8	2.0	2.1	2.2	2.3	2.4	2.5
HD Institutional	N	14,949	15,614	16,205	16,642	17,038	17,646	17,957	18,504	18,712	18,925
	RPMP	467.9	483.8	496.7	505.3	511.2	523.0	526.2	536.6	536.5	535.4
	%	48.3	48.2	48.0	47.4	46.9	46.8	46.3	46.3	45.6	44.9
CAPD	N	1,659	1,611	1,553	1,576	1,602	1,573	1,523	1,472	1,469	1,492
	RPMP	51.9	49.9	47.6	47.9	48.1	46.6	44.6	42.7	42.1	42.4
	%	5.4	5.0	4.6	4.5	4.4	4.2	3.9	3.7	3.6	3.6
APD	N	1,915	2,081	2,221	2,315	2,389	2,508	2,563	2,556	2,714	2,757
	RPMP	59.9	64.5	68.1	70.3	71.7	74.3	75.1	74.1	77.8	78.4
	%	6.2	6.4	6.6	6.6	6.6	6.6	6.6	6.4	6.6	6.6
Transplant	N	12,061	12,610	13,238	13,951	14,581	15,230	15,864	16,485	17,146	17,817
	RPMP	377.5	390.8	405.8	423.6	437.5	451.4	464.9	478.1	491.6	506.8
	%	39.0	38.9	39.2	39.7	40.1	40.4	40.9	41.3	41.8	42.5
Total	N	30,953	32,401	33,789	35,122	36,327	37,742	38,749	39,942	41,009	41,931
	RPMP	968.9	1,004.0	1,035.7	1,066.5	1,090.0	1,118.6	1,135.5	1,158.3	1,175.7	1,192.6



# British Columbia (PD and Home Hemodialysis)



Status	Trend	Target	Actual
●	↑	≥ 33%	32.8%



# **BARRIERS TO HHD PROGRAM GROWTH**

# Preferred modality and training...

- 2362 patients with progressive CKD followed by Kidney Clinics began renal replacement therapy between October 1, 2010 and September 30, 2014 in BC.
  - Reviewed 'Preferred Modality' noted in PROMIS prior to initiation

Modality	Number (Percentage)
Hemodialysis	785 (33.2)
Home Hemodialysis	44 (1.9)
Peritoneal Dialysis	901 (38.2)
Pre-emptive transplantation	80 (3.4)
Conservative care	34 (1.4)
Undecided	518 (21.9)

# Preferred modality and training...

- 44 patients (1.9%) indicated HHD as their preferred modality.
  - However, only 25 (57%) actually started home hemodialysis training.
- Where did the other 19 patients end up?

Hospital hemodialysis: 5 (26.3%)

Satellite hemodialysis: 9 (47.4%)

Died: 2 (10.5%)

Transplanted: 3 (15.8%)

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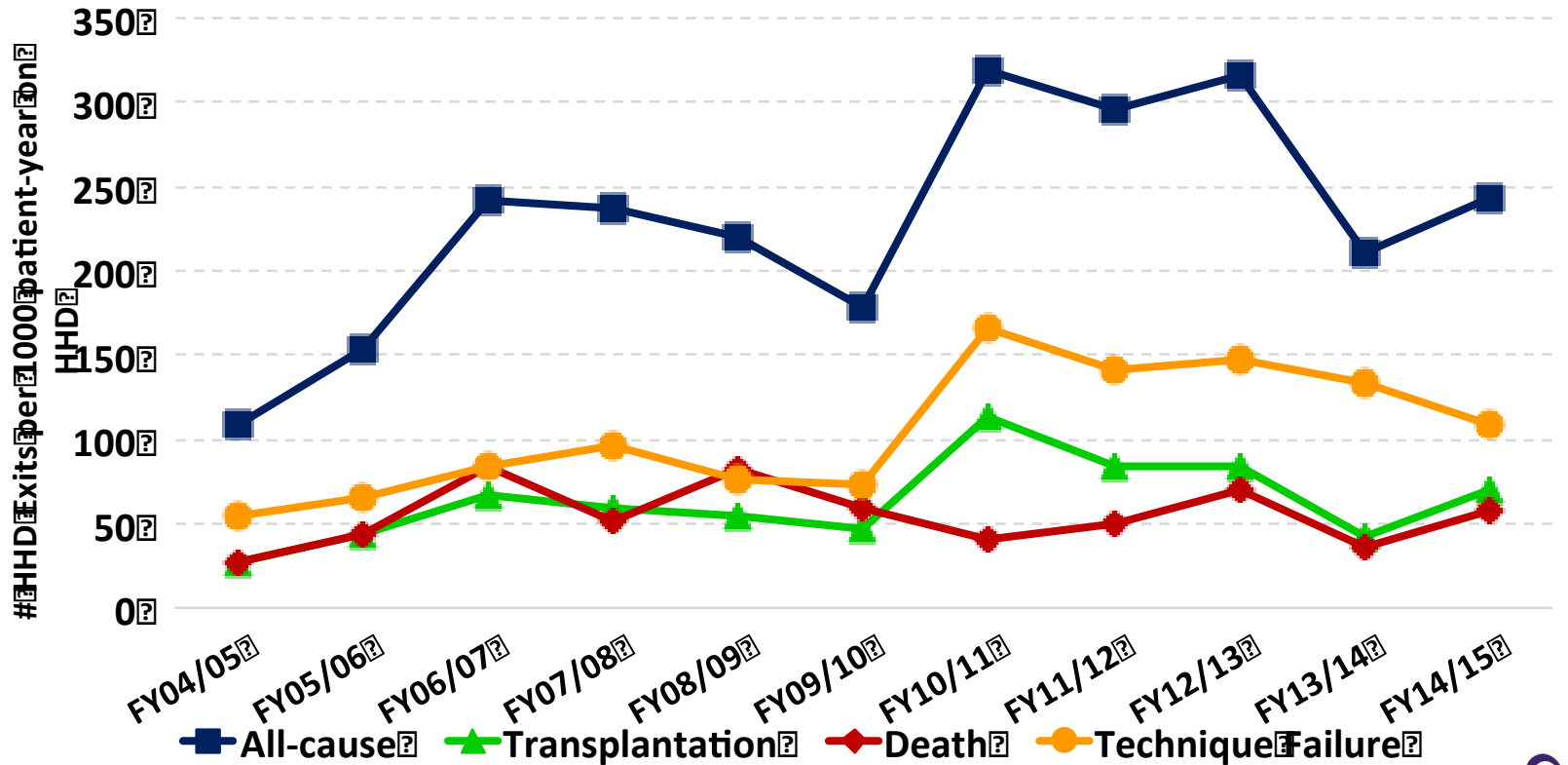
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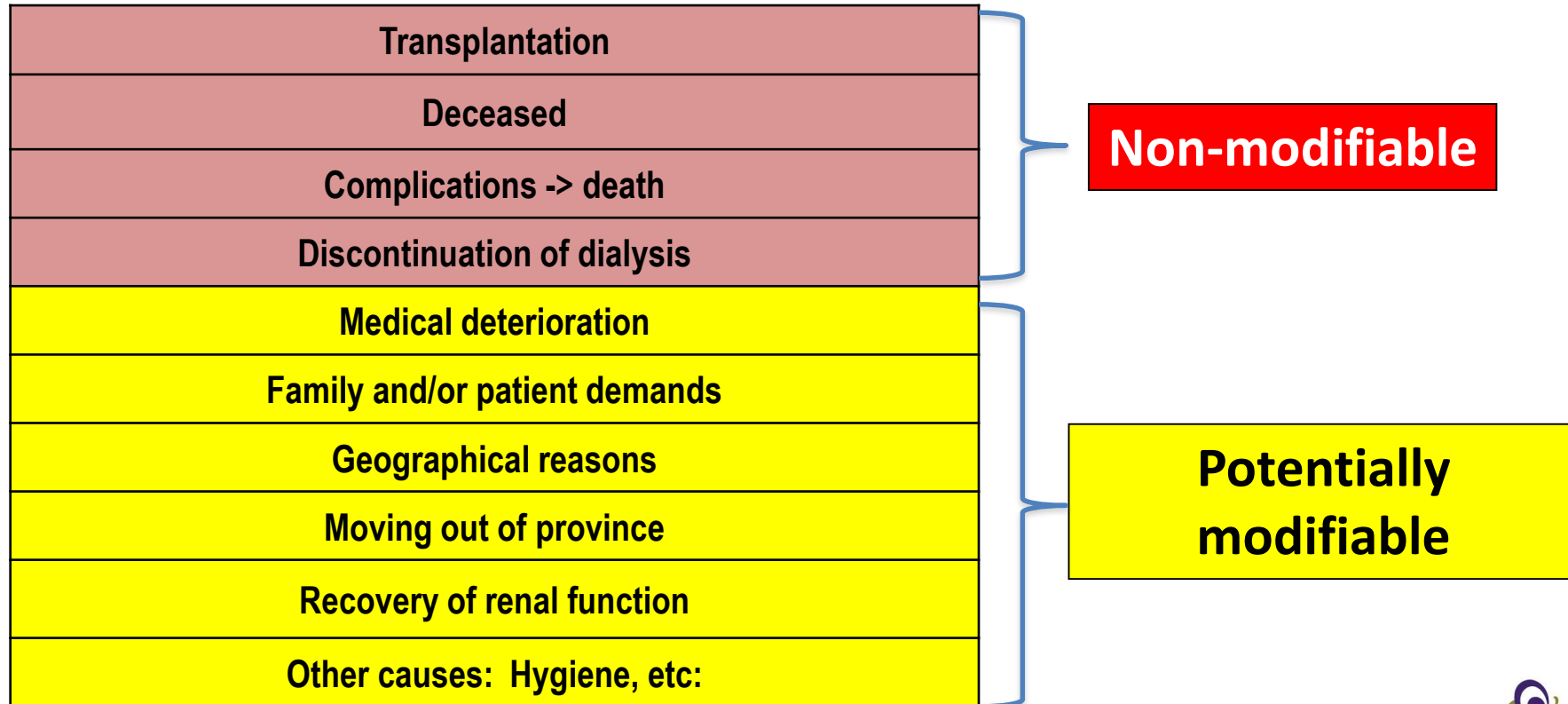
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# HHD Annual Attrition Rate Overtime



# Where did HHD patients go? Attrition







# Efforts to increase uptake of home dialysis PD and Home HD

# “Broad” interventions, by era

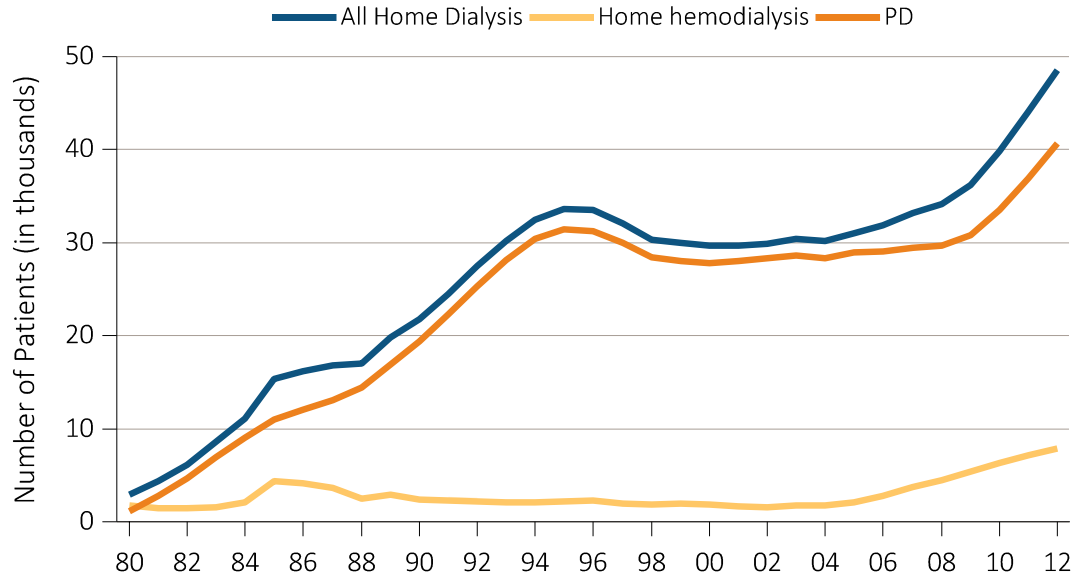
Era	Years	Interventions
1	2002 - 2005	<ul style="list-style-type: none"><li>• Established working groups (PD et HD)</li><li>• Funding model revision</li></ul>
2	2007 - 2011	<ul style="list-style-type: none"><li>• Uptake (Nurse navigators; educational materials)</li><li>• Attrition (Home services funding; respite provision)</li></ul>
3	2011 - present	<ul style="list-style-type: none"><li>• Uptake (NxStage™ Implementation)</li><li>• Attrition (“PD Assist”)</li></ul>



# **NEW TECHNOLOGIES: NXSTAGE SYSTEM ONE**

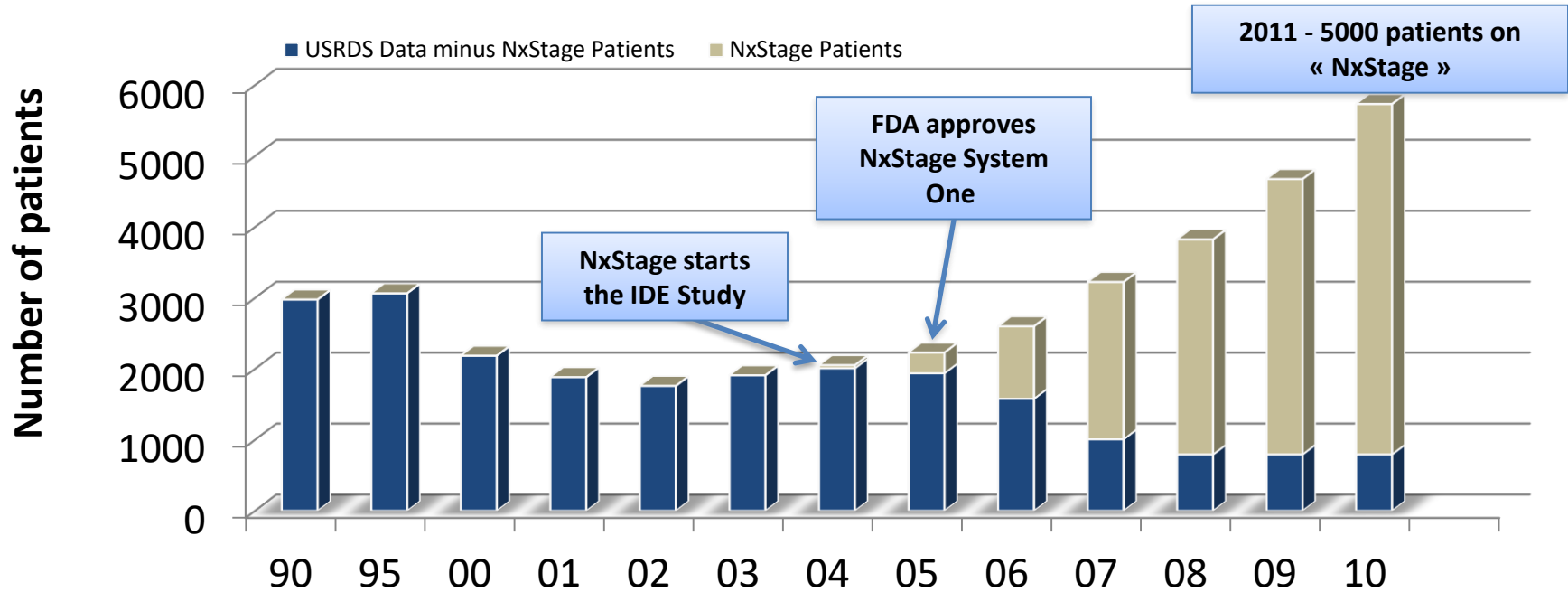


**vol 2 Figure 1.18 Trend in the number of prevalent ESRD patients using home dialysis, in thousands, by type of therapy, in the U.S. population, 1980-2012**



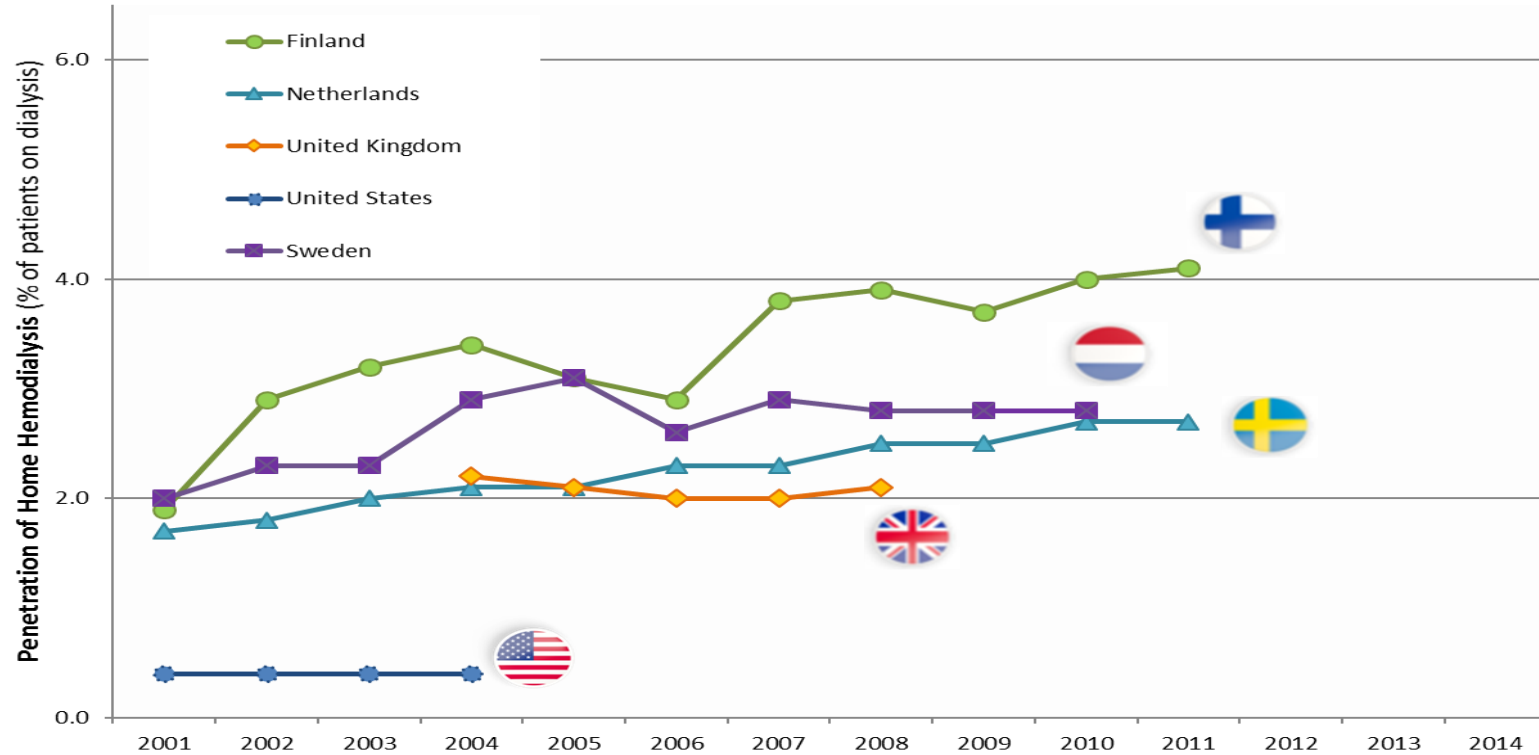
*Data Source: Reference table: D.1. December 31 prevalent ESRD patients; peritoneal dialysis consists of CAPD and CCPD only. Abbreviations: CAPD, continuous ambulatory peritoneal dialysis; CCPD, continuous cycler peritoneal dialysis; ESRD, end-stage renal disease.*

# Impact of NxStage on Home HD in the USA

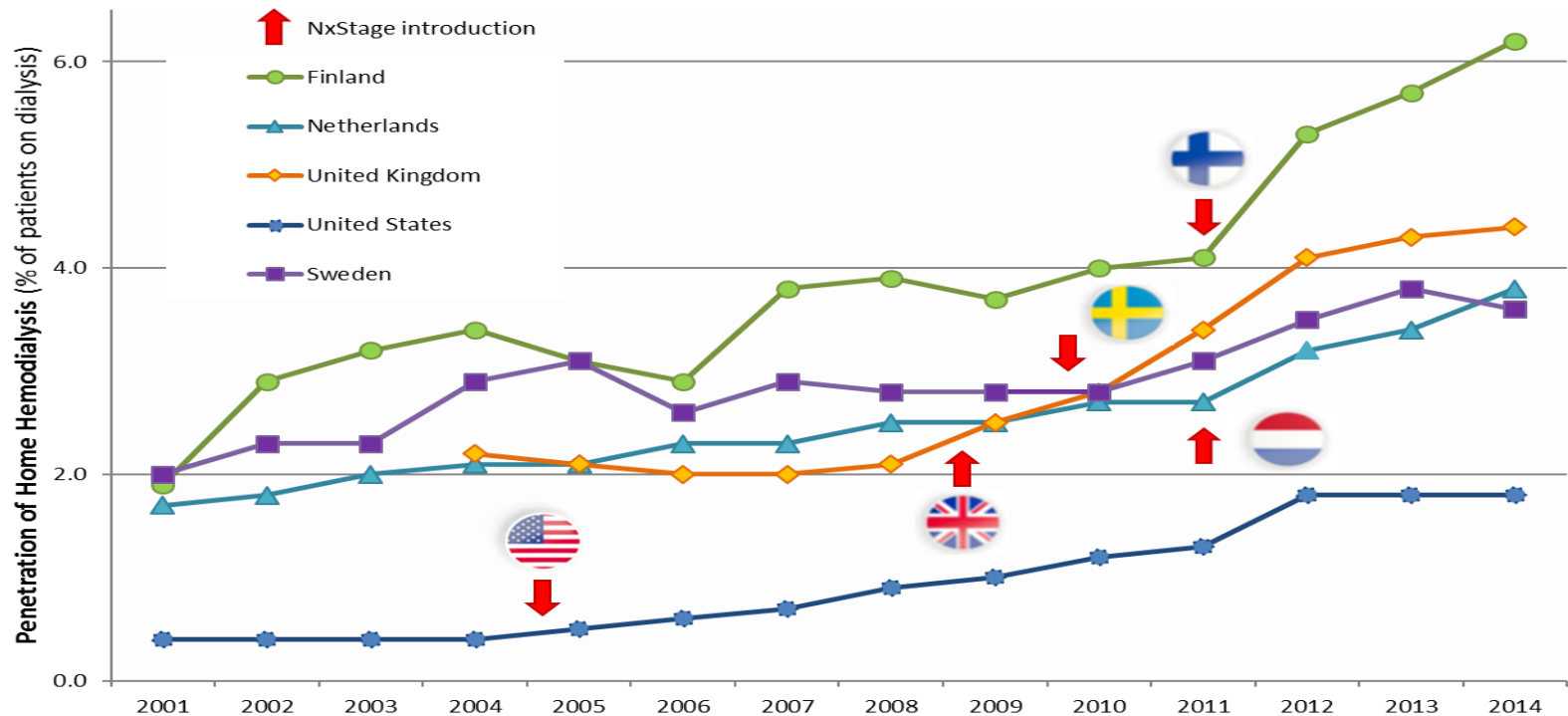


Based on 2010 USRDS Annual Data Report (containing data through 2008) and NxStage data on file as of February 2011. USRDS patient data for 2009-2010 not yet available until actual data is published.

# Home HD Penetration is Limited



# With more options Home HD can grow



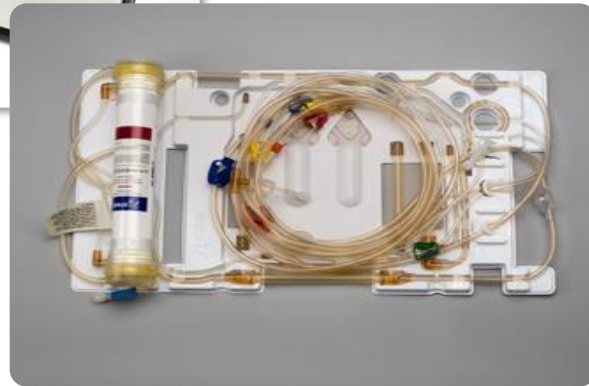


# Baxter (Gambro) AK95S/AK96S





# NxStage System One



2001...Industry sponsored advisory board:  
“define our ‘ideal’ HHD system”



- Criteria identified at that time:
  - System able to fit in a suitcase
  - System which takes 10 minutes to set up and 10 minutes to clean up
  - System which requires no interaction / maintenance between dialysis treatment sessions
  - System which is light enough to carry for the average patient
  - System which doesn't look like a dialysis machine to minimize 'medicalization' of the home
  - System which is simple to operate – a big friendly 'green = go' button and a obvious 'red stop sign shaped' stop button

...can fit in a suitcase

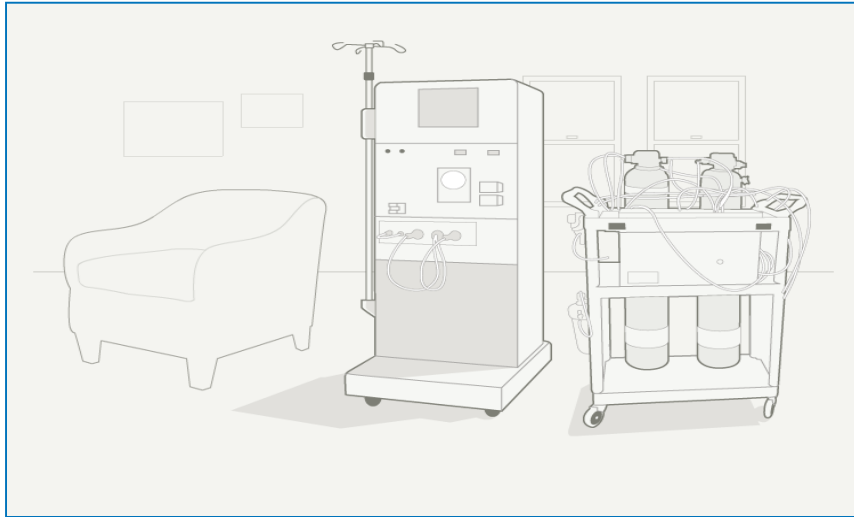
PureFlow® SL Package



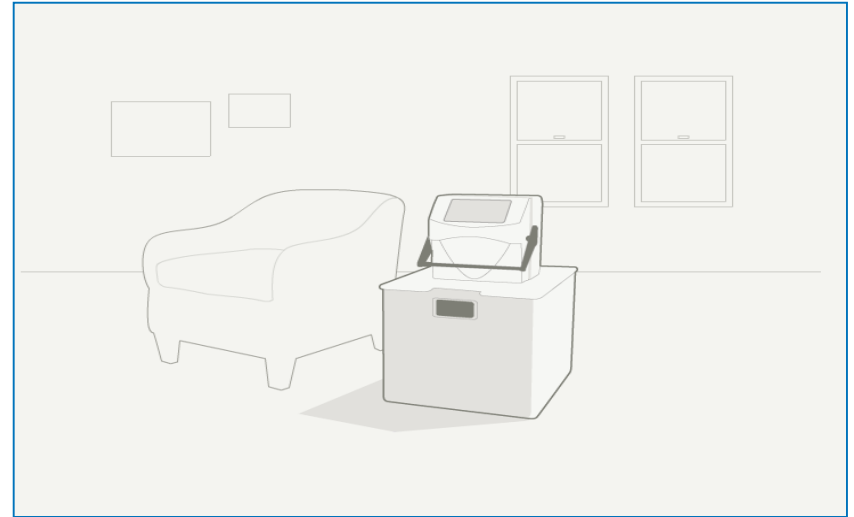
Express Package



...can fit in a suitcase



Traditional system  
(dialysis machine and RO)



NxStage System One  
with PureFlow<sup>®</sup> SL

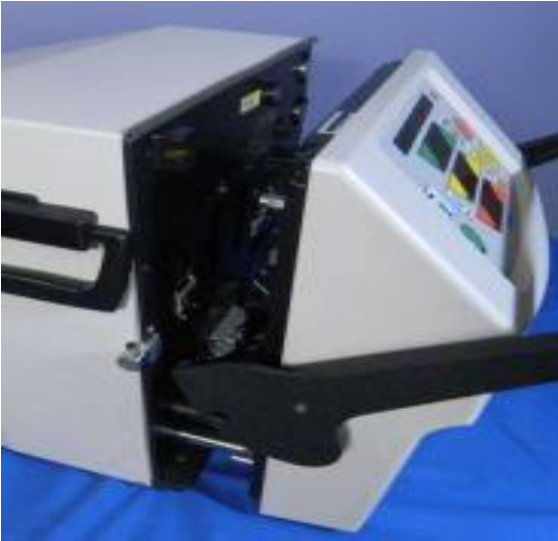
...can be quickly set-up and cleaned-up

## The Cyclor and Cartridge





...can be quickly set-up and cleaned-up



...can be quickly set-up and cleaned-up

- Cyclor requires simple wipe-down of any visible blood
- PureFlow does require interactions of creating dialysate
  - May last 2 dialysis sessions



...small enough to transport



...doesn't look like a dialysis machine to minimize 'medicalization' of the home



...friendly 'green to go' and 'stop sign to stop'



# Additional advantages of NxStage®

- Reduced renovation requirements:
  - Standard household amperage
  - Garden hose connection
- Simplicity for rural patients on wells / septic fields:
  - 20 – 60 L dialysate per session



# NxStage®:

## “Peritoneal Dialysis of the Blood”

### Similarities to PD

- Lactate based fluids
- Saturation of dialysate (dwell time)
- Dosing (prescribed clearance volume)
- Weekly Kt/V

### Similarities to HD

- Blood flow rate dependent
- Monitor blood and fluid circuit pressures
- Any vascular access (graft, fistula, catheter)
- Anticoagulation



# Clearance data:

British Columbia Data

Freedom Study Data

European Cohort data



# British Columbia Pilot Project Data

(n = 20)



	Baseline	6 months	Variability
<b>Hemoglobin (g/L)</b>	109.4 ± 14.2	109.93 ± 13.1	<b>0.50</b> ± 19/1
<b>Potassium (mmol/L)</b>	4.8 ± 0.8	4.6 ± 0.6	<b>-0.2</b> ± 0.7
<b>Bicarbonate (mmol/L)</b>	26.5 ± 4.8	26.7 ± 4.3	<b>0.2</b> ± 5.8
<b>Urea (mmol/L)</b>	14.7 ± 7.9	16.5 ± 7.6	<b>1.8</b> ± 8.4
<b>Creatinine (umol/L)</b>	587.2 ± 208	698.4 ± 309.3	<b>111.2</b> ± 266.7
<b>Phosphate (mmol/L)</b>	1.46 ± 0.4	1.52 ± 0.5	<b>0.06</b> ± 0.6
<b>Albumin (g/L)</b>	38.1 ± 4.7	38.9 ± 5.9	<b>0.8</b> ± 5.4

# Freedom One study

(n=247)




Parameter	Units	Baseline	6 month	12 month	P-value
Creatinine	umol/L	796	804	804	0.24
Blood urea	mmol/L	20.3	20.6	20.9	0.27
K+	mmol/L	4.8	4.5	4.5	<0.001
Bicarbonate	mmol/L	23	23.8	23.9	<0.001
Calcium	mmol/L	2.22	2.25	2.25	0.14
Phosphate	mmol/L	1.81	1.71	1.71	0.03
iPTH	pmol/L	46.1	62.3	54	0.23
Albumin	g/L	39	40	40	0.001
Hemoglobin	g/L	117	111	110	<0.001

# KIDHNEy Cohort

(n = 127)



Parameter	Units	Baseline	3 month	6 month
Creatinine	umol/L	760	708	712
Urea	mmol/L	20.0	19.1	19.0
K+	mmol/L	4.81	4.64	4.61
Bicarbonate	mmol/L	23.2	24.0	24.0
Calcium	mmol/L	2.29	2.30	2.28
Phosphate	mmol/L	1.72	1.68	1.71
Albumin	g/L	37.1	37.6	37.9
Hemoglobin	g/L	113	111	111

A world map with a light blue background and white landmasses. Several orange arrows point towards North America and Europe. A purple rounded rectangle with a white border is overlaid on the map, containing white text.

No differences in clearance at 3,  
6 and 12 months



Photo: Lianhe ZaoBao

# Summary...

- Home hemodialysis provides a cost-effective treatment modality which offers a number of health outcome advantages
  - Likely due to ability to increase dose of dialysis rather than ‘home’ *per se*
- New technologies with simplified user interface provide the opportunity to:
  - increase uptake
  - reduce program losses
  - And do so without adversely affecting dialytic clearances





**Thank you!**

