

DIALYSIS

THE VIEW FROM THE OTHER SIDE

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Division of Nephrology, University of British Columbia

October 2011



**Nephrology and
Renal Transplant Days**

OBJECTIVES

1. Identify the limitations of conventional hemodialysis and become become familiar with the evolving concept of "dialysis adequacy".
2. Learn about the variety of individualized dialysis regimens aimed at intensifying the dialysis prescriptions and potential benefits thereof.
3. Become familiar with the model of nocturnal in-centre dependent dialysis, and some barriers to implementing such a program in your centre.

STATEMENT OF DISCLOSURES

No personal or financial affiliations with:

- Handidart
- Cats
- Pigs
- Jack Nicholson
- The makers of saw tools
- The Rubix cube
- Any cellphone company

ADEQUACY OF DIALYSIS



WE HAD IT RIGHT THE FIRST TIME

- The first dialysis session that was ever performed reportedly lasted 76 hours!
- In the early days of hemodialysis (1960s), treatments typically lasted 8 to 12 hours in duration
- Unfortunately, increases in demand, early studies in dialysis, and financial considerations led us to discover how little we could get away with
- The “minimum necessary amount” has arbitrarily become the “the new standard of care”



CONVENTIONAL HEMODIALYSIS

WHAT WE SEE

- 3x / week, 4 hours per run
- Occasional changes in medications
- Occasional changes in goal weight
- Routine Bloodwork, focus on:
 - Phosphate <1.7 , Calcium $2.1 - 2.4$
 - PTH $<$ some number
 - Hemoglobin 110-120 g/L
- If cramps $\rightarrow$ Quinine
- If hypotension $\rightarrow$ Midodrine
- If hypertension $\rightarrow$ BP meds
- Dialysis is *adequate* as long as
 - $Kt/V >1.2$ and $URR >65\%$



Rearranging deckchairs on the Titanic?

CONVENTIONAL HEMODIALYSIS

WHAT IS ACTUALLY HAPPENING

MON	TUES	WED	THURS	FRI	SAT	SUN
HD		HD		HD		

3 times a week, our patients are subjected to 4 hours of :

- Hemodynamic shock (→ ischemia to brain, heart, gut, peripheries)
- Multiple potentially fatal cardiac rhythms (including V Tach)
- Hypokalemia
- Alkalemia
- Brain edema (rapid removal of solutes)

3 times a week, our patients experience

- Pulmonary edema
- Hyperkalemia
- Acidemia
- Extreme Thirst
- Hypertension

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- To add insult to injury the shift from one extreme to the other occurs extremely rapidly
- This makes the life of a hemodialysis patient as “non-physiologic” as possible
- Snapshot of the last two years in one BC unit:
 - 219 new patients started hemodialysis, of whom
 - 15 switched to peritoneal dialysis
 - 3 received a transplant
 - 12 moved away
 - *31 died*

Mortality rates remain high in the dialysis population, despite a progressive rise in Kt/V over years

CONVENTIONAL HEMODIALYSIS

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MON	TUES	WED	THURS	FRI	SAT	SUN
HD		HD		HD		

Recently published study of 32,605 hemodialysis patients

During their “long stretch”, patients are more likely to

- Die from
 - Infections, cardiac arrest, myocardial infarction
- Be admitted to hospital due to
 - Congestive heart failure, arrhythmia, stroke



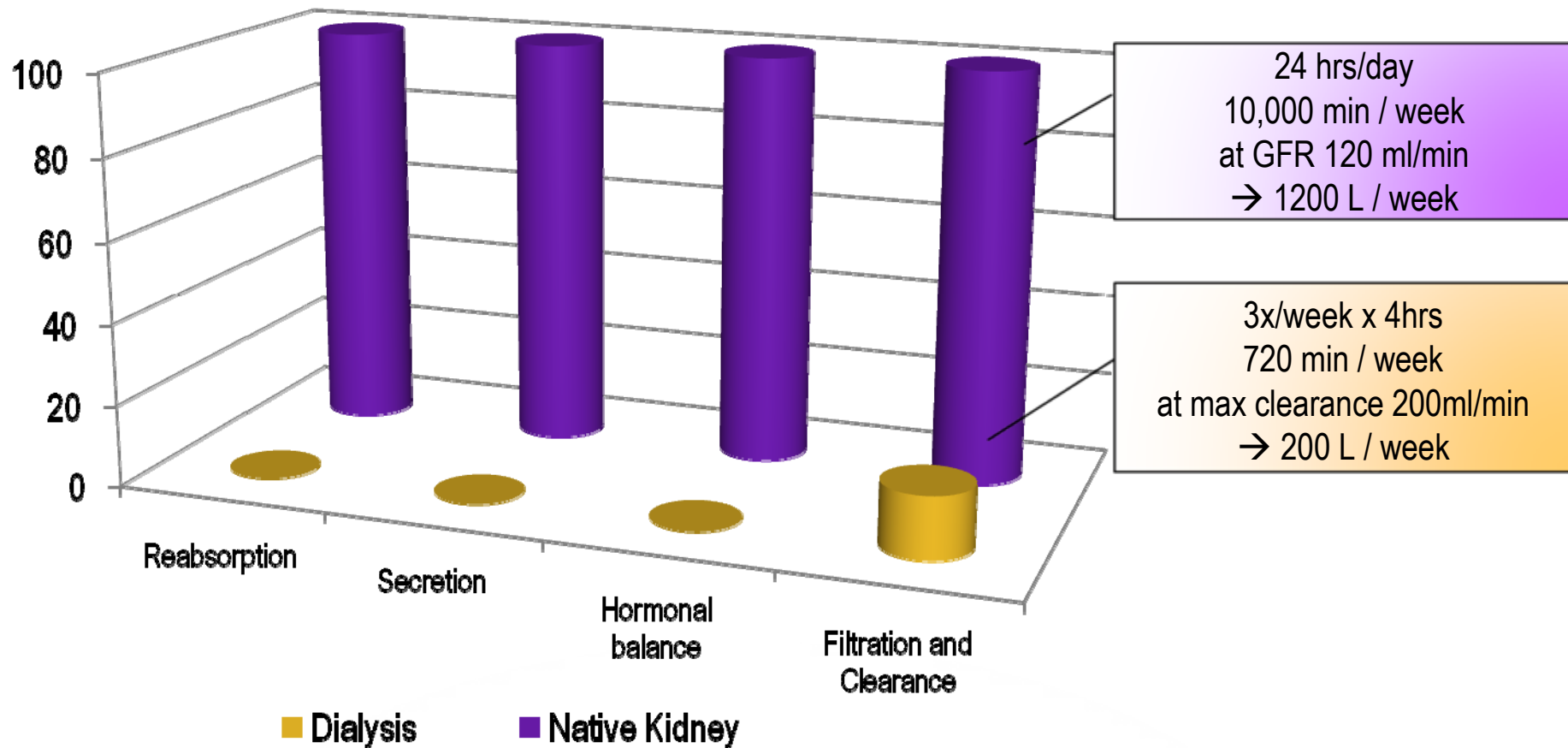
UNHEALTHY DELUSIONS WE HAVE: “RENAL REPLACEMENT THERAPY”



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INTENSIVE HEMODIALYSIS MODALITIES

MODALITY	RUNS PER WEEK	DURATION OF RUN (hours)	Blood flow rate (ml/min)	Dialysate flow rate (ml/min)	Replacement fluid rate (ml/min)
In center conventional	3	4	> 350	> 500	-
Short Daily	5	2.5 - 4	> 350	> 500	-
Nocturnal	3 – 7	6-10	200-300	300-500	-
Hemodia-filtration	3	4	> 350	> 600	> 80

INTENSIVE HEMODIALYSIS MODALITIES

MODALITY	RUNS PER WEEK	DURATION OF RUN (hours)	Qb blood flow rate (ml/min)	Qd dialysate flow rate (ml/min)	Qr replacement fluid rate (ml/min)	"Simulated" native GFR
In center conventional	3	4	> 350	> 500	-	< 15 %
Short Daily	5	2.5 - 4	> 350	> 500	-	< 35%
Nocturnal	3 – 7	6-10	200-300	300-500	-	25-95%
Hemodia-filtration	3	4	> 350	> 600	> 80	20 - ? %

(not replaced: reabsorptive, endocrine, secretory function)



Time has emerged as the most important variable in the dialysis prescription

CONVENTIONAL HEMODIALYSIS

THE TRUTH



- 12 hours of treatment with a machine cannot match normal (24/7) kidney function
- The nature of a 3x/wk dialysis schedule invites extreme highs and lows
- It is impossible to undo 48-72 hours of “badness” within 4 hours without causing any collateral damage
- To make any appreciable clinical difference, we have to reconsider two variables:
 - The frequency of dialysis treatments per week
 - The duration of dialysis treatments per run
- We need to smooth out the saw tooth



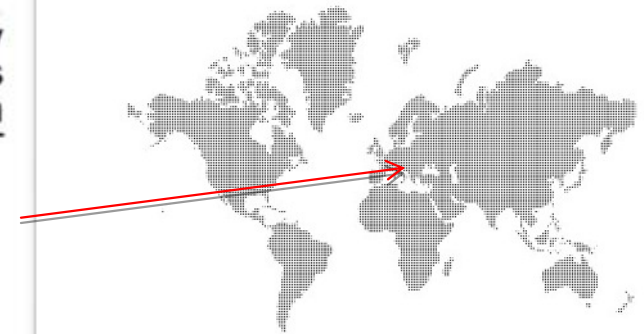
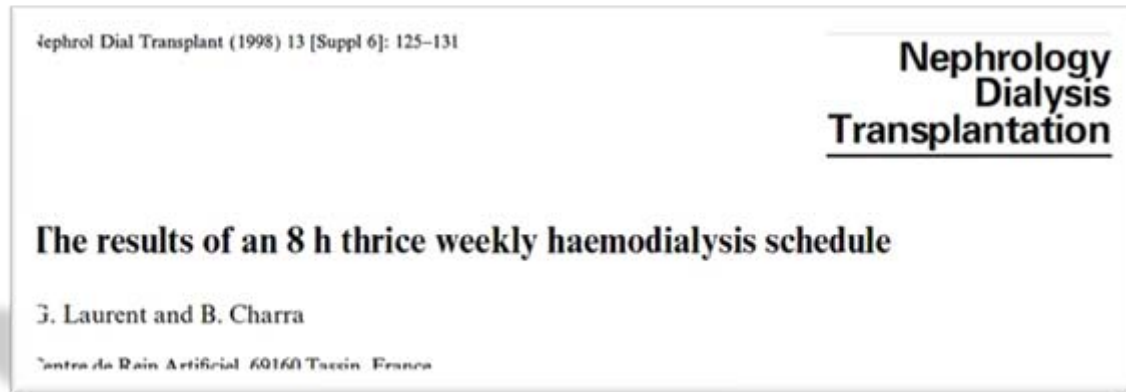
NOCTURNAL HEMODIALYSIS

OLD CONCEPT

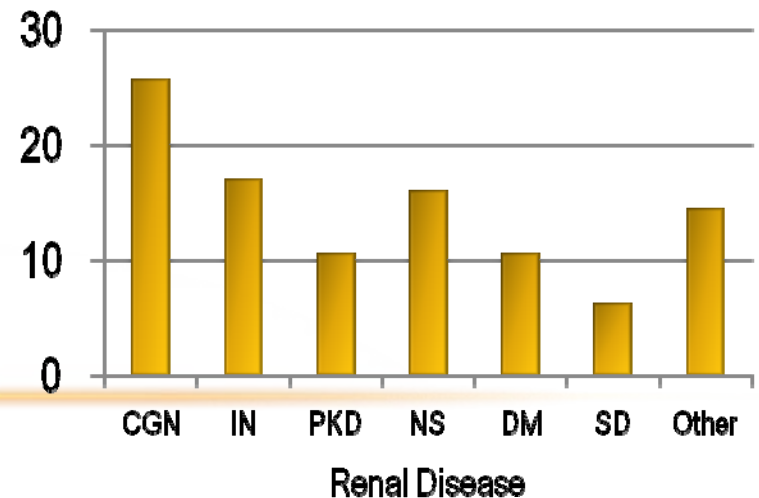
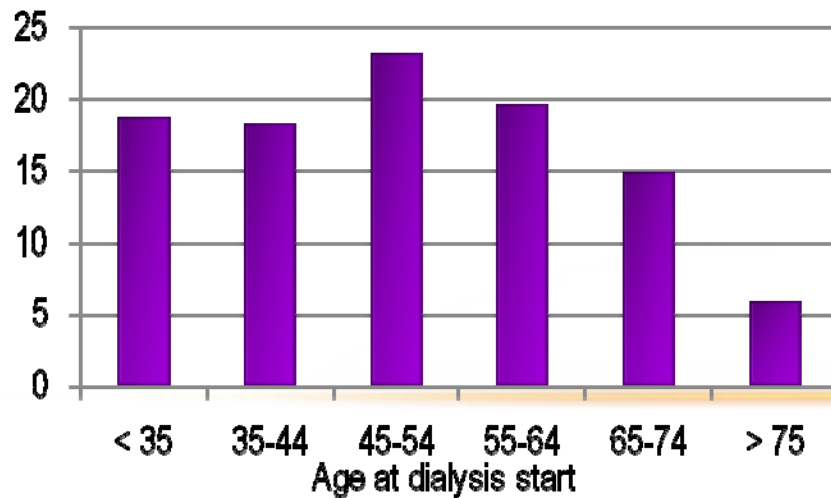
EVOLVING TECHNOLOGY



ORIGINS: THE TASSIN EXPERIENCE

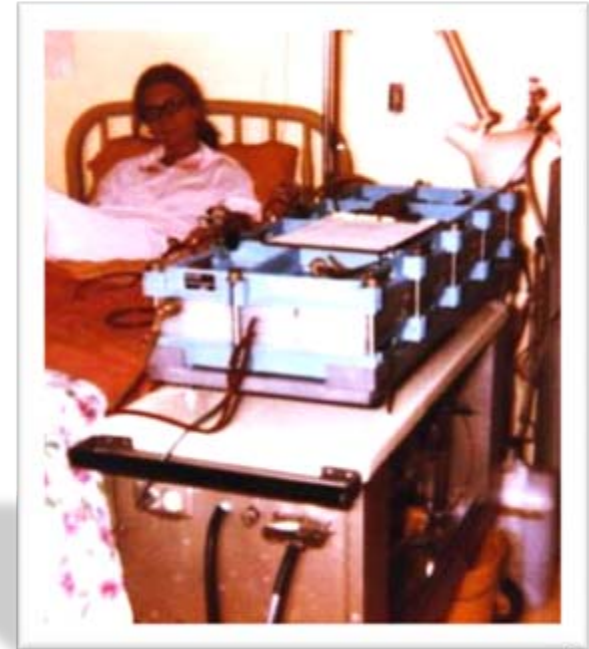


- 868 patients received “long” hemodialysis runs between 1968 – 1996



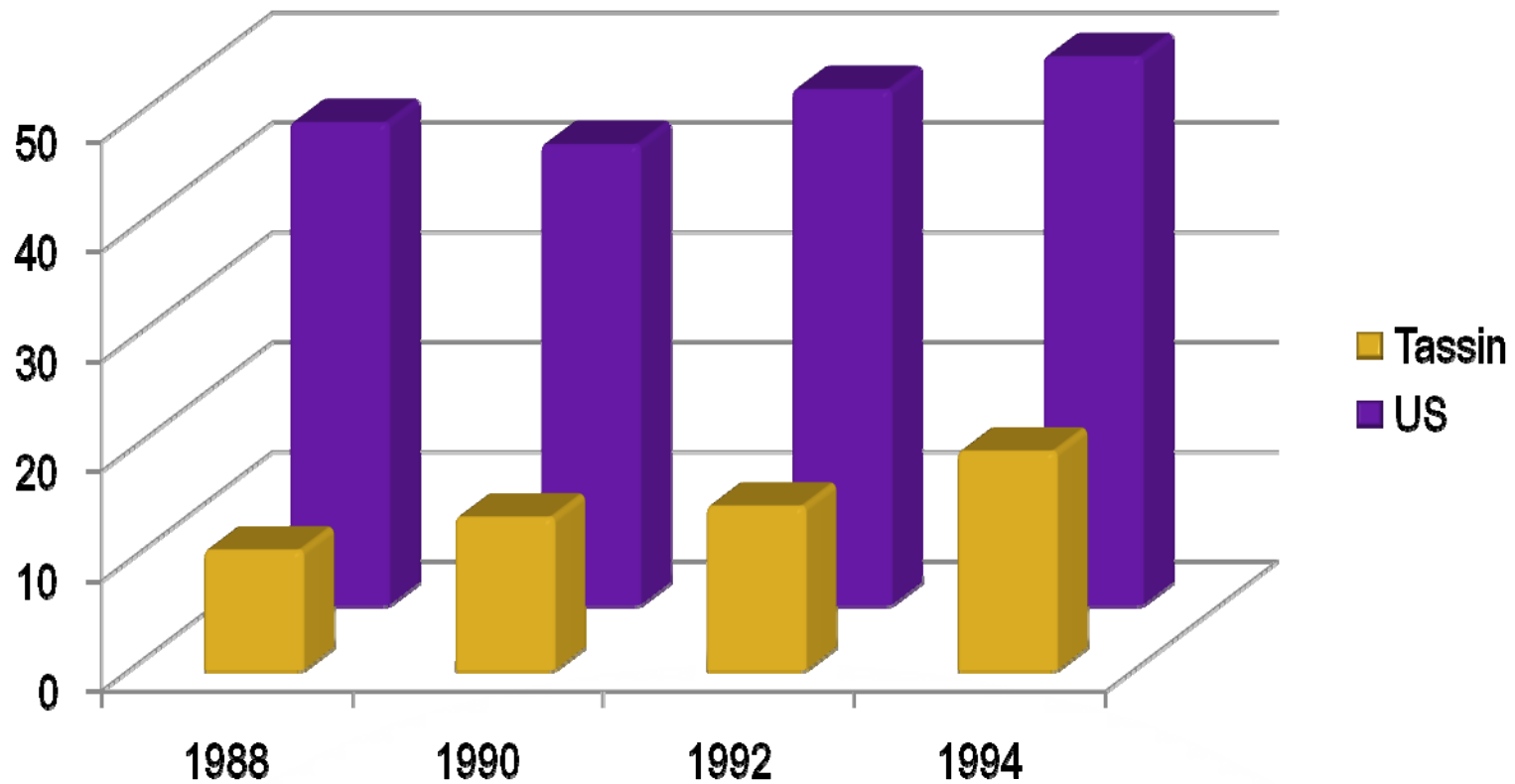
THE ORIGINAL RECIPE

- 8 hours
- 3 x per week
- Cuprophan Kiil Dialyzer
(later flat-plate/hollow fibre cuprophan)
- Na 139, K 1.5, Ca 1.75, Cl 106, acetate 35
- Qd 500 ml/min
- Qb 220 ml/min
- AVF prevalence 75%
- No Epo until 1989



The patients are requested to eat a varied diet unrestricted in proteins with a large calorie intake. They are asked not to add salt to their food. However, the use of cheese, a staple part of the French diet, is not restricted (except during the first few weeks of treatment).

5 YEAR MORTALITY RATES COMPARED TO UNITED STATES HEMODIALYSIS POPULATION



Standardized Mortality Ratio 0.25-0.40

OTHER IMPORTANT OUTCOMES

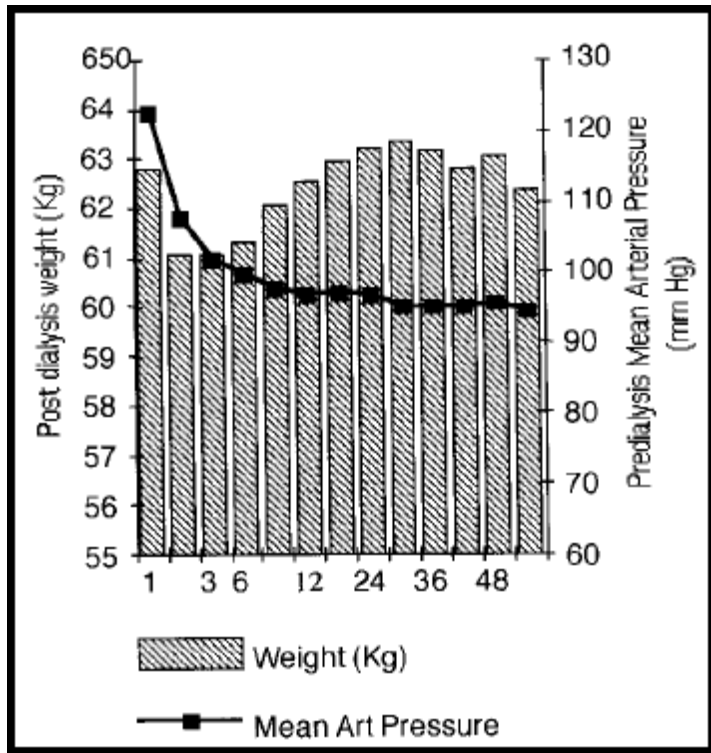


Table 7. Intradialytic incidents per 1000 dialysis sessions vs session duration

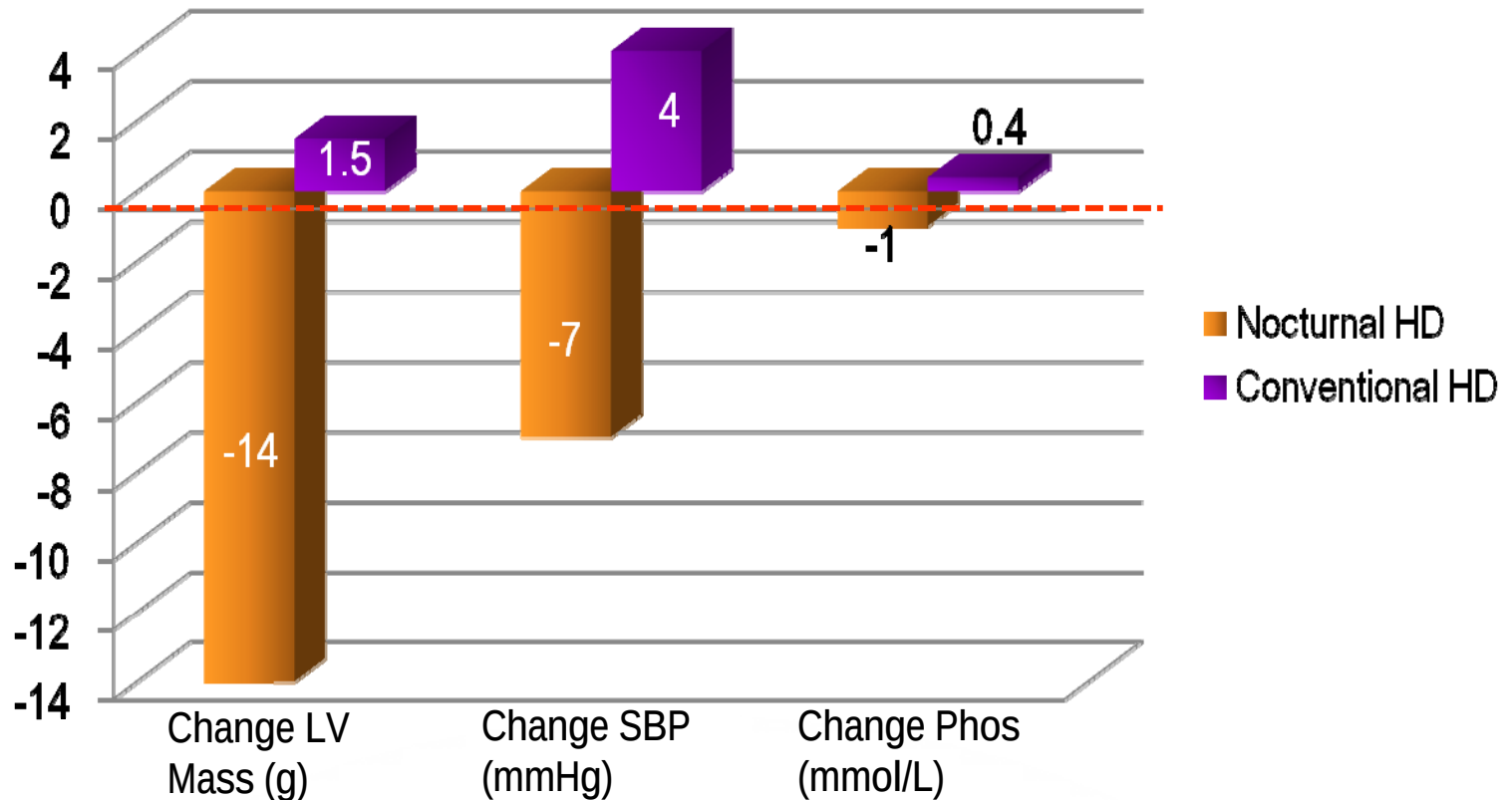
	Diaphane	Bregamo	Tassin	Tassin
Session time (hs)	4.3	4	8	5
Hypotension	208	216	70	129
Cramps	102	110	31	20
Vomiting	44	45	6	15
Headache	30	—	7	12

(comparison to Italian and French registries)

Reduction in BP
Improvement in nutrition and weight

Less intradialytic hypotension and other complications during dialysis

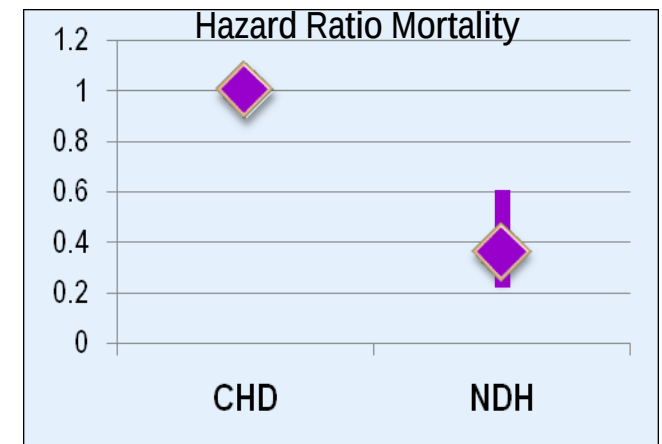
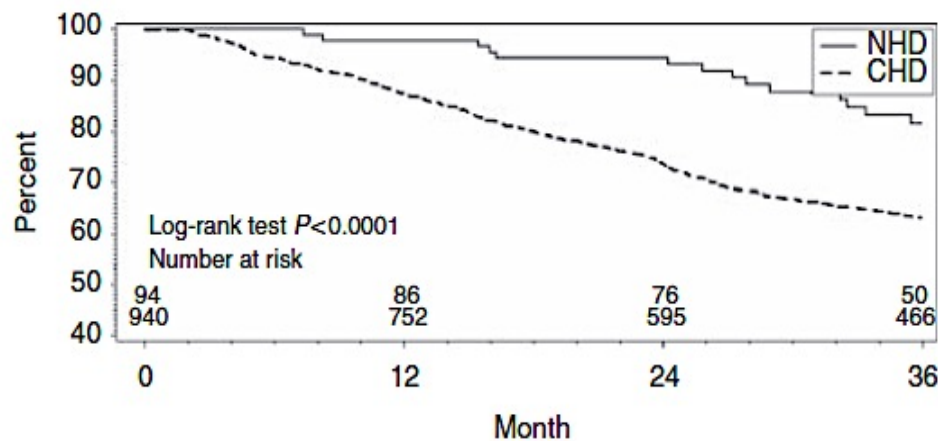
Randomized trial of 52 patients, 26 received 3x/wk HD, 26 received 6x/wk nocturnal HD



16 / 26 nocturnal patients stopped their anti-hypertensives (versus 3/25)
19 / 26 nocturnal patients stopped their phosphate binders (versus 3/25)
Modest improvement in kidney disease related quality of life measures

Survival and hospitalization among patients using nocturnal and short daily compared to conventional hemodialysis: a USRDS study

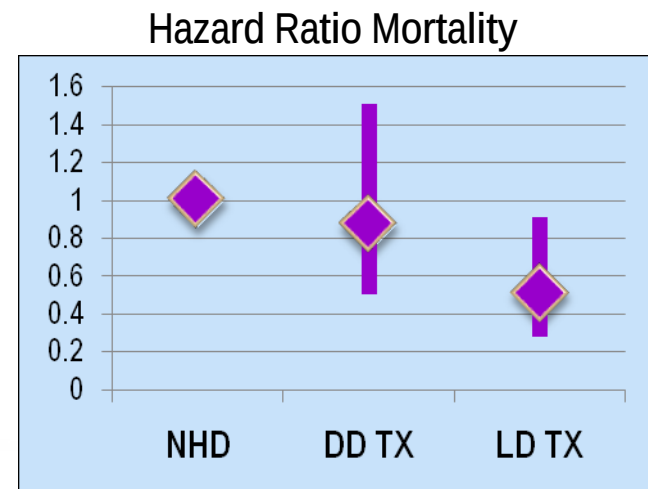
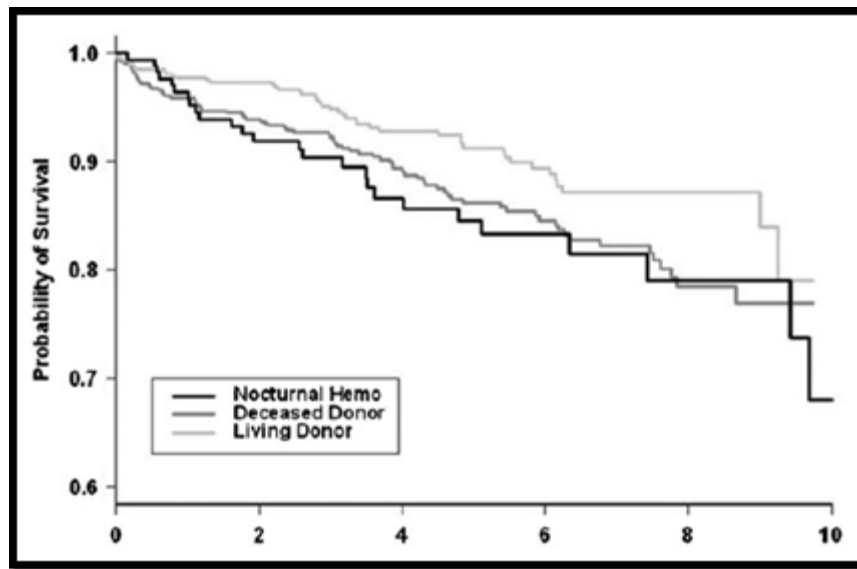
94 nocturnal HD patients matched to 940 conventional HD patients (in USRDS dataset)



Nocturnal dialysis patients live longer than those on conventional hemodialysis

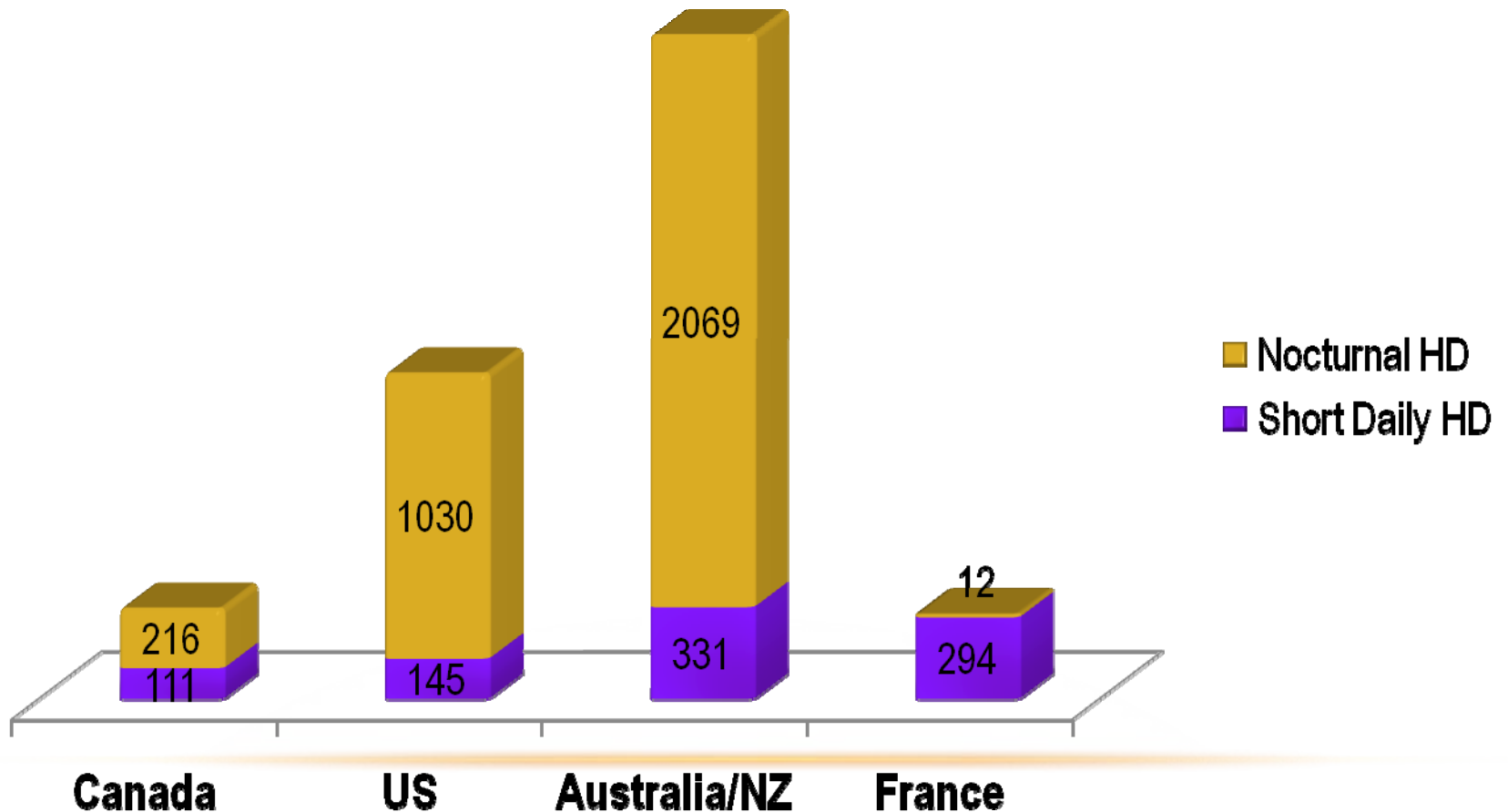
Survival among nocturnal home haemodialysis patients compared to kidney transplant recipients

177 nocturnal HD patients (Toronto data) matched to 1062 transplant patients (USRDS dataset)



Long-term survival of nocturnal patients is similar to those who receive a deceased donor transplant

THE REST OF THE WORLD CAUGHT ON



OBSERVED BENEFITS OF NOCTURNAL DIALYSIS

- Longer survival
 - LV mass regression
 - Better phosphate clearance
 - Discontinuation of phosphate binders
 - Liberalization of diet
 - Improved kidney-disease related quality of life
 - Improved blood pressure control
 - Discontinuation of anti-hypertensive medications
 - Improved fluid control
 - Improved hemodynamic stability during dialysis
 - Better middle molecule clearance?
- 

WHY DO PATIENTS DO BETTER ON NOCTURNAL HEMODIALYSIS REGIMENS ?

THE BELIEVERS

Longer treatment time allows for gentler ultrafiltration rates

- More effective and better tolerated volume removal

More effective removal of small and middle molecules

- Especially phosphate clearance, but also all other uremic toxins

Slowed blood and dialysate flows

- Avoid rapid changes in solutes

THE SKEPTICS

People well enough to perform nocturnal hemodialysis at home are

Healthier to begin with

More motivated and compliant

Of a certain socio-economic status

More likely to be educated

More supported by family and friends

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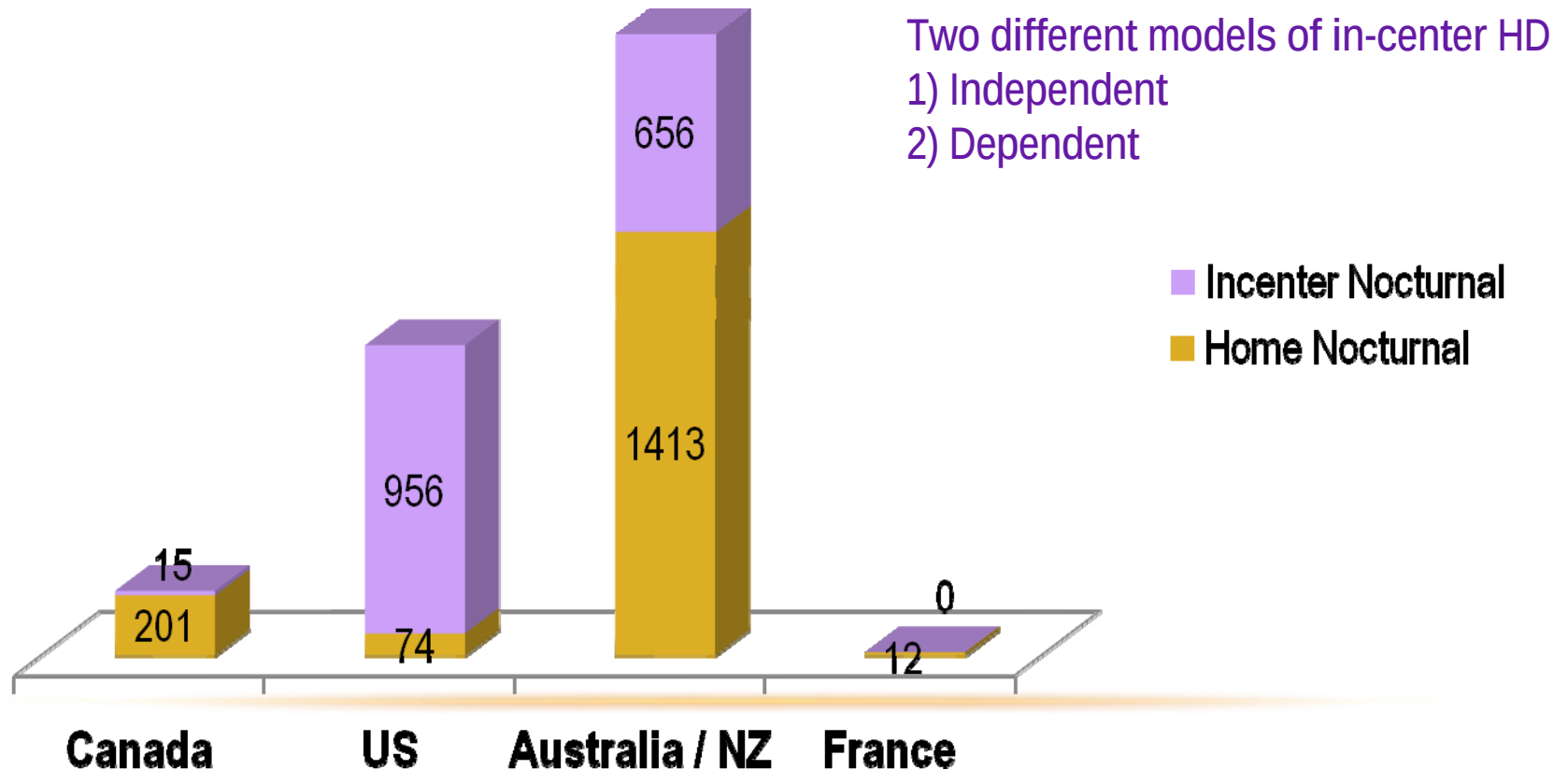
THE SKEPTICS

People well enough to perform nocturnal hemodialysis at home are

- Healthier and more fit to begin with
- More motivated and invested in health
- More compliant with treatment
- Of a certain socio-economic status
- More likely to be educated
- More supported by family and friends
- More likely to have a stable home

This provided the rationale for in-center nocturnal hemodialysis

NOCTURNAL DIALYSIS - MY PLACE OR YOURS?



IN-CENTER NOCTURNAL HEMODIALYSIS

Under the umbrella of home-based independent hemodialysis
Program at Vancouver General Hospital

Patients trained fully for independent hemodialysis

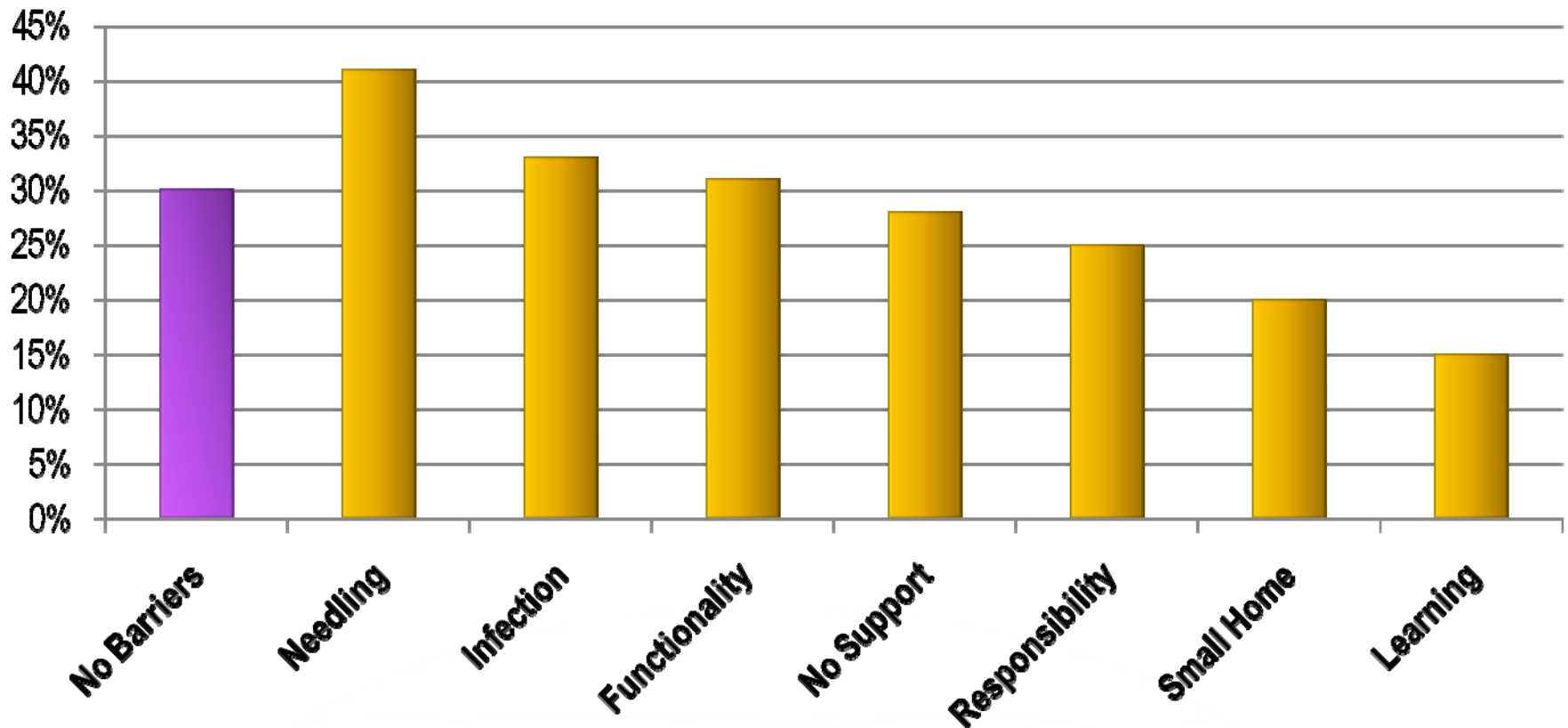
- Self-management of all aspects of dialysis treatment
 - Set-up/clean up
 - Self-cannulation
 - Dialysis prescription
 - Management of alarm situations

This can be
intimidating at first !

Supervised by one RN and one PCA (only assist with emergencies)
Clinical follow up in IAMHD clinic by IAMHD team

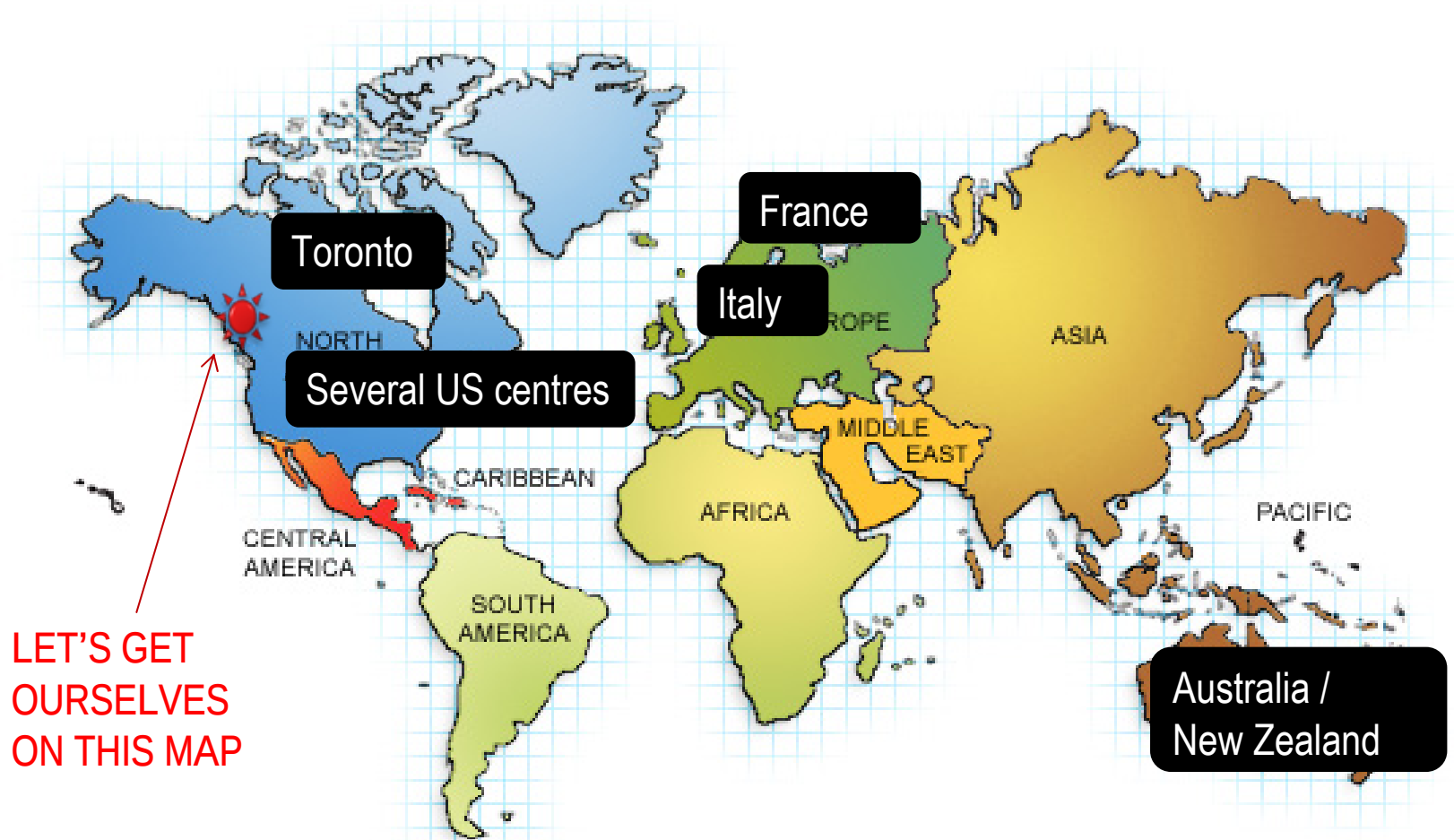
WHAT BARRIERS DO PATIENTS PERCEIVE WHEN CONSIDERING INDEPENDENT DIALYSIS?

Province-wide survey of 3009 kidney patients undertaken in 2009



This provided the rationale for in-center nocturnal “dependent” hemodialysis

PIONEER CENTERS OFFERING NOCTURNAL IN-CENTER DIALYSIS



NOCTURNAL IN-CENTER HEMODIALYSIS

NOT ALL ROADBLOCKS
ARE EQUAL



INITIAL PLANNING CONSIDERATIONS

Funding

- Start-up Cost
- Ongoing operational cost

Staff – RN and Technicians

- Schedule
- Incentive

Location

- Where in the unit

Patients

- Who and how many



ADDITIONAL PLANNING CONSIDERATIONS

HD machines

- Timing and location of disinfection and terminal cleans
- Avoidance of interference with am and pm shifts

Housekeeping

- Rescheduling

Patient transportation

- Handydart
- Drop-off, pick-up
- Entrance
- Parking, pick-up



NOT TO FORGET...THE MEDICINE

- Dialysis Prescription
- Patient Selection Criteria
- Protocol Development
- Physician Coverage
- Communication Tools
- Multidisciplinary Clinic Care
- Outcome Assessments



PATIENT SELECTION



WHAT WOULD MAKE YOU SUSPECT A PATIENT NEEDS MORE INTENSE DIALYSIS?

Results of 2010 province-wide survey of BC Nephrologists:

1. Uremia: unexplained nausea, vomiting, poor appetite
2. Refractory hyperphosphatemia
3. Refractory pruritus
4. Unexplained cognitive changes
5. Unexplained fatigue
6. Unexplained neuropathy
7. Frequent intradialytic hypotension
8. severe HTN (especially when fluid-responsive)
9. $Kt/V < 1.2$ / $URR < 65\%$
10. Consistently bad vascular access flows



Combined with home HD patient selection criteria to yield final criteria

PATIENT SELECTION PROCESS



PATIENT SELECTION CRITERIA **ENTRANCE INTO NOCTURNAL HEMODIALYSIS UNIT – SPH**

*Entrance into the nocturnal facility-based assisted hemodialysis program will be on a priority system based on medical indications (levels 1). Should there be more eligible patients than spots, a lottery system will be used to allocate patients. In the event space is available in the program, after all **Level 1 patients** have been assigned, any patients expressing an interest in the program (level 2) will be considered, again through a lottery system.*

Level 1 Patients

- Uremic symptoms
- Refractory pruritus
- Uremic serositis
- Frequent IDH
- Severe hypertension
- Severe hyperphosphatemia
- KtV <1.2, URR <65%
- Poor vascular access flows
- Soft tissue calcification / calciphylaxis

Level 2 Patients

- Patient interest or preference

PATIENT COMMUNICATION

How to get to the unit

Transportation

By car: You may drive yourself, if you can. If this is not possible, arrange a ride with your family or friends. Enter via Emergency entrance, Burrard St after 8 pm

By bus: The following buses stop in front or near St. Paul's: #1 Burrard Station/Beach, #2 Macdonald - 16th Avenue/Burrard Station, #22 Knight/Macdonald, and #44 UBC/Downtown. Check www.translink.bc.ca for schedules and times.

By HandyDART: Check with your social worker or Translink for information.

Parking: Parking is available at St. Paul's Hospital. You will have to use the Emergency entrance to enter the hospital from the parking lot. Ask the nurse to have your parking ticket stamped. Parking tickets will be accepted by the lot attendant after 6:00am.

Providence HEALTH CARE
How you want to be treated.

Nocturnal Dialysis Unit Hours:

Sunday to Friday:
9 pm – 6 am

St. Paul's Hospital Hemodialysis Unit

60 – 1081 Burrard Street
Vancouver, BC V6Z 1Y6
Phone: 604-806-8453
Fax: 604-806-8449

Providence HEALTH CARE
Vancouver Coastal Health
Renal Agency

Providence HEALTH CARE

Vancouver Coastal Health
Promoting wellness. Ensuring care.

Renal Agency

NOCTURNAL HEMODIALYSIS PROGRAM

ST. PAUL'S HOSPITAL

Program Information and

Patient Agreement

PROGRAM INFORMATION

The Provincial Renal Agency, in partnership with renal care teams across British Columbia, is expanding dialysis options for patients. Current options for dialysis in BC include:

- In-centre or community unit hemodialysis
- Self-care hemodialysis in a hospital
- Home-based independent hemodialysis
- Peritoneal dialysis

An addition option being trialled is "nocturnal hemodialysis" – a program where patients undergo slower dialysis overnight instead of the more common 4 hour runs during the day. Research shows that patients may experience a number of health and lifestyle benefits as a result of longer total weekly treatment times. Some of these potential benefits are:

PROGRAM PROTOCOLS

IF YOU RECEIVED THIS FACSIMILE IN ERROR, PLEASE CALL 604-806-8886 IMMEDIATELY																																																																					
PREScriBER'S ORDERS NO DRUG WILL BE DISPENSED OR ADMINISTERED WITHOUT A COMPLETED CAUTION SHEET ALLERGY/INTOLERANCE STATUS FORM (PHC-PH047)	Draft December 14, 2010																																																																				
NOCTURNAL HEMODIALYSIS UNIT CONTINUING CARE ORDERS (Page 1 of 1) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 15%;">DATE</th> <th style="width: 5%;">Day</th> <th style="width: 5%;">Mon</th> <th style="width: 5%;">Tue</th> <th style="width: 5%;">Wed</th> <th style="width: 5%;">Thu</th> <th style="width: 5%;">Fri</th> <th style="width: 5%;">Sat</th> <th style="width: 5%;">Sun</th> <th style="width: 5%;">Total</th> </tr> <tr> <th colspan="8"></th> </tr> </thead> <tbody> <tr> <td colspan="2">Goal Weight (kg)</td> <td colspan="8"></td> </tr> <tr> <td colspan="2">Dialyzer</td> <td colspan="8"></td> </tr> <tr> <td colspan="2">Dialyzer Rinse: ☐ Standard or ☐ Other _____</td> <td colspan="8"></td> </tr> <tr> <td colspan="2">Duration (hours per run) (Standard 8 hours)</td> <td colspan="8"></td> </tr> <tr> <td colspan="2">Frequency (runs per week) (Standard 3x/week)</td> <td colspan="8"></td> </tr> </tbody> </table>		DATE	Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total									Goal Weight (kg)										Dialyzer										Dialyzer Rinse: ☐ Standard or ☐ Other _____										Duration (hours per run) (Standard 8 hours)										Frequency (runs per week) (Standard 3x/week)									
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COMMUNICATION TOOLS



ON CALL PHYSICIAN (EVERY NIGHT):
DR. FARAH
 604-844-0167 (PAGER)
 604-307-9304 (CELL)

NOCTURNAL HEMODIALYSIS UNIT PROGRAM – SPH PROBLEM SHEET

Please record any problems / concerns identified during a run. Problem sheets will be reviewed every morning by physician.

PATIENT NAME	DATE (at start of run)	PROBLEM / CONCERN	NAME OF RN	MD REVIEW AND PLAN

NOCTURNAL
 ST. PAUL

CLINICAL
 SUMMARY

ETIOLOGY

ELIGIBILITY
 (refer to No



CURRENT

CURRENT

eligibility details:
 (refer to Nocturnal HD Patient Selection Criteria form)
 ELIGIBILITY FOR ENTRANCE INTO HD PROGRAM

PROGRESS SO FAR

OFFICIAL PROGRAM LAUNCH IN
JANUARY 2011

PROGRAM AT IN-CENTER
HEMODIALYSIS UNIT, ST. PAUL'S
HOSPITAL



DELIVERY OF DIALYSIS AND PATIENT CARE

- Dialyze 3x/week, 8 hours per run, 22pm – 6am
 - Slowed blood and dialysate flow rates
 - Vital signs q2h x 1wk, then q4h x 2wks, then beginning & end, prn
 - Pre and post run BW of pertinent parameters for first three runs, thereafter as per usual practice
 - Transonic access flows performed by nurses as per usual practice
 - Physician on-call coverage at all time
 - Regular clinic follow-up and sooner when necessary
 - Charting in PROMIS
- 

THE PATIENTS

Started with 16 patients, currently at 17, with flux however (transplants)

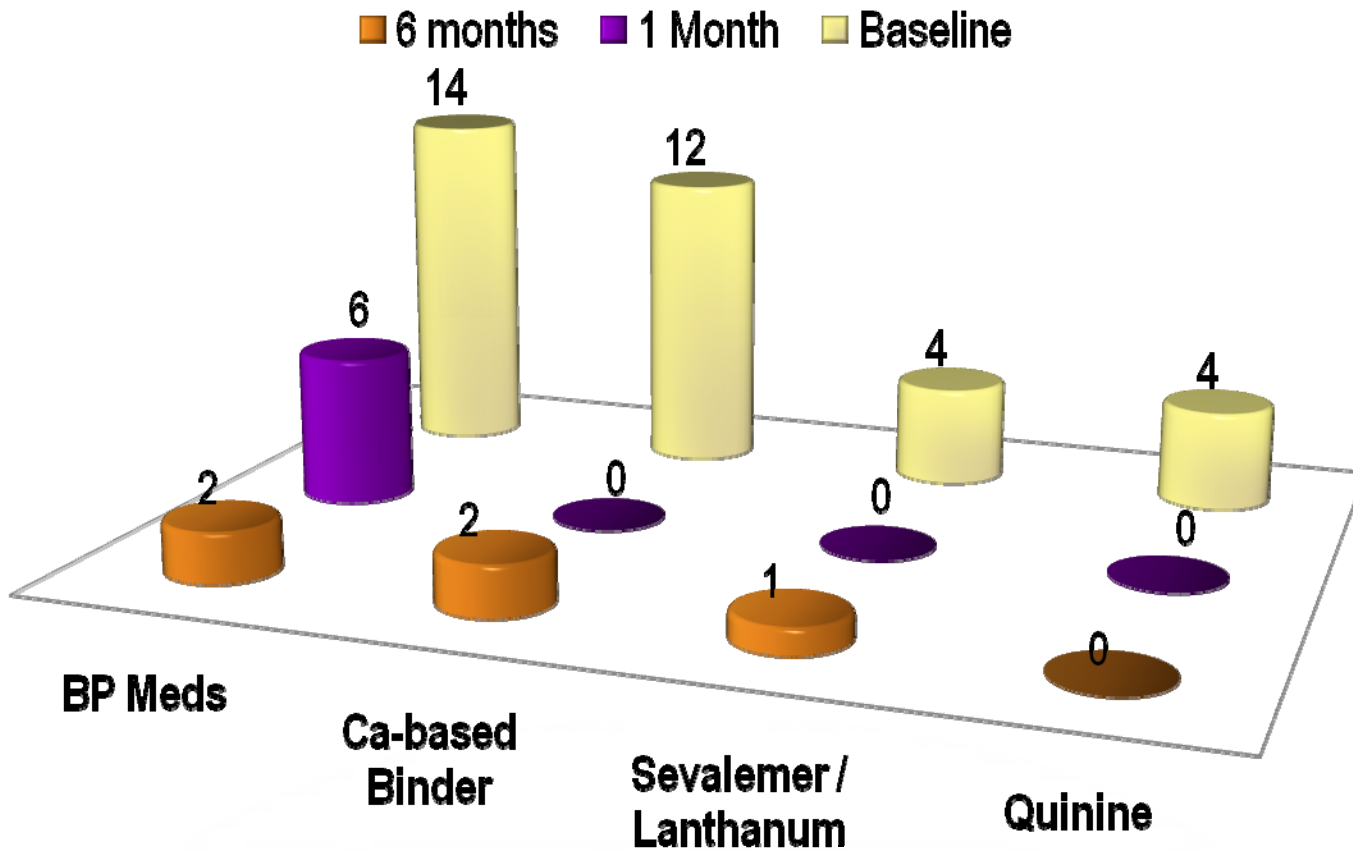
Productivity – the programs has allowed:

- One person to keep his job
- One person to get a job and a home again
- Two people to upgrade to full-time jobs
- One person to pursue full-time school
- One person to start ballroom dancing
- One person to lose 15 kgs (intentionally)

Biggest adjustment: sleep and snoring neighbours

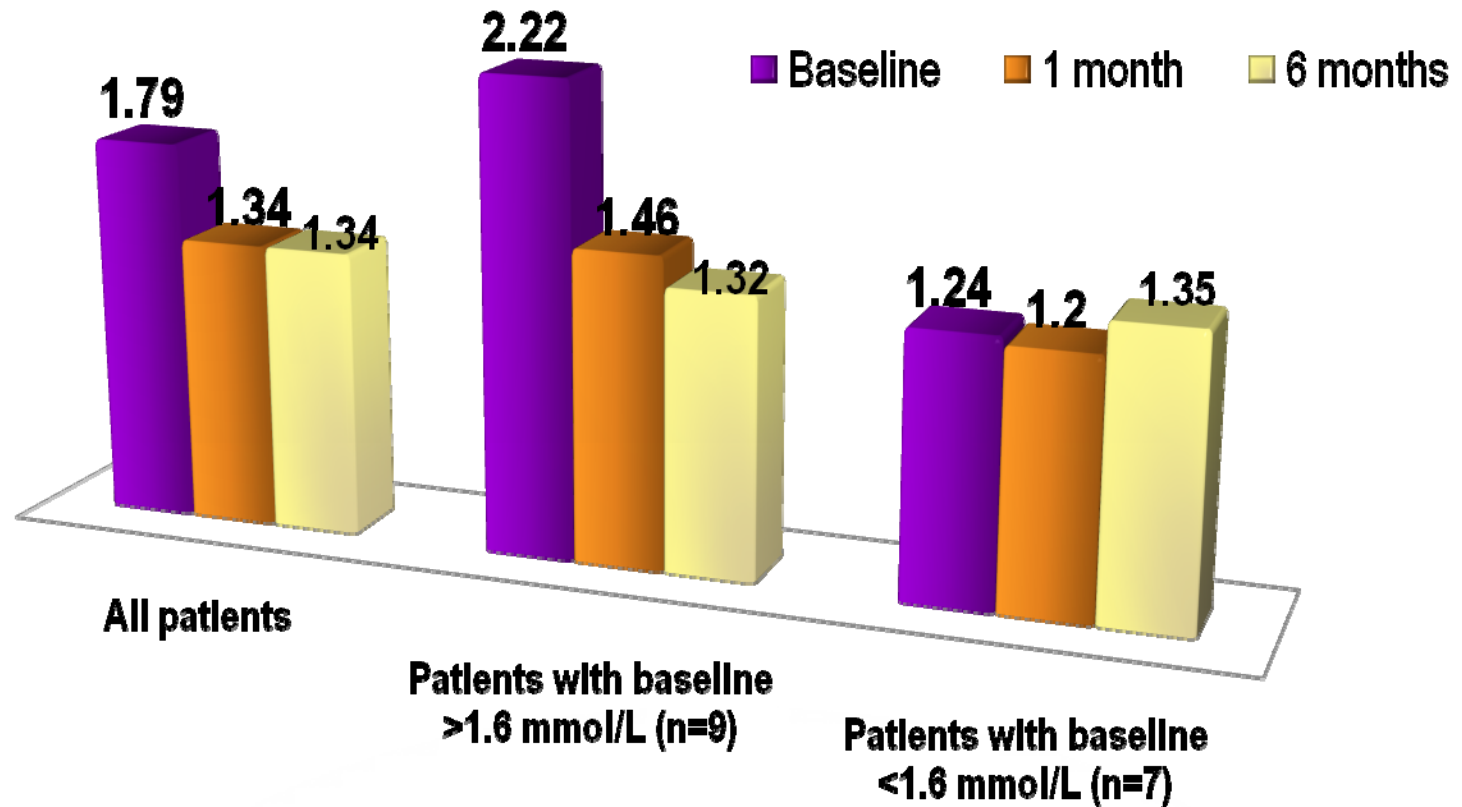


IMPACT ON MEDICATIONS



Most medication changes occurred within first two weeks of starting nocturnal therapy

IMPACT ON PHOSPHATE CONTROL



This effect was DESPITE elimination in phosphate binders

OTHER OUTCOMES UNDER ASSESSMENT

Bridging toward independent therapies

Biochemical Results

- Hemoglobin
- Acid base status
- Middle molecule clearance – b2M
- Mineral metabolism – Calcium, PTH, Alkaline phosphatase

Cardiac Function

- Echocardiogram
- Cardiac MRI

Other Medication Tracking

- EPO dosing

Volume Control

- Ability to achieve GW
- IDWG
- Frequency of IDH

Dialysis Related Symptom Burden

- Edmonton Symptom Assessment Scale

Vascular Access complications

- Thrombosis
- Infection
- Interventions

Cost

- Medications
- Hospitalizations



AN AMAZING TEAM OF PEOPLE TO THANK

SUMMARY AND TAKE-HOME POINTS

- We have to change the way we think about dialysis and dialysis adequacy.
 - All our patients are under-dialyzed.
 - We have to stop thinking of dialysis as a good replacement of normal kidney function
 - Time and frequency of dialysis are much more important than having the newest technology gadget on our dialysis machines.
 - We have to individualize dialysis therapies for each of our patients
 - One size does not fit all.
-

THANK YOU FOR
YOUR ATTENTION

QUESTIONS /
COMMENTS

