



Home Hemodialysis: What is New?

Tom Cornelis MD, nephrologist
2nd Self-Care Dialysis Symposium
Brussels, May 23 2014

Maastricht UMC+



Clinical benefits of intensive home HD

	Nocturnal HD	Short Daily HD
Blood pressure	+++ (PVR reduction)	++ (ECV reduction)
LV hypertrophy	+++ (afterload reduction)	++ (preload reduction)
LV systolic function	+++	?
Arterial compliance	+++	?
Sleep apnoea	+++	?
Autonomic nervous system	++	?
Phosphate	+++	f(dialysis duration)
Anemia	++	+
Malnutrition	++	++
Inflammation	++ (CRP, IL-6)	+ (CRP)
Cognition	+	?
Fertility	++	?
QoL	++	++

Benefits of intensive home HD

Modality	Phosphate control	Volume control	CKD stage
Conventional HD(F) (3x4h/week)	-	-	5
CAPD/APD			5
Short daily HD (6x2-3h/week)			4-5
Nocturnal HD (3x8h/week)			4
Frequent Nocturnal HD (6x6-8h/week)			3
Kidney transplantation			3



Outline

- **Literature Update:**
 - survival
 - cardiovascular protection
 - pregnancy and sex hormones
 - residual kidney function
 - vascular access and adverse events
 - particularities
- Role for incremental home HD?

Outline

- Literature Update:
 - **SURVIVAL**
 - cardiovascular protection
 - pregnancy and sex hormones
 - residual kidney function
 - vascular access and adverse events
 - particularities
- Role for incremental home HD?

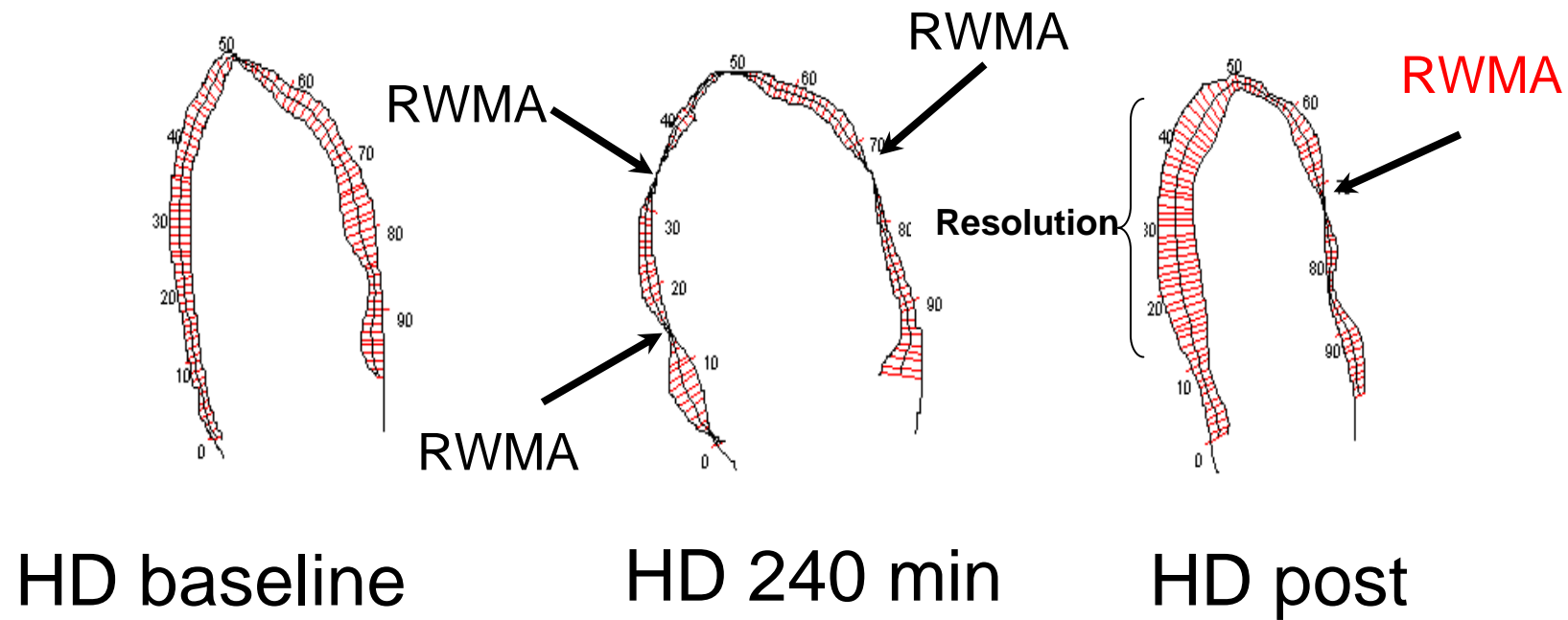
Survival *Benefits* vs Conventional HD

Study	Countries, duration	Intensive HHD	In-center CHD	Relative mortality HHD
<i>Johansen et al</i> (KI 2009)	USA, 3 years	94 pts home NHD (5.7 days/week)	940 pts USRDS	HR 0.36; P<0.001
<i>Johansen et al</i> (KI 2009)	USA, 3 years	43 pts SDHD (5.4 days/week)	430 pts USRDS	HR 0.64; P=NS
<i>Marshall et al</i> (AJKD 2011)	Australia and New-Zealand, 72052 patient-years	865 pts frequent or extended HHD	21184 pts	HR 0.53; P<0.05
<i>Lockridge - Kjellstrand</i> (Hemodial Int 2011)	USA, 287 patient-years	87 pts home NHD (mean 40±6 h/week)	87121 incident pts USRDS	SMR 0.53; P=0.005 (ITT)
<i>Nesrallah et al</i> (JASN 2012)	France, USA, Canada, 3008 patient-years	338 pts intensive HHD (4.8x7.4 h/week)	1388 pts DOPPS	HR 0.55; P=0.01 (ITT)
<i>Weinhandl et al</i> (JASN 2012)	USA, mean 1.8 years	1873 pts daily HHD (5-6 sessions/week)	9365 pts USRDS	HR 0.87; P<0.01 (ITT)

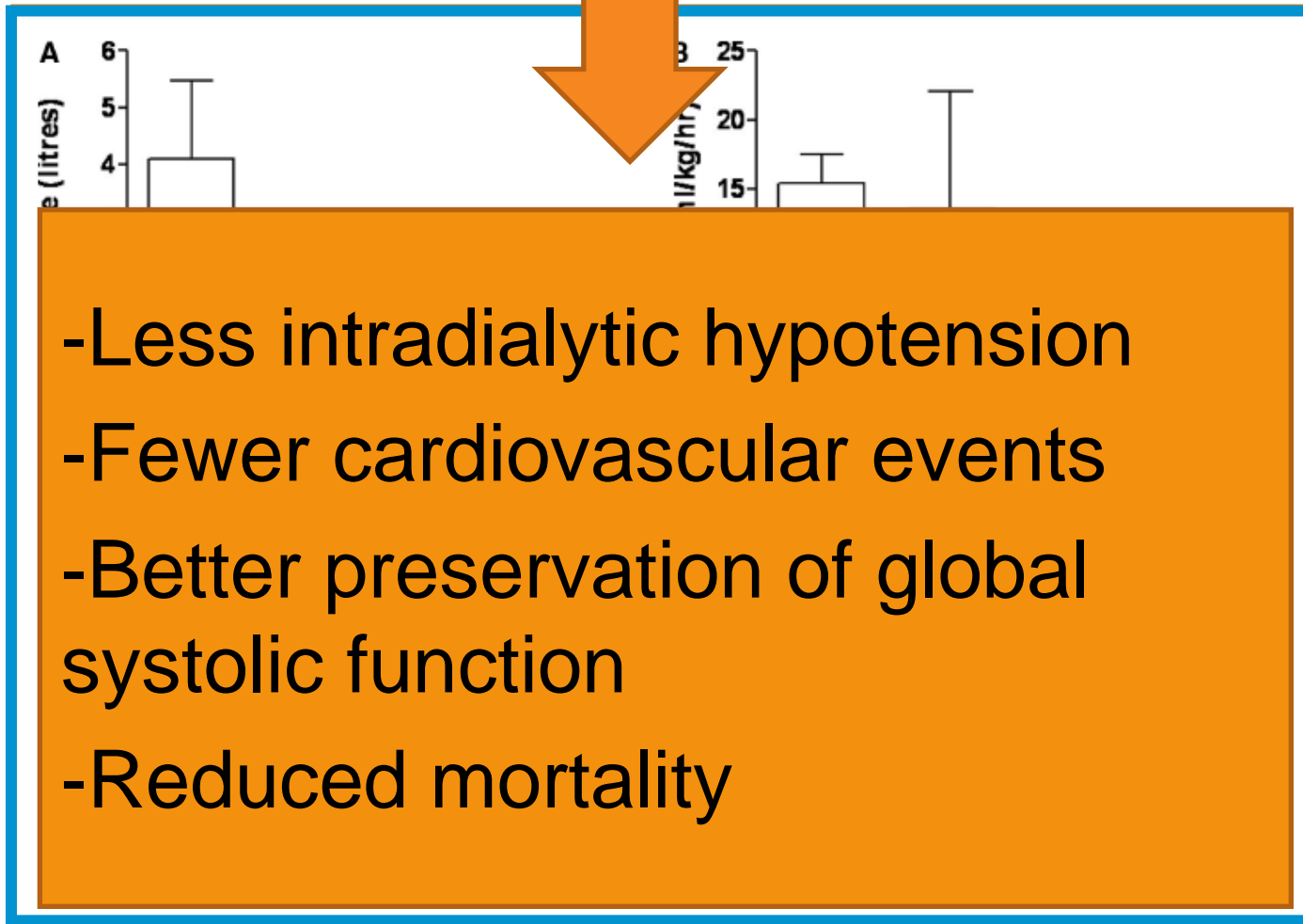
Outline

- Literature Update:
 - survival
 - **CARDIOVASCULAR PROTECTION**
 - pregnancy and sex hormones
 - residual kidney function
 - vascular access and adverse events
 - particularities
- Role for incremental home HD?

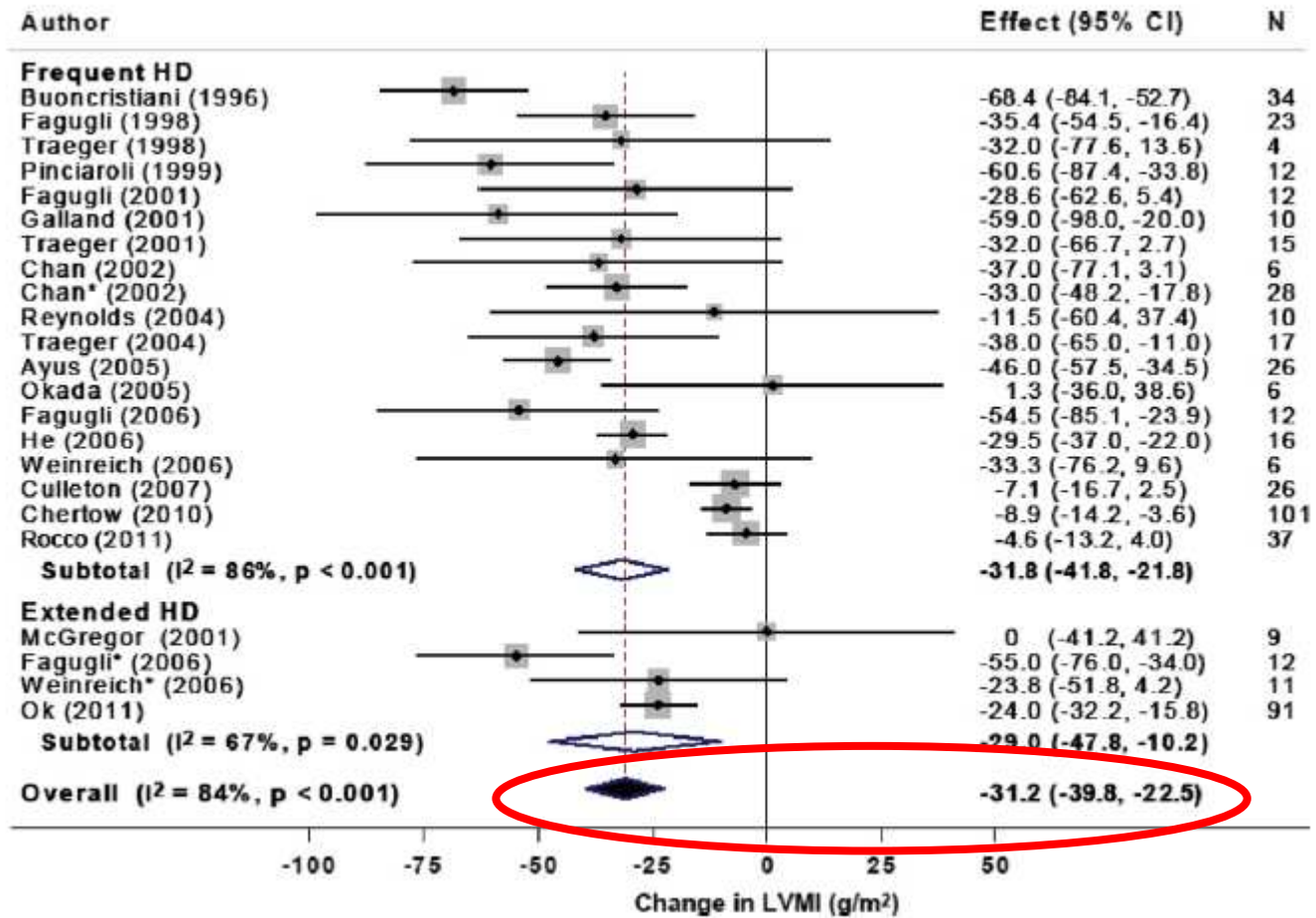
Protection against Myocardial Stunning



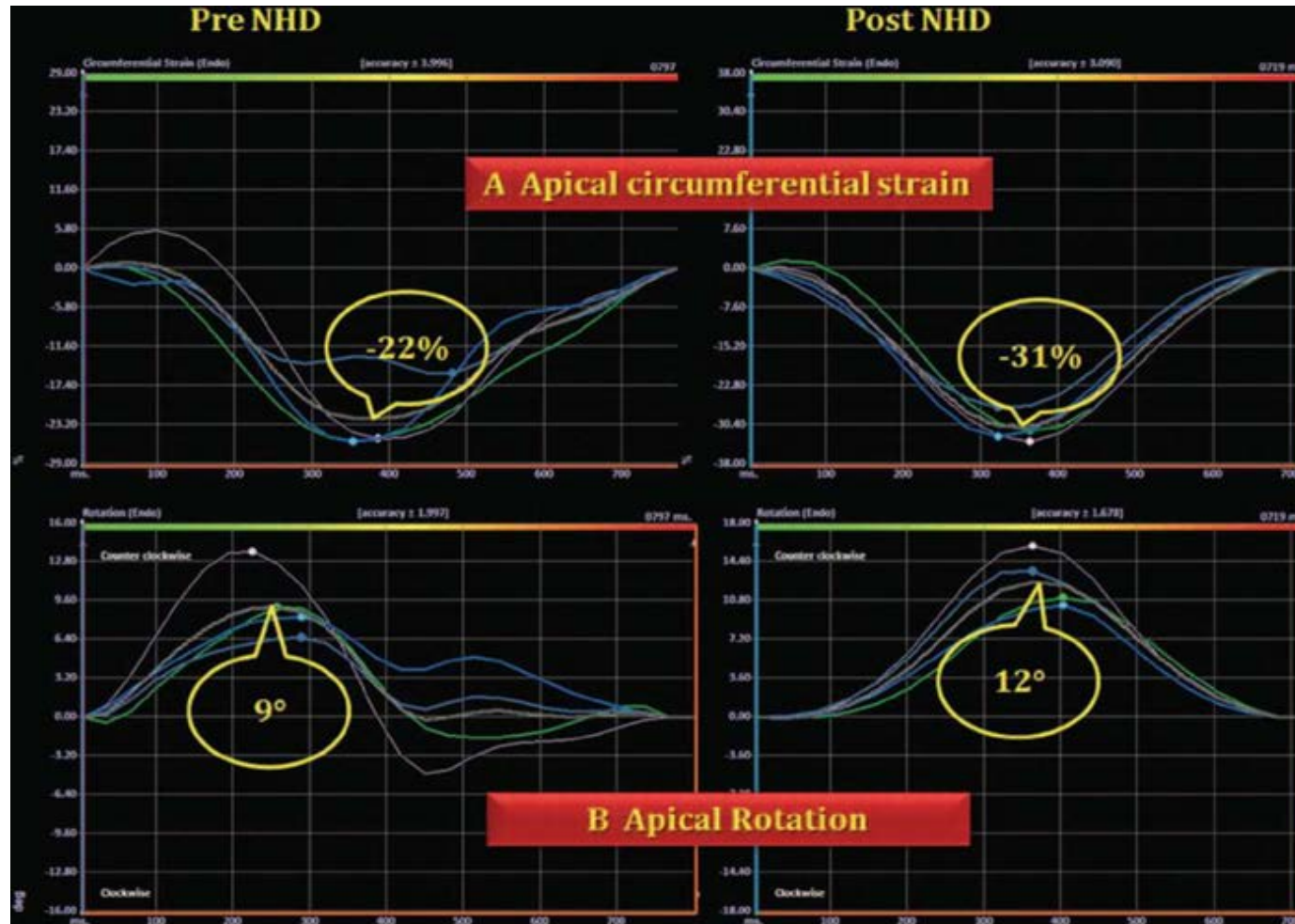
Protection against Myocardial Stunning



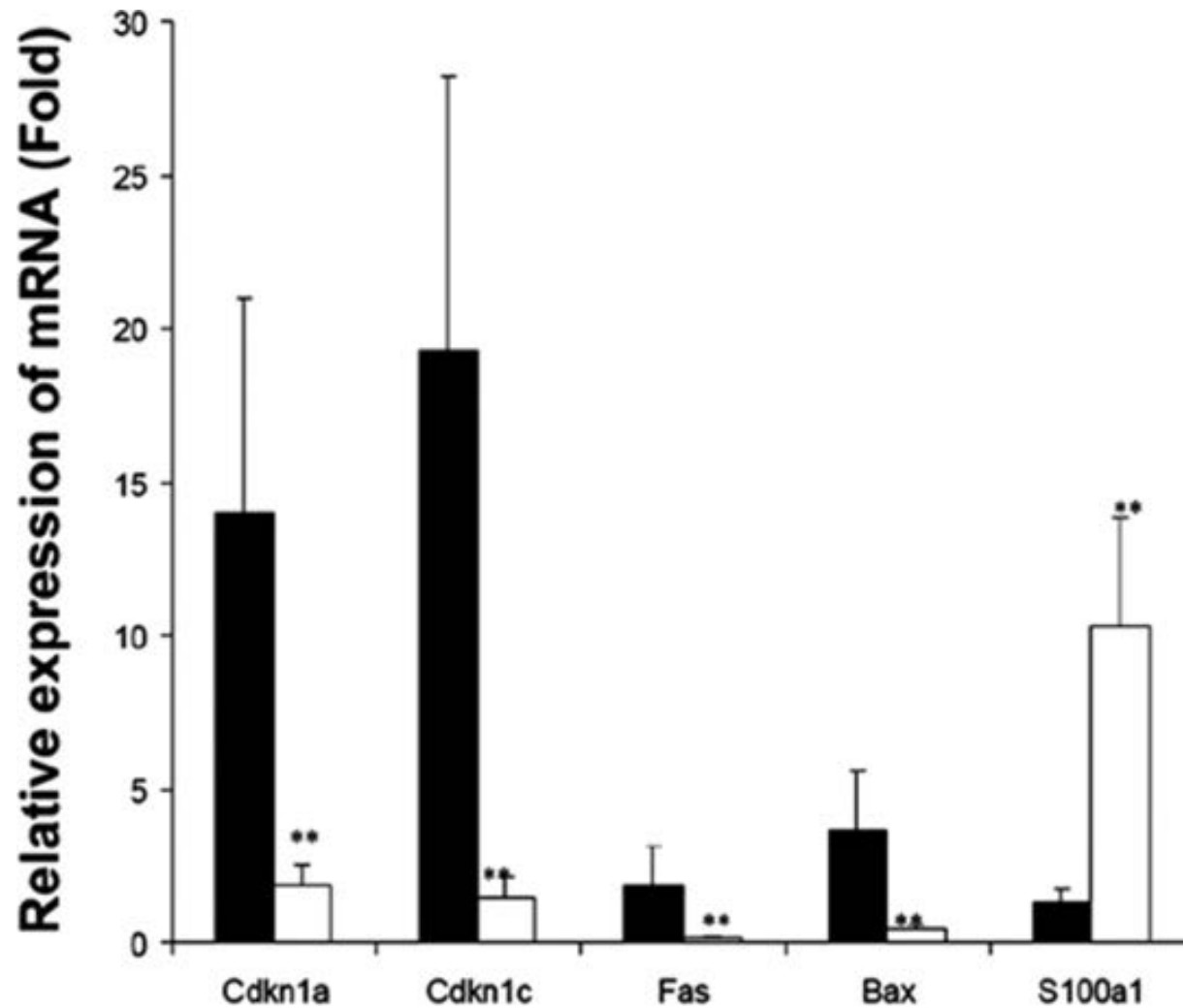
Intensive HD Reduces LVH



Myocardial Mechanics after Conversion to NHD



Cardiomyocyte gene signature after conversion to NHD



Acute Hemodynamic Effects in Extended Dialysis

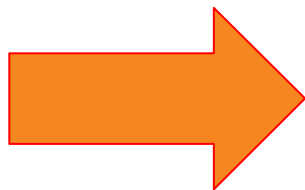
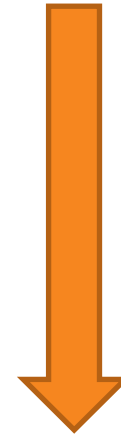
Parameter	4hHD	4hHDF	8hHD	8hHDF
Peripheral SBP (mmHg)	-21.7	-23.3	-6.7*	-0.5*†
Peripheral DBP (mmHg)	-5.0	-11.5	-1.1†	-1.2†
Central SBP (mmHg)	-19.2	-24.2	-7.1	-3.8
Central DBP (mmHg)	-5.0	-12.1*	-2.6	+3.5†
CO (L/min)	-1.4	-1.6	-0.4†	-0.5†
RBV (%)	-8.1	-9.1	-4.4†	-3.3*†
ET rate (W)	-13.3	-16.2	-14.2	-14.5

Outline

- Literature Update:
 - survival
 - cardiovascular protection
 - **PREGNANCY AND SEX HORMONES**
 - residual kidney function
 - vascular access and adverse events
 - particularities
- Role for incremental home HD?

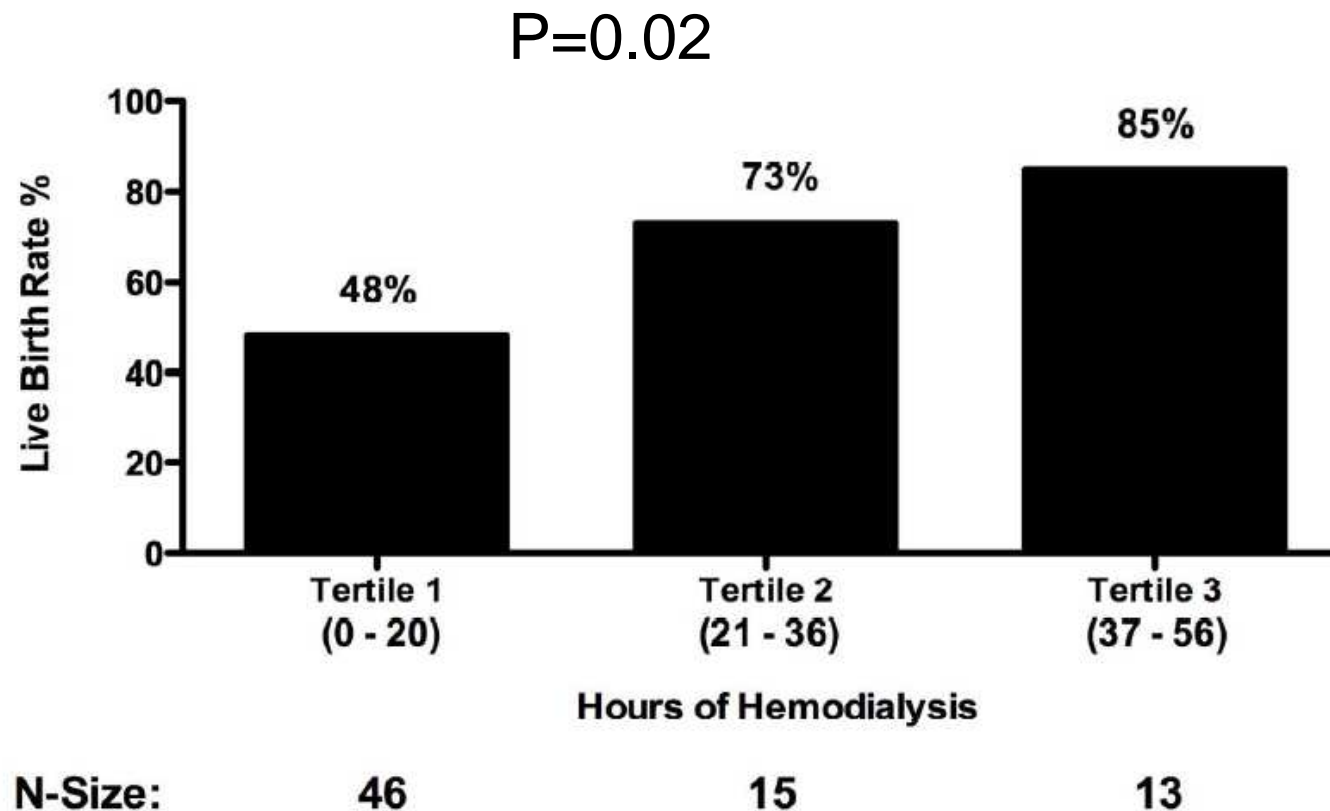
Intensive Home HD in Pregnancy

- Uremic toxins
- Peripheral vascular resistance
- Hypervolemia
- Blood pressure
- Endothelial dysfunction



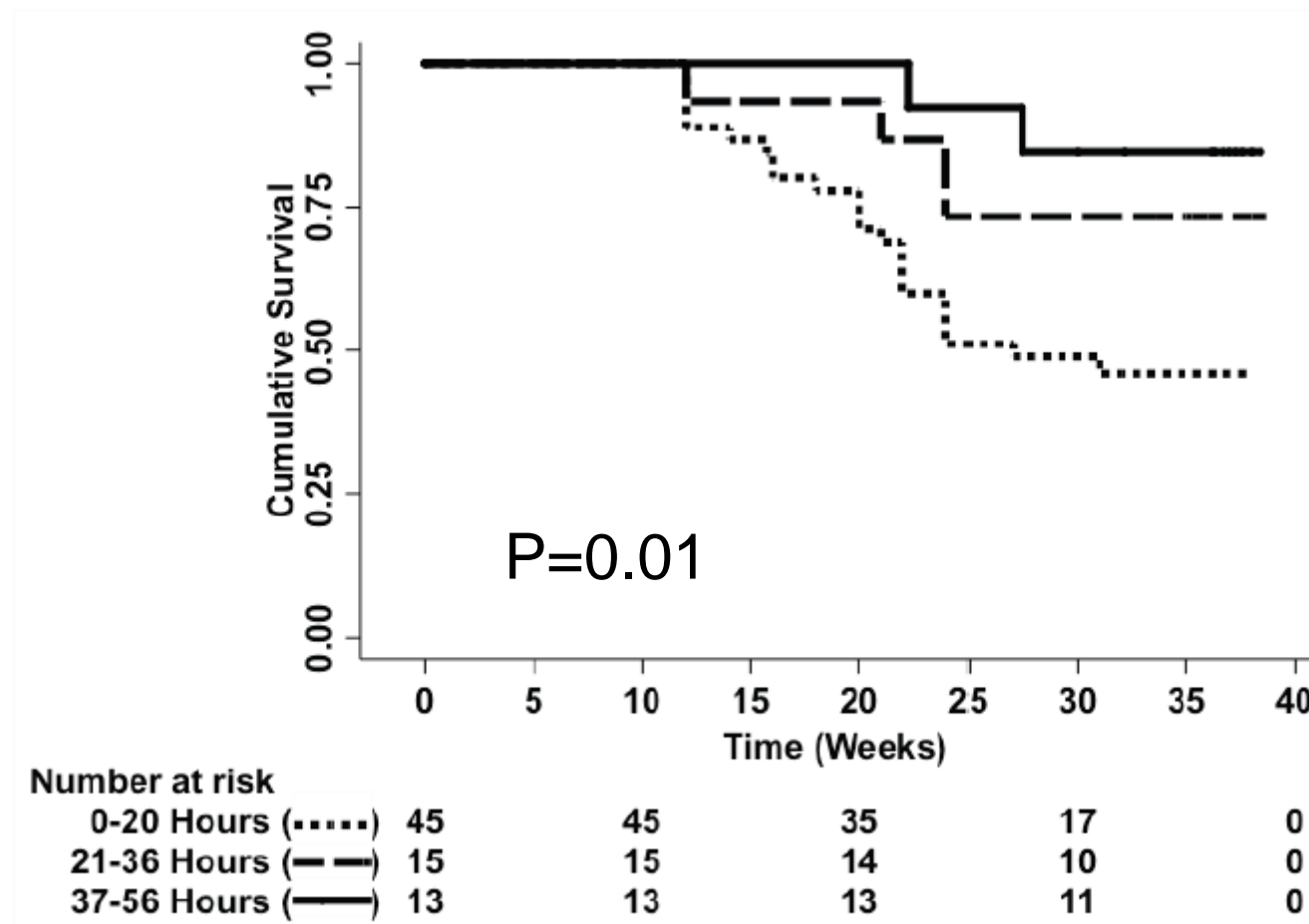
Normal placental development
Reduced risk of preeclampsia
Prevention of polyhydramnios
Better fetomaternal outcomes

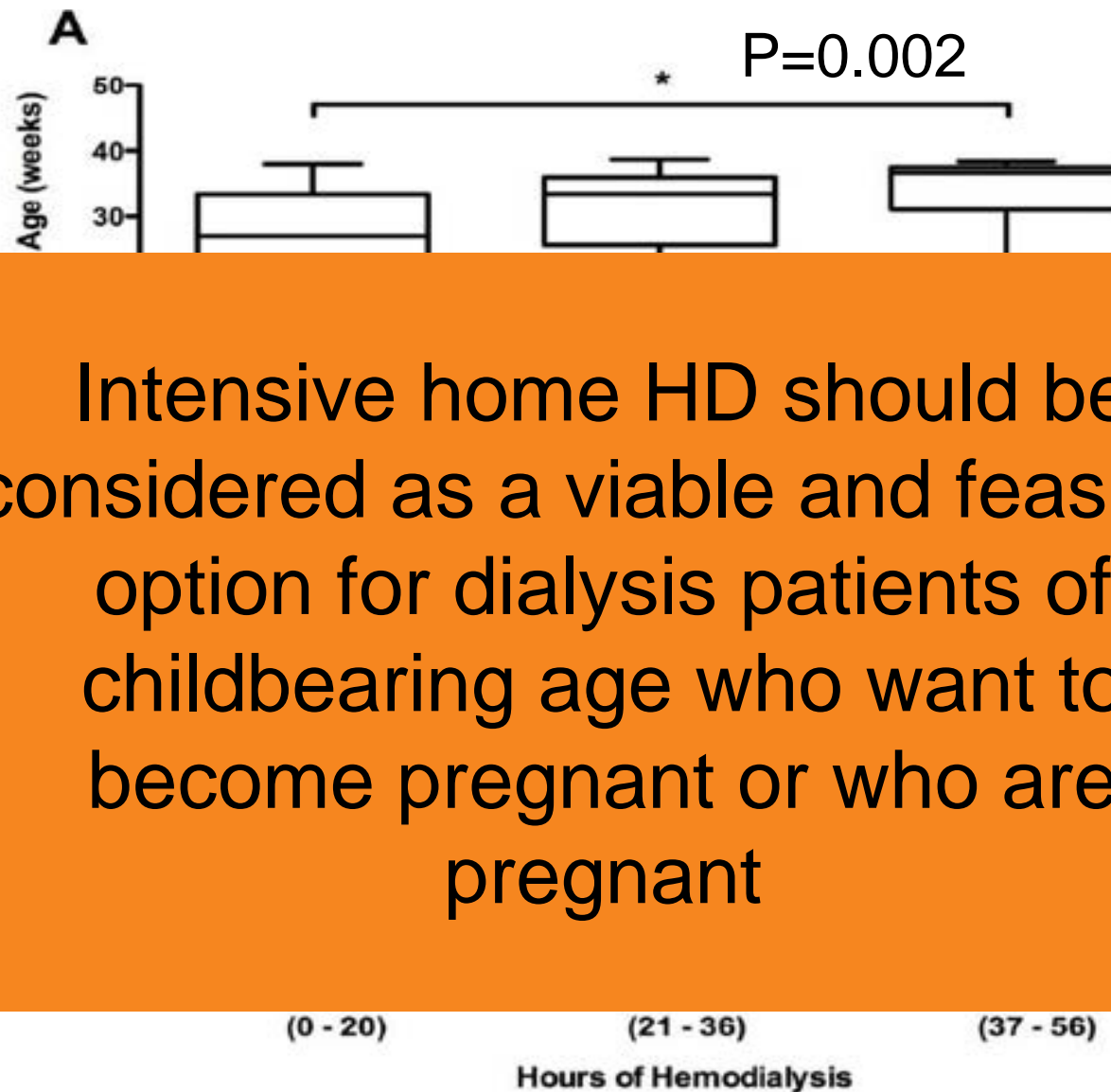
Improved Pregnancy Outcomes with Intensive Home HD



Live Birth Rates by Dialysis Intensity

Time to event analysis by dialysis intensity

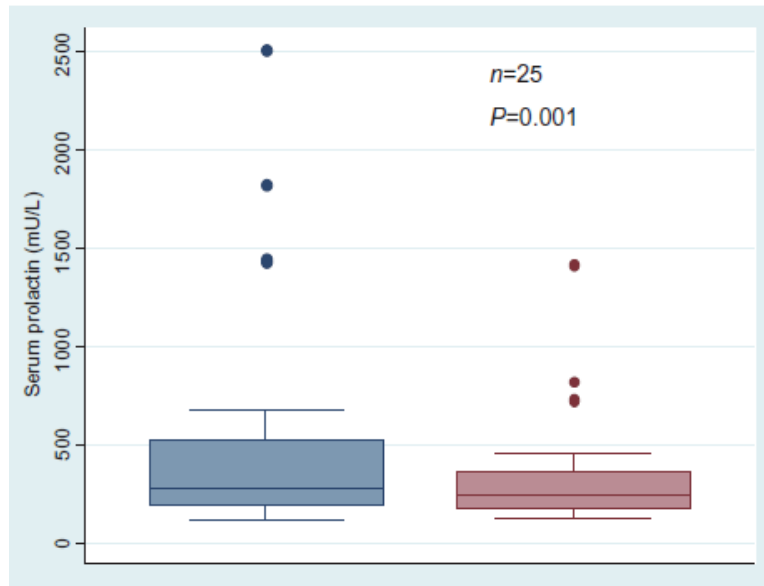




Intensive home HD should be considered as a viable and feasible option for dialysis patients of childbearing age who want to become pregnant or who are pregnant

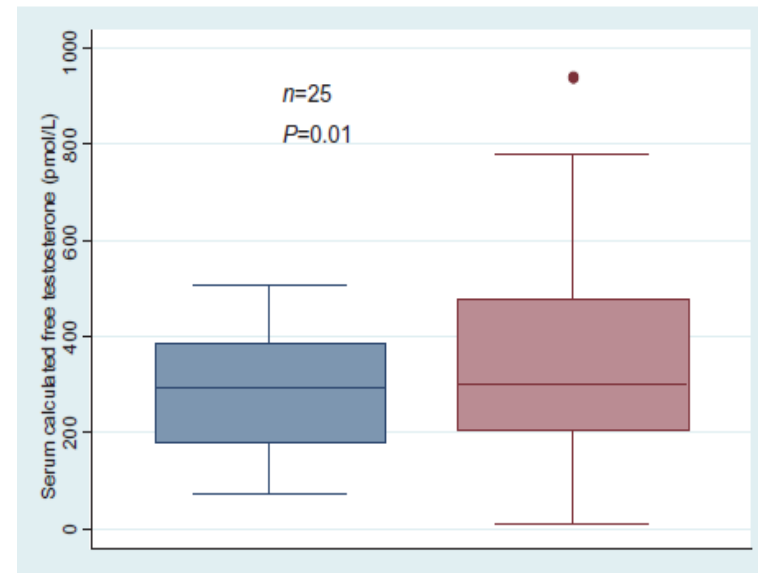
Sex Hormones and Intensive Home HD

Prolactin



CHD → NHD

Free testosterone

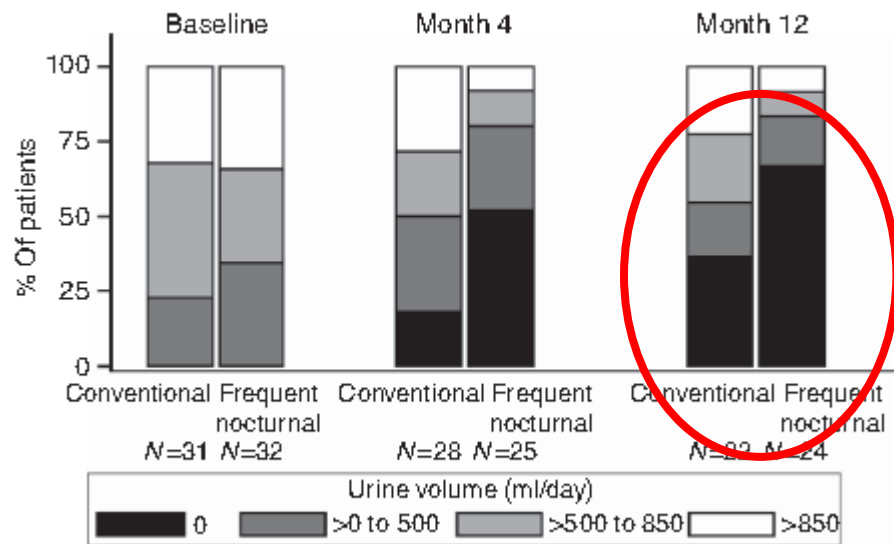


CHD → NHD

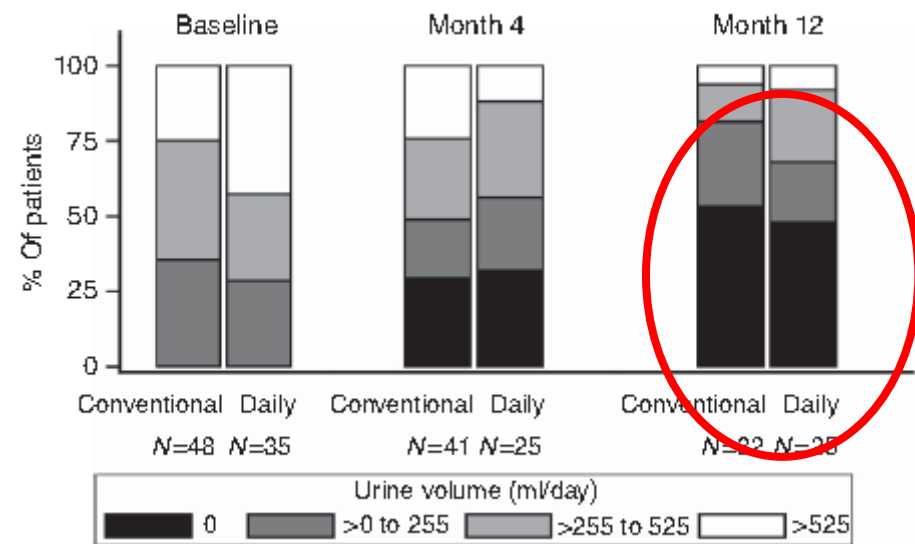
Outline

- **Literature Update:**
 - survival
 - cardiovascular protection
 - pregnancy and sex hormones
 - **RESIDUAL KIDNEY FUNCTION**
 - vascular access and adverse events
 - particularities
- Role for incremental home HD

FHN: Residual Kidney Function



Nocturnal Trial



Daily Trial

FHN: Residual Kidney Function

- More intradialytic hypotension in nocturnal HD? Not excluded
 - Platelet activation and increased inflammation in extended HD? Possible
 - Drivers of RKF are reduced in nocturnal HD:
 - Blood pressure
 - Extracellular volume
 - Osmotic load
- no clear-cut relationships were found

Outline

- **Literature Update:**

- survival
- cardiovascular protection
- pregnancy and sex hormones
- residual kidney function
- **VASCULAR ACCESS AND ADVERSE EVENTS**
- particularities

- Role for incremental home HD

Frequent Hemodialysis and Vascular Access

- In-depth review
- MEDLINE search for all trials looking at vascular access outcomes in frequent HD
- Nineteen studies included (1998-2012): 3 RCT, 11 prospective cohort, 5 retrospective cohort
- Vascular access events: admissions, dysfunction, infection, permanent access failure
- Statistics: log-linear mixed effects models with study specific random effects

Vascular Access in High Dose HD?

	Access- years	Relative risk (intensive/conventional)	Event rate		
			difference	ratio	p
Access admissions	0				

1. Increased risk of vascular access complications in intensive home HD
2. Increased need for vascular access vigilance?
3. Relatively low event rates in AVF; Fistula First strategy?

0 1 2 3 4 5
Ratio

Adverse events in home HD

- 2 Canadian home HD centers, 500 patient-years
- 1 death and 6 potentially fatal adverse events
= 0.06 events/1000 dialysis treatments
- 5/7 events human errors with lapses in protocol adherence

Case No	Human Error(s) or Machine/ Disposable Defects	Immediate Cause of Adverse Event	Details
1	Human error	Blood loss	Ignored machine alarms; improper threading of connections; placement of wetness detectors in incorrect position
2	Human error	Air embolism	Neglected to clamp CVC
3	Possible human error, possible disposable defect	Blood loss	Possible failed integrity of cap; possibly did not correctly thread connections
4	Possible human error, possible disposable defect	Blood loss	Improper placement of clamp; failed integrity of cap
5	Human error	Blood loss	Improper machine setup; neglected to use wetness detectors
6	Human error	Blood loss	Improper threading of connections; placement of wetness detector in incorrect position
7	Human error	Blood loss	Did not follow machine setup protocol specific to local home HD program

Adverse events in home HD

- 2 Canadian home HD centers, 500 patient-years
- 1 death and 6 potentially fatal adverse events
= 0.06 events/1000 dialysis treatments
- 5/7 events human errors with lapses in protocol adherence

Need for Quality Insurance Framework:

1
2
3 **1. Case review**

4 **2. Technique audit of patient**

5
6 **3. Specific questions to program e.g. Device**
7 **defect? Human error? Change protocol?**
Change HD recruitment/retention?

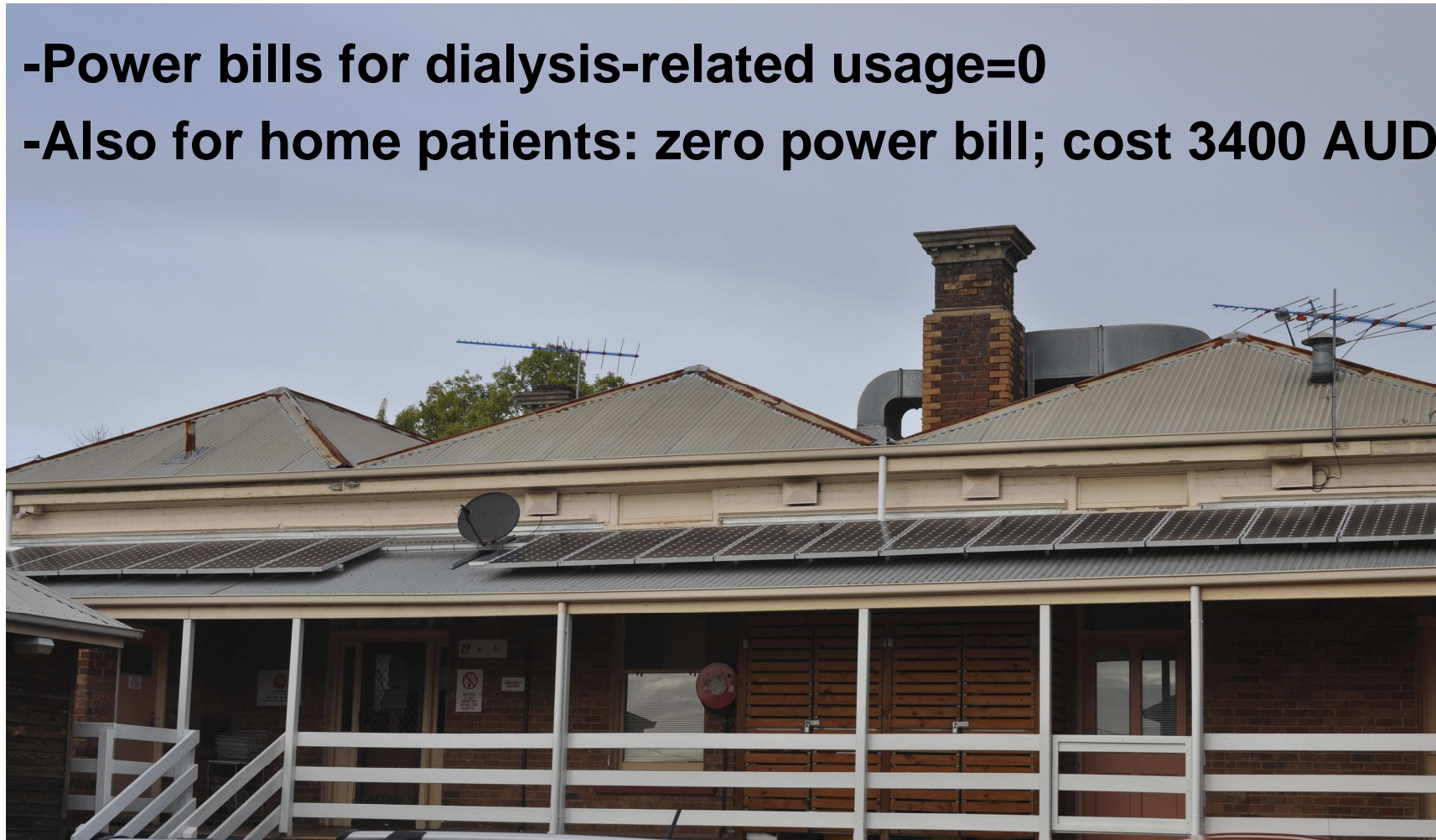
ctor

Outline

- **Literature Update:**
 - survival
 - cardiovascular protection
 - pregnancy and sex hormones
 - residual kidney function
 - vascular access and adverse events
 - **PARTICULARITIES**
- Role for incremental home HD

Solar-assisted Home Hemodialysis

- Power bills for dialysis-related usage=0
- Also for home patients: zero power bill; cost 3400 AUD



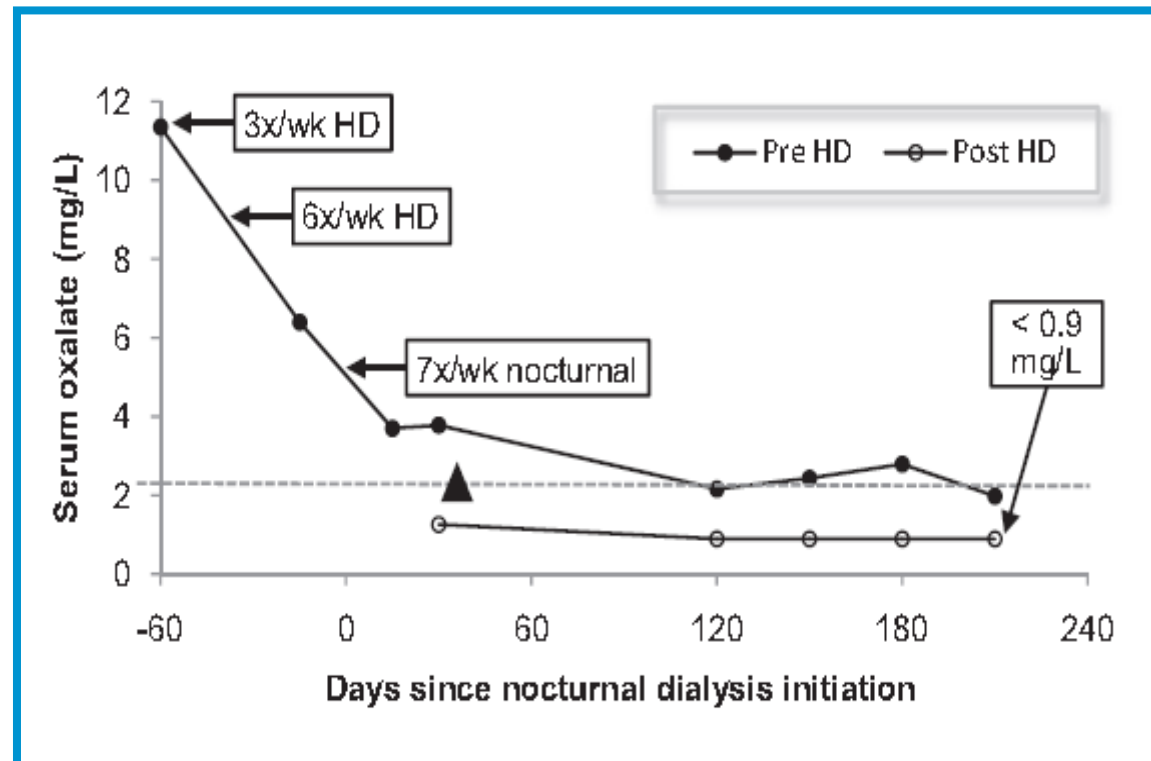
Solar-assisted Hemodialysis

Northern territory mobile bus



Van in design phase in South Australia

Intensive HD in Primary Hyperoxaluria



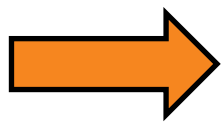
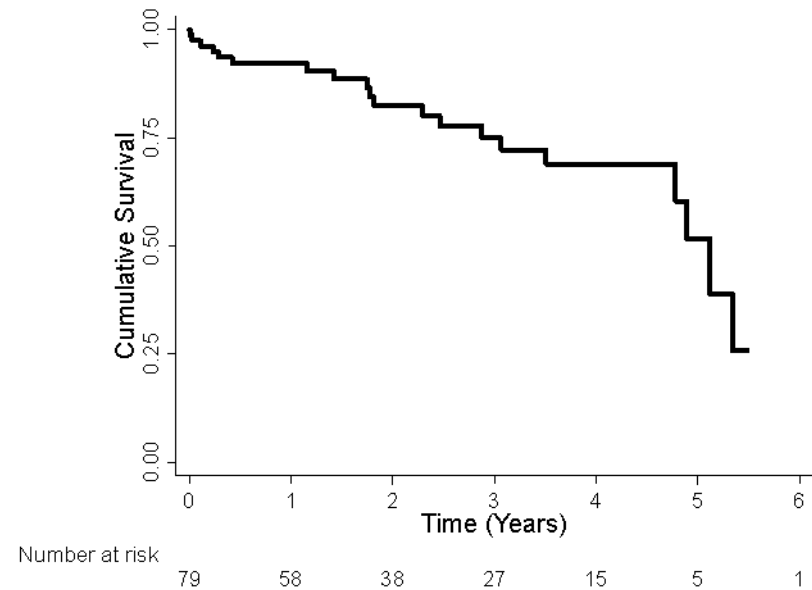
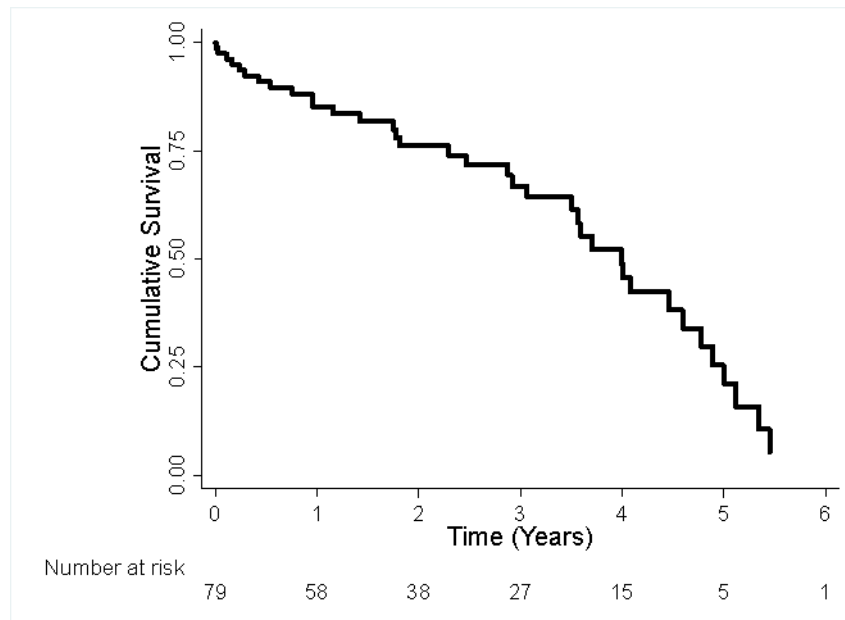
Home Hemodialysis in the Elderly

- 6 centres, 79 patients ≥ 65 years at start
- cumulative time at risk 188 years; median follow-up time 2.0 (1.0-3.6) years
- 17 (22%) deaths: CV events (8), co-morbidities (4), withdrawal (2)
- 20 (26%) technique failures: co-morbidities (10), partner-related (6)
- 19 (24%) kidney transplantations

Home Hemodialysis in the Elderly

Primary Outcome: death or technique failure

Secondary Outcome: technique failure



Home HD is Feasible in the Elderly;
QoL? Survival? Hospitalization? Cost?...

Outline

- Literature Update:
 - survival
 - cardiovascular protection
 - pregnancy and sex hormones
 - residual kidney function
 - vascular access and adverse events
 - particularities
- **Role for incremental home HD**

Role for INCREMENTAL Home HD?

- *Definition:* increase dialysis dose according to RKF together with clinical and subclinical parameters e.g. 3x4h→3.5x4h→4x4h→3.5x8h→6x8h/week
- *Rationale:* more rapid loss of RKF, attention and global cognition, and increased vascular access complications with frequent HD?
- Tools to monitor subclinical parameters:
 - e.g. bio-impedance, physical activity measurement, polysomnography, FGF23, oxidative stress, inflammation, AGE's, MRI, PET...
- Requires further studies and validation



Conclusions

- Home HD is an excellent option for our ESRD patients
- Potential adverse events should not be ignored and require attention and further study
- We live in an era of EBM...but RCT's are extremely difficult to perform
- So should we not rely on the ample beneficial effects of (intensive) home HD in observational studies as well as on the day-to-day clinical experience with these patients?
- The role of incremental home HD needs investigation

Thank you! Questions?

