

# **Everything You Need to Know about Peritoneal Dialysis In a Remote or Indigenous Community**

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# Faculty/Presenter Disclosure

- Dr. Benjamin Thomson, Associate Professor, Queen's University
- Relationships with commercial interests:  
Grants/Research Support:
  - Old: CIP, POEM (Western University), Innovation Research Grant, CTAQ (Queen's University), CIHR (CONNECT, ACHIEVE), PDOPPS trial funding
  - Current: None
- Committees: Ontario Renal Network Peritoneal Dialysis Focus Group
- Speaking fees: Baxter Canada

## Mitigating Potential Bias

- No mitigation has been required. Content in this talk does not relate to either research grant topics, funding guidelines or funding organization objectives.

# Learning Objectives

- Describe the basic anatomy and physiology of peritoneal dialysis
- Describe the process of a patient from a remote community, returning to his/her community on peritoneal dialysis
- Describe the differences between hemodialysis and peritoneal dialysis as related to cost, quality of life, residual renal function and survival- “Why not hemodialysis everywhere?”
- Describe the most common complications of peritoneal dialysis - “When to contact nephrology?”

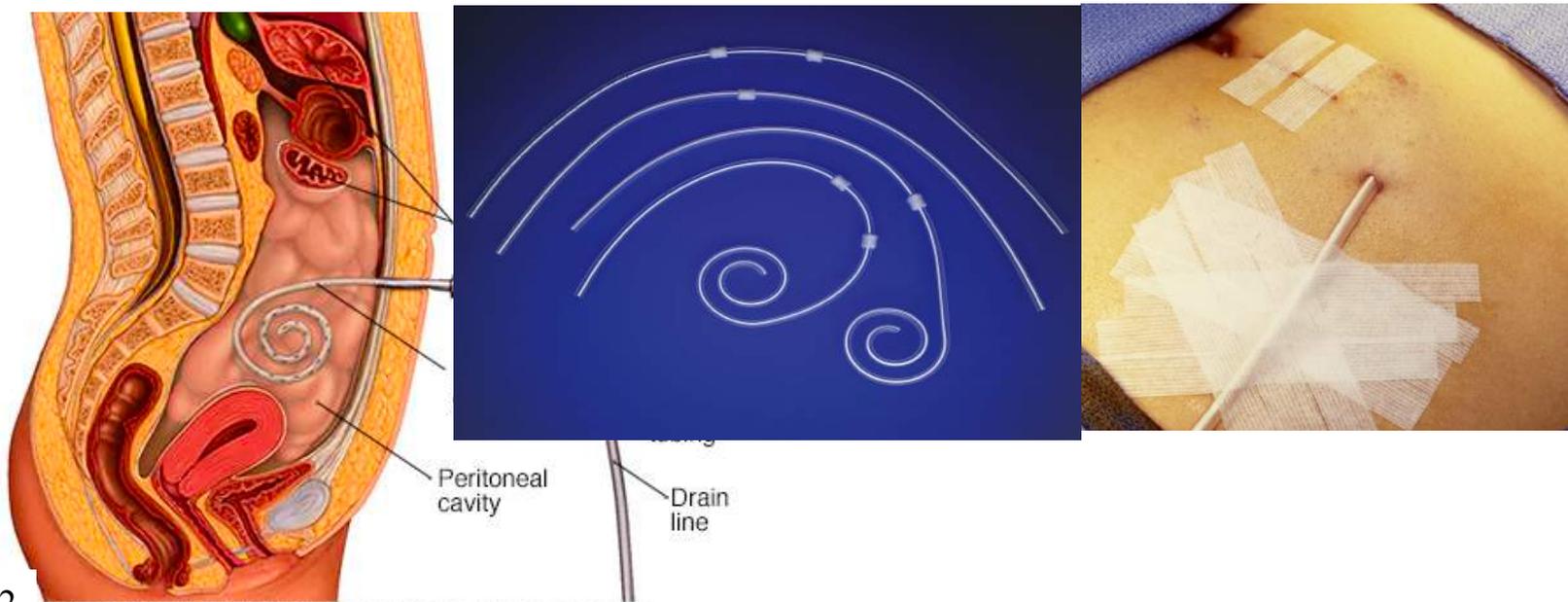
AFTER completion of learning objectives:

1. Review MSERS talks for September to December 2022
2. Review future directions of MSERS



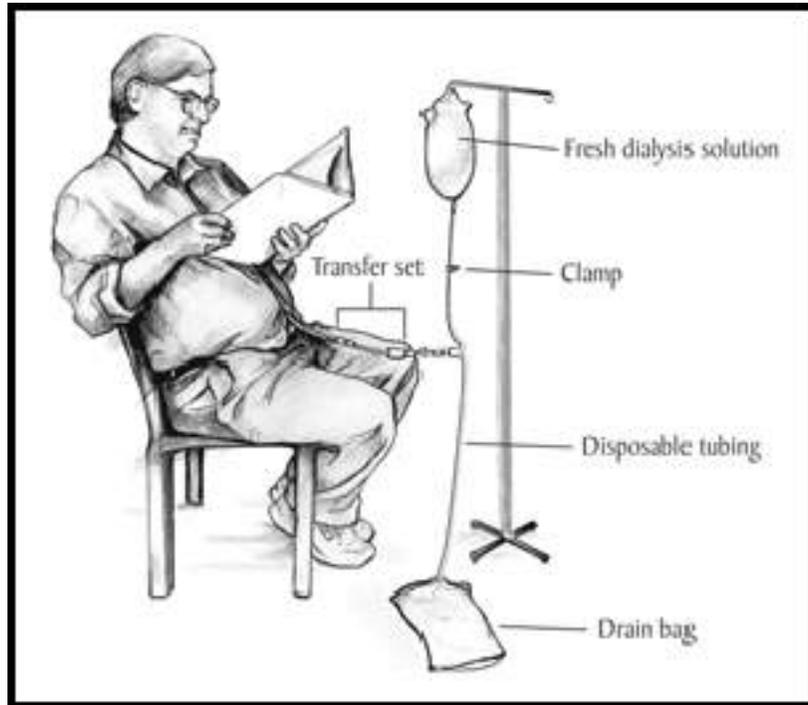
# Anatomy and Physiology of Peritoneal Dialysis

- A patient with end-stage-renal disease requires renal replacement therapy “dialysis”
- ”Dialysis” is a process that includes solute clearance and fluid removal, using a combination of diffusion and osmosis
- Hemodialysis uses a hemodialysis machine and a synthetic membrane across which diffusion and osmosis occurs
- Peritoneal dialysis uses our own peritoneal membrane for osmosis and diffusion
- A catheter is surgically inserted into the peritoneum, typically about 2-3 inches lateral and inferior to umbilicus
- Peritoneal dialysis catheter sits in the peritoneum. Fluid goes in and out through catheter, with diffusion and osmosis across peritoneal membrane leading to waste and water removal.

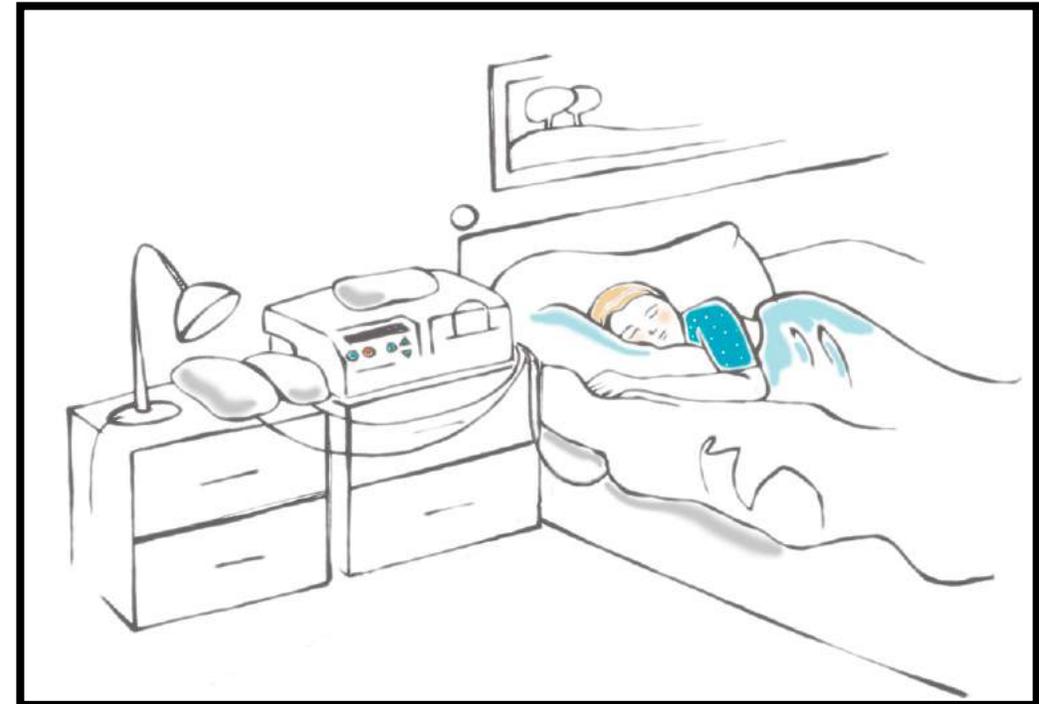


# Anatomy and Physiology of Peritoneal Dialysis

- Fluids are provided by the Peritoneal Dialysis company in **sterile** bags.
- “Exchanges” in one of two ways:



“MANUAL” exchange



“CYCLER” device for overnight exchanges

**Peritoneal Volume**



**NIPD**

“Nocturnal Intermittent Peritoneal Dialysis”  
(exchanges use cyclor)

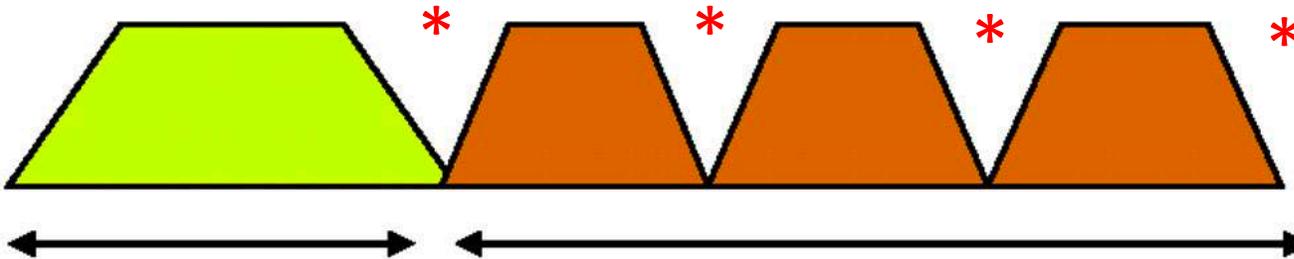
**Peritoneal Volume**



**CCPD**

“Continuous Cyclor Peritoneal Dialysis”  
(exchanges use cyclor)

**Peritoneal Volume**



**CAPD**

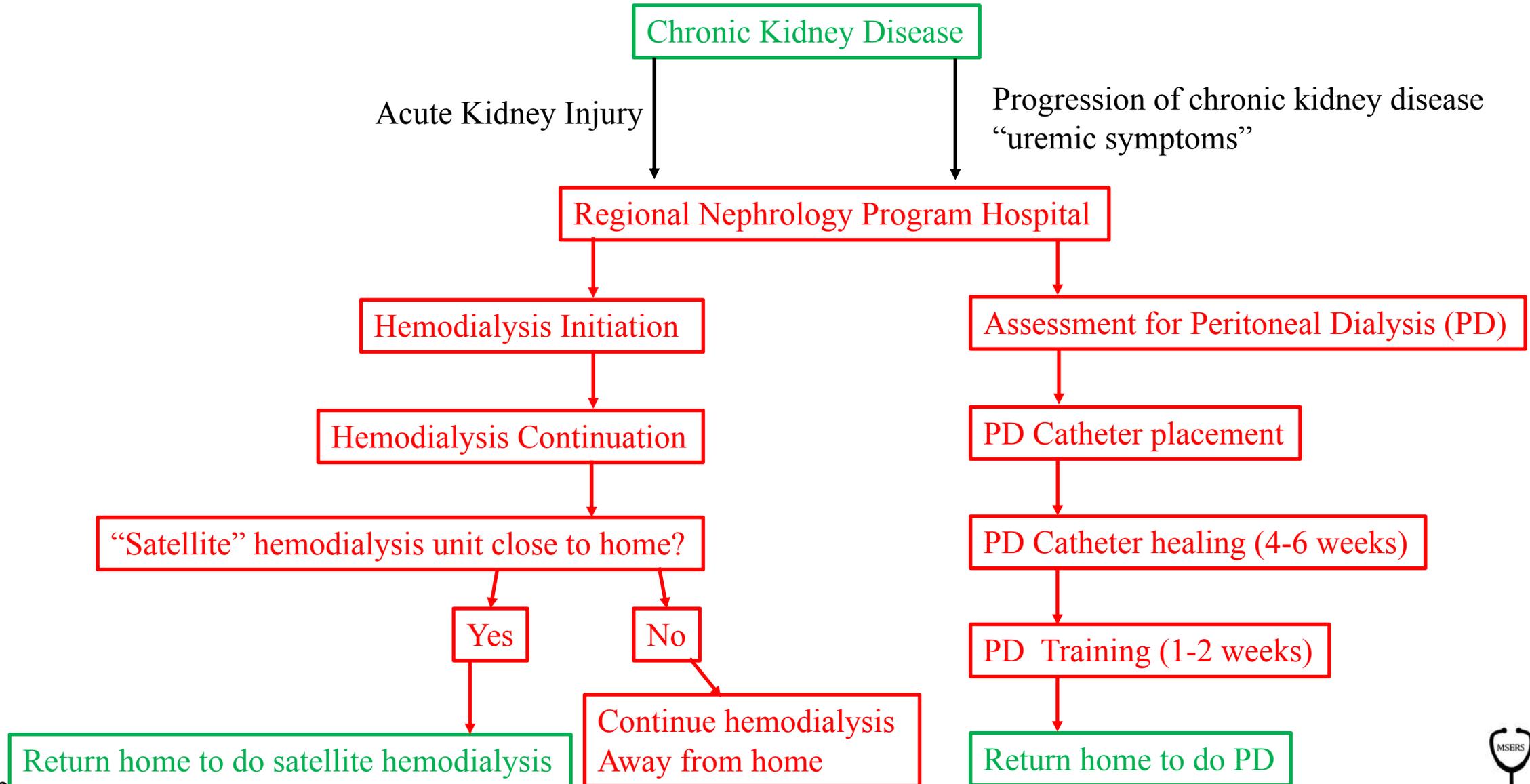
“Continuous Ambulatory Peritoneal Dialysis”  
(all manual exchanges)

**Nighttime period**  
**(8-10 hrs)**

**Daytime period**  
**(14-16 hrs)**

\* Must find clean environment

# From home to dialysis and ?back home? Patient Journey



# The Unfortunate Truth

Return home to do satellite hemodialysis

Continue hemodialysis  
Away from home

Return home to do PD

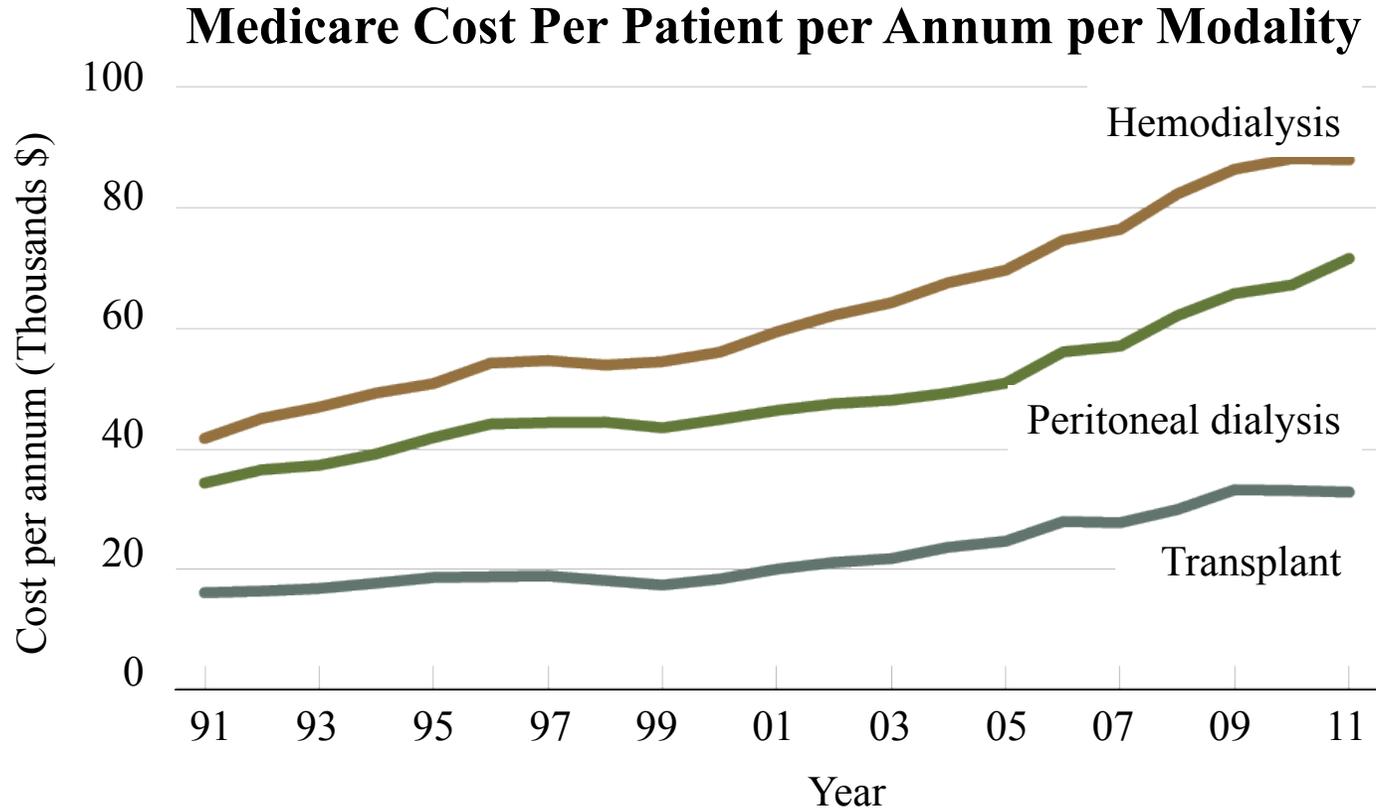
1. Some patients are not candidates to do peritoneal dialysis safely at home
2. Many communities do not have a nearby satellite hemodialysis unit

When 1 and 2 is true:

- That patient indefinitely receives hemodialysis outside their community.
- That patient's return to their community only occurs if he/she is willing to stop hemodialysis

*“You’re asking me to choose between living away from my home and family, or dying.”*

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?” Cost



- Home Hemodialysis saves 5,000 to 15,000\$ /year, compared to in-center (infrastructural costs plumbing/electrical)
- Peritoneal Dialysis saves 25,000 to 30,000\$/year, compared to in-center (no infrastructural costs)
- There is a high fixed cost with initiation of new dialysis unit (infrastructural, human resources costs)

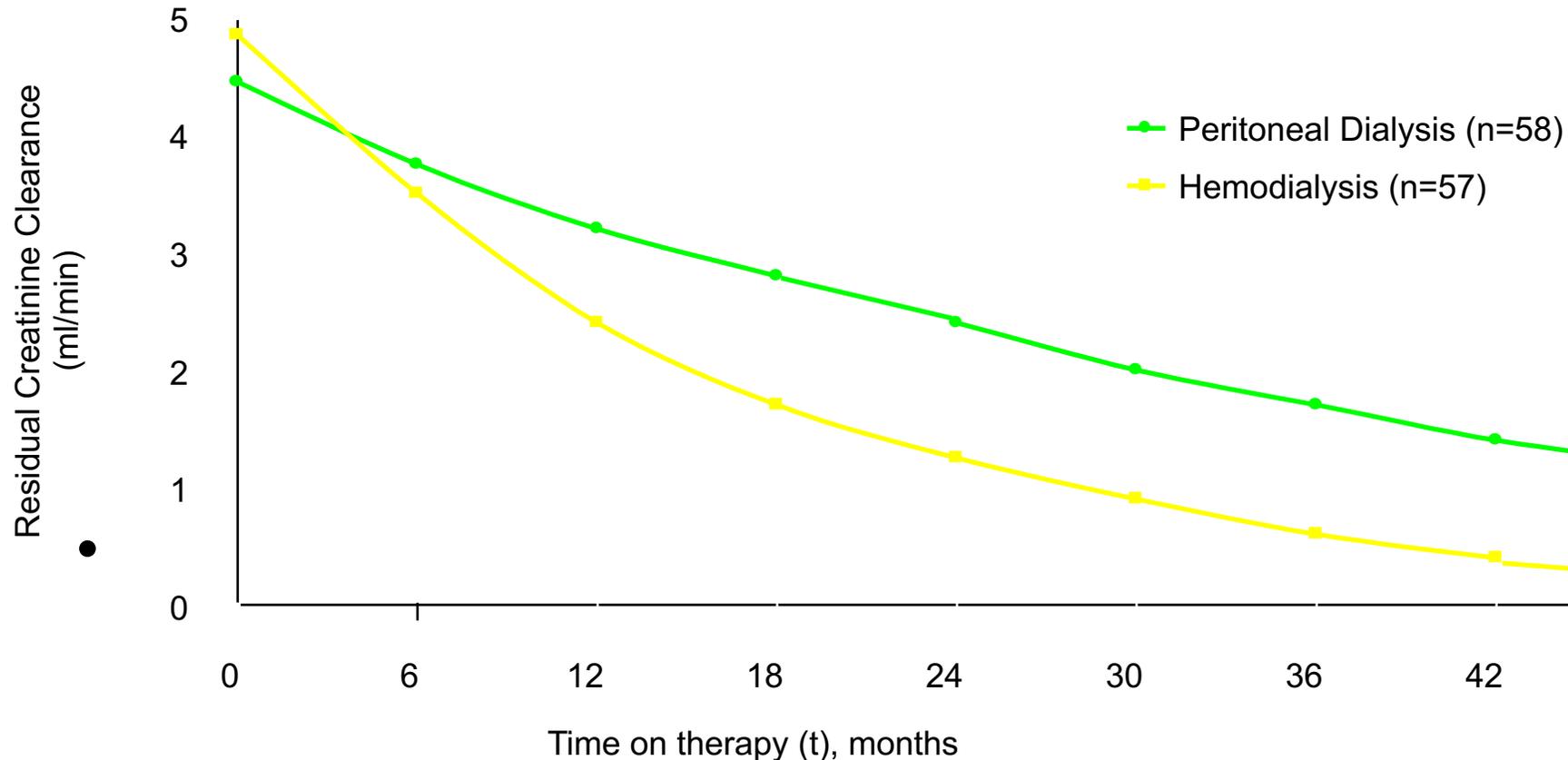
## Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?”: Quality of Life

Author	Patients	Reference	Findings
Oren B and Enc N	300	Int J Nurs Pract	QOL Prevalent PD > HD
Brown EA et al	140	NDT 25(11), 2011, 3755-3763	Elderly patients (>65) Prevalent PD > HD with more "illness intrusion" in HD
Czyzewski et al	117	Ann Transplant 2014: 19: 576-585	QOL Prevalent Ren Tx > PD > HD
Theofilou P	144	J Clin Med Res 2011: 3(3): 132- 138	Environment and Social Relationships PD > HD, HD had more suicidal thoughts and sleep problems
Wu et al	928	JASN 2004: 15(3): 743-753	Bodily pain, travel, diet restrictions, dialysis access related QOL better PD than HD PD > HD for finances, HD = PD for change at 1 year QOL
Korevaar et al	56	KI 2003: 64(6): 2222-2228	Incident PD = Incident HD, Survival worse in HD
Michels et al	550	PDI 2011: 31(2); 138-147	CAPD = APD
Guo et al	93	KISupp 2002: 81: S72-9	Use of icodextrin (compared to Dextrose) improves QOL at 13 weeks

- QOL in PD > HD, especially in “illness intrusion,” social relationships, sleep quality, travel, dietary restriction, finances. Studies not completely captured value of “return home” to QOL
- Prescription of PD must be personalized to maximize patient Quality of Life (daytime interruptions)

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?”

## Peritoneal Dialysis Maintains Residual Renal Function Longer

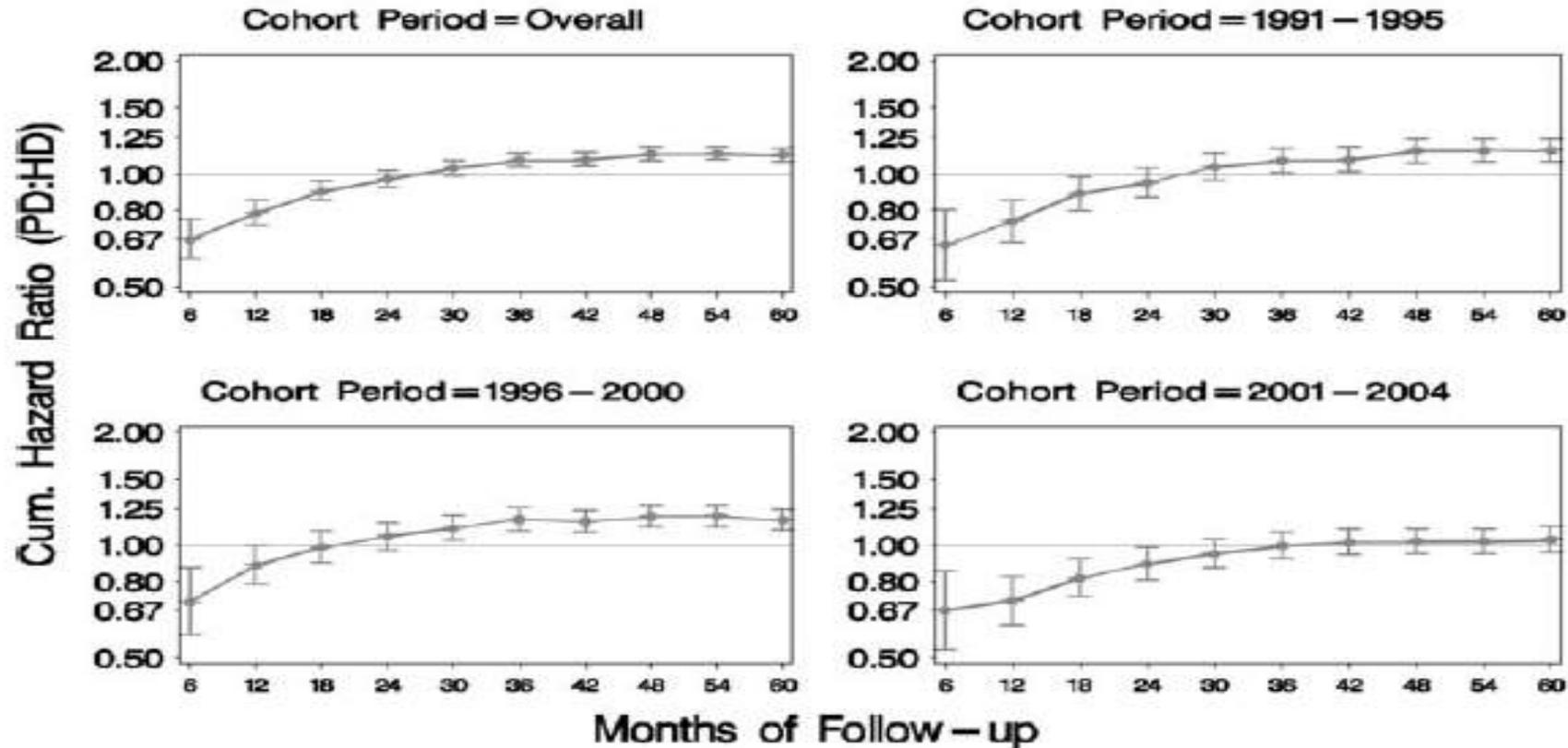


- Residual renal function simplifies volume control (management of excess volume)
- Residual renal function associates with improved survival

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?": Survival

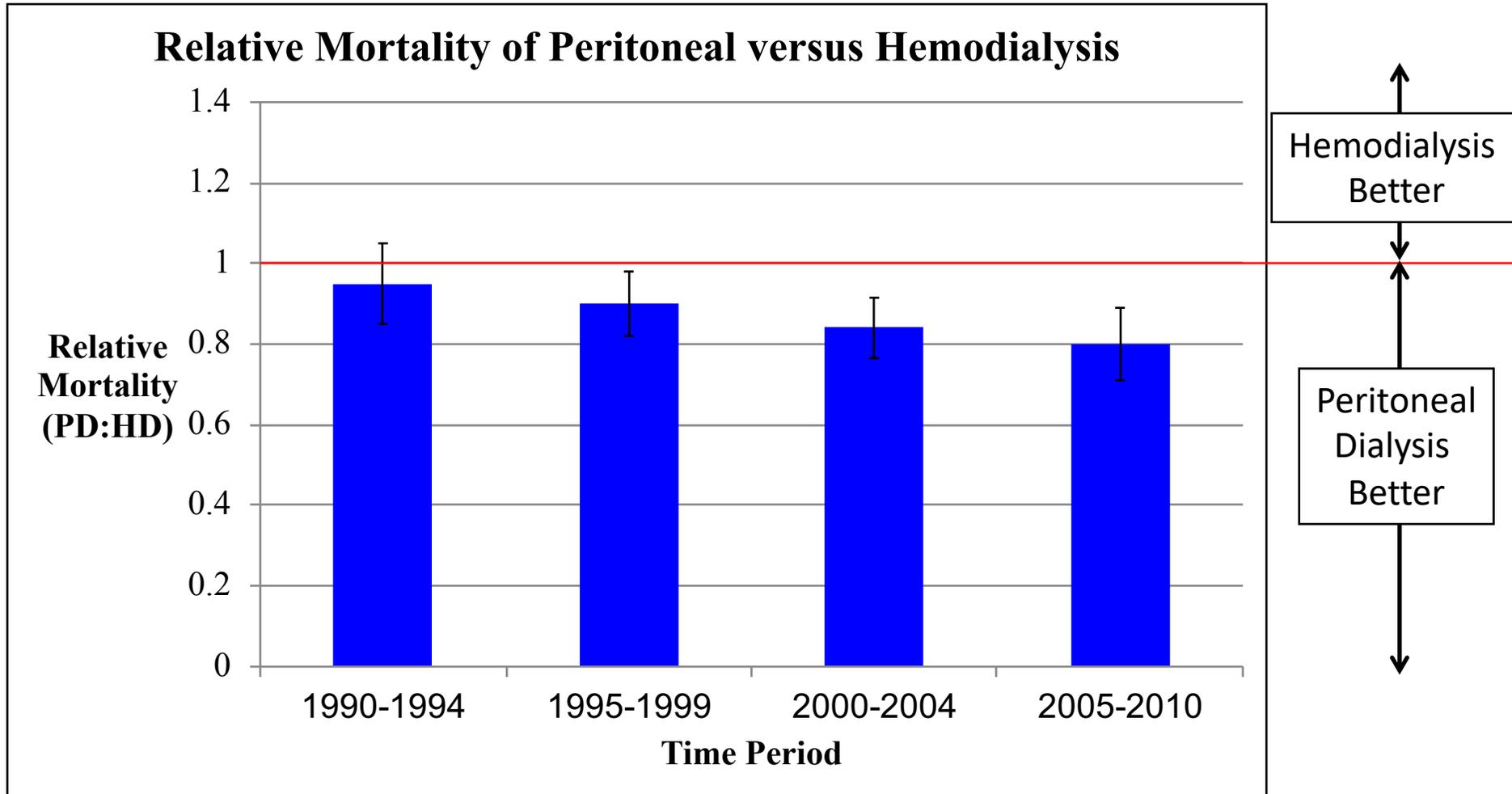
HD and PD are associated with end-stage renal disease

## ITT Adjusted Cumulative Hazard Ratios by Cohort Period



- Peritoneal Dialysis has survival advantage over hemodialysis in first 24 month of renal replacement; after this equivalent
- Survival in peritoneal dialysis has improved from 1990 to 2004. Similar improvements not seen in hemodialysis

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?": Survival



- Similar to Yeates study: Survival in PD > HD
- Survival in peritoneal dialysis has improved, but survival in hemodialysis stayed same

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?”: Survival

NECOSAD group

- 38 patients randomized to PD versus HD
- 5 years followup
- Hazard Ratio of death HD:PD = 3.8 (1.1-12.6) favoring PD survival  
aHR death HD:PD = 3.6 (0.8 – 15.4), not statistically significant

**Bottom Line:** Survival in PD is either better (or the same) than HD

“Bridge to Transplant”

- Early survival advantage (Yeates et al, Heaf and Wehberg)
- Survival in PD improving but in HD stagnant
- My view: PD may be better on initiation dialysis, same/better after 24 months

# Peritoneal Dialysis versus Hemodialysis: “Why not Hemodialysis Everywhere?”

1. Reliable electricity
2. Clean and reliable source of water with water cleaning system
3. Trained staff or patient
4. Hemodialysis machine and supporting equipment
5. Backup machine and equipment
6. Money
7. Alternative (Peritoneal dialysis) should be possible for most patients

There is an economy of scale- when a large number of patients are present, the infrastructure/staffing/water system costs can be offset by a larger number of patients using the equipment.

Simpler machines for home hemodialysis can be used (breakdown more often, still require 1/2/3/4/5), require more frequent treatments and more time to setup than traditional hemodialysis machines



# Case 1: Jane in Attawapiskat



53 year old female Jane, from Attawapiskat

→ March 2021 started peritoneal dialysis for Polycystic kidney disease

→ April 2021 - returned to Attawapiskat

→ Early May 2021 – Notices bilateral lower limb edema. PD prescription changed to increase fluid removal

→ Late May 2021- Comes to nursing station with dyspnea progressive for 1 month.

Available blood work is all normal.

Physical Exam: BP 139/84, heart rate 83, rr 20, T 36.7 deg C.

CVS exam normal

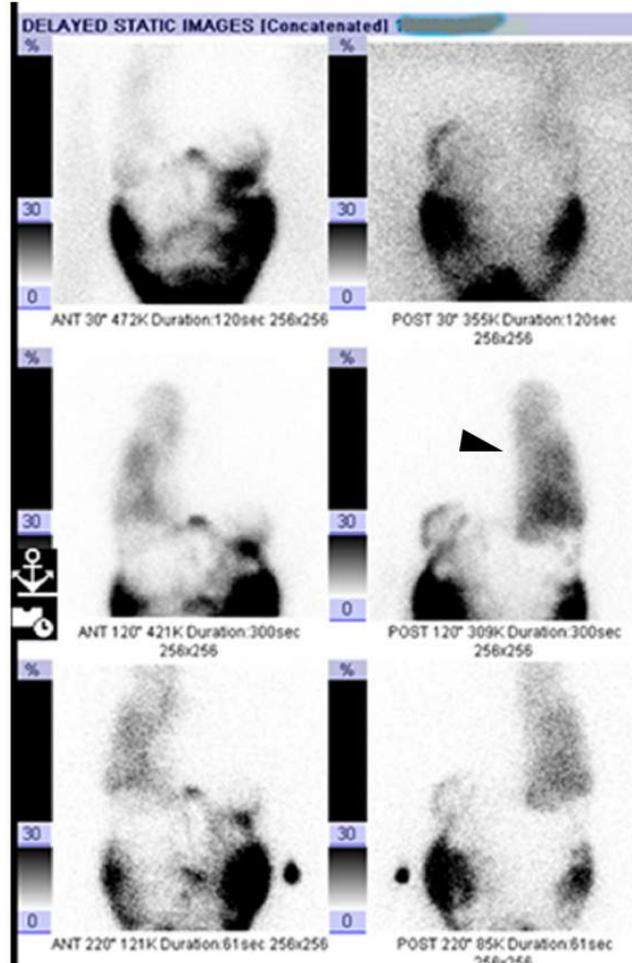
Resp exam: Decreased air entry 1/2 Right side, dull to percussion. Otherwise normal

You order a Chest Xray.

## Case 1: Jane in Attawapiskat



# Case 1: Jane in Attawapiskat



~1.5% PD patients  
90% right sided  
PCKD may be risk factor  
Presentation = dyspnea (95%)

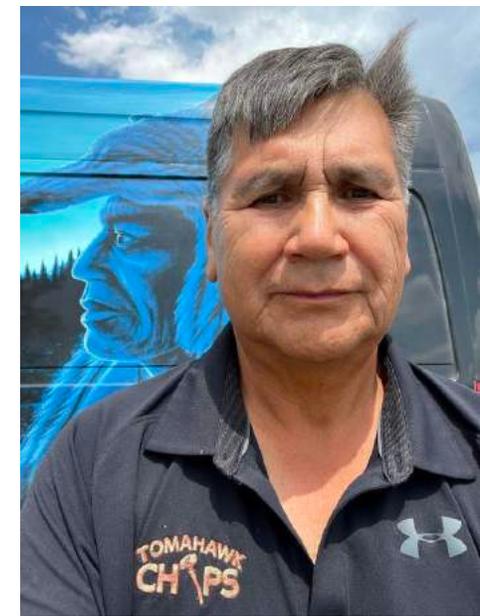
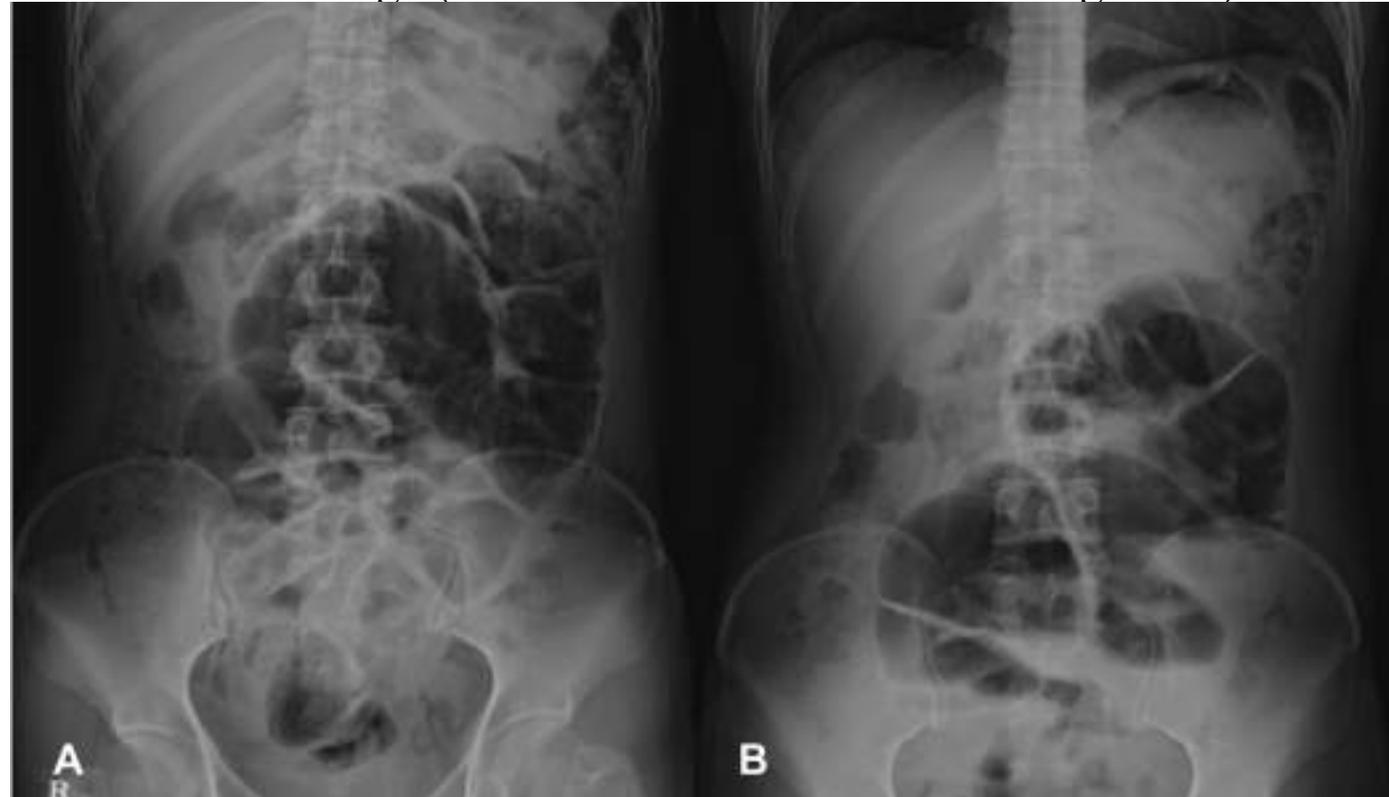
## Case 2: Charlie in Red Lake

57 year old man

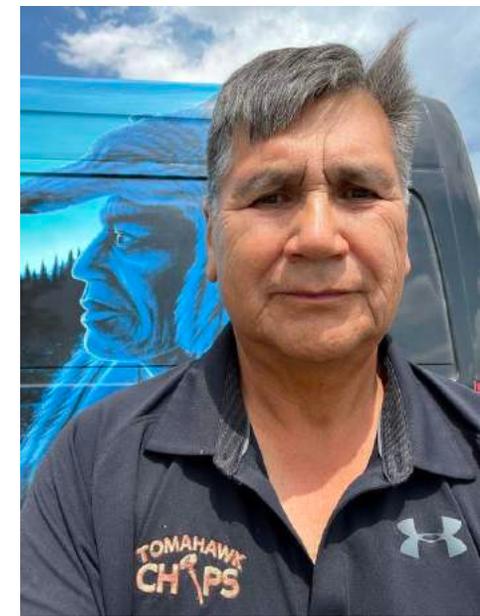
PD since 1990 (diabetic nephropathy)

Multiple past episodes if peritonitis related to his Peritoneal dialysis

Bowel obstruction 1 month ago (resolved with conservative management)



## Case 2: Charlie in Red Lake



### Encapsulating Peritoneal Sclerosis

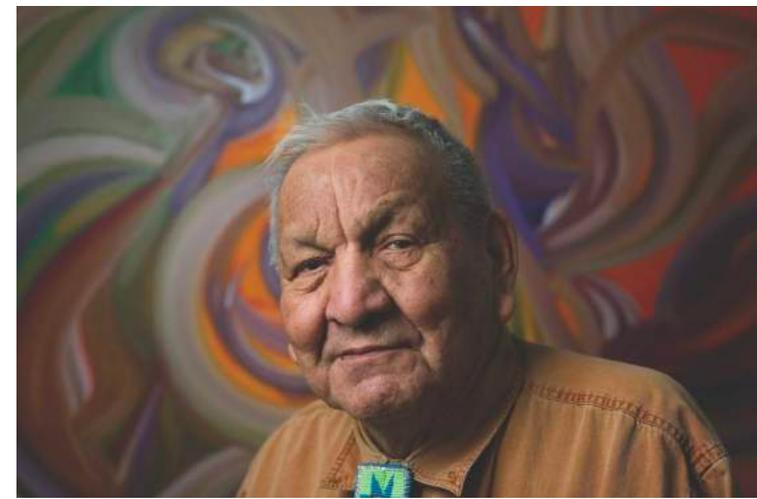
- Aka “cocoon abdomen”
- ~0.5 to 3% prevalent PD patients
- Presentation = recurrent bowel obstruction
- Bowel tethers to hard peritoneum
- Two types: Classical + Post-transplant
- Diagnosis = laparotomy
- Risk factor = peritonitis, PD vintage
- Treatment = enterolysis +/- TPN
- No evidence for screening

## Case 3: Randy in Moose Factory

75 year old man

PD since 1995 (Hypertensive nephrosclerosis)

Presents with progressive volume overload over the last 3 months



**What are the causes of progressive volume overload in a patient on peritoneal dialysis?**

- Loss of residual renal function
- Nephrotic syndrome in patient with residual renal function
- Dietary or fluid noncompliance
- PD noncompliance
- High transporter (use more exchanges, use APD rather than CAPD)
- Inadequate prescription (failure to use icodextrin, wrong concentration bags)
- New diagnosis (eg. liver disease, cardiac disease)

## Case 4: Judy in Pikangikum

49 year old woman, on PD since 2017

Presents to nursing station with nausea, mild abdominal discomfort  
Review of systems unremarkable. No other signs or symptoms

**Exam:** BP 120/80, hr 75, rr 18, T 36.7  
Cardiac, respiratory exam normal  
Abdominal exam: Mild discomfort on palpation diffuse

Knowing she is on PD, any other questions to ask?

- Has anything about your peritoneal dialysis management changed in the last few weeks?
- Have you noticed any change in the color of your PD fluid?



## Case 4: Judy in Pikangikum

- 2 weeks ago, her cat started sleeping in her bedroom as a friend with a cat allergy was visiting. The cat commonly sleeps in bed with Judy
- PD fluid has been cloudy for several days, and abdominal discomfort 2 days



# Case 4: Judy in Pikangikum PD peritonitis

## PRESENTATION

Abdominal pain, cloudy effluent

## DIAGNOSIS

- 2 of 3 of:
- Symptoms of peritoneal inflammation (Abdominal Pain)
  - Cloudy effluent (wbc count 100, > )50% neuts
  - Organisms on gram stain or culture of PD fluid

## EMPIRIC TREATMENT

Either 2 cephalosporins (Cefazolin and Ceftazidime IP) OR  
1 cephalosporin (Ceftazidime) and Vancomycin IP OR  
Vancomycin and Tobramycin IP

**\*\*WEIGHT BASED!!**

## TARGETED TREATMENT

WAIT until cultures/sensitivity back



## Case 4: Judy in Pikangikum PD peritonitis

- Not all abdominal pain in PD patients is peritonitis  
(consider heartburn, MSK pain, biliary, hepatic, pancreas, etc)
- Patients with PD peritonitis often have little or no pain  
(abdominal exam is very important!)
- Fever usually absent or mild
- Wbc count usually normal
- Blood cultures usually negative
- Patients RARELY appear sick (except with Staph aureus or Pseudomonas or secondary PD peritonitis)
- Typically arises from touch contamination of catheter, peri-catheter from exit site infection, or from across bowel wall.
- With early treatment, most cases of PD peritonitis (> 90%) should be cured without PD catheter removal, and without conversion to hemodialysis



## Case 5: Randy in Moose Factory

→ Randy returns to the nursing station complaining of a scrotal bulge

His cardiac, respiratory exam are normal. Vital signs are unremarkable.

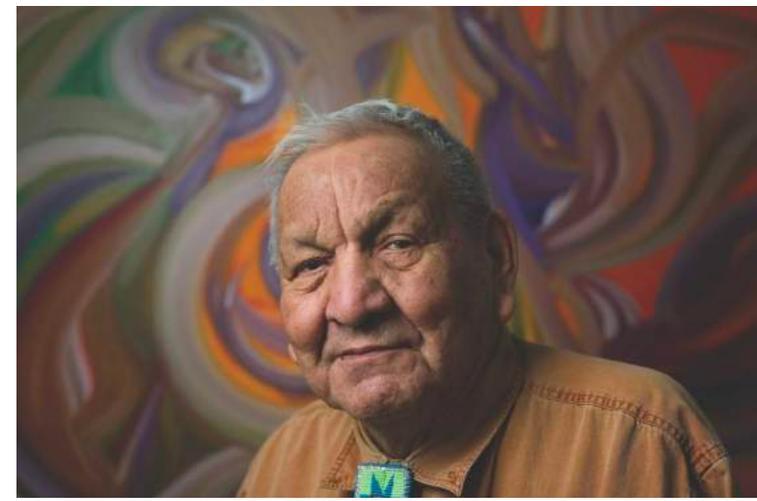
He has no recent blood work

On abdominal exam, he has a painless bulge in the right side of his scrotum.

You attempt to reduce it back into abdomen but it appears fixed.

The bulge is uncomfortable for Randy but he is in no acute discomfort.

What could this bulge be?

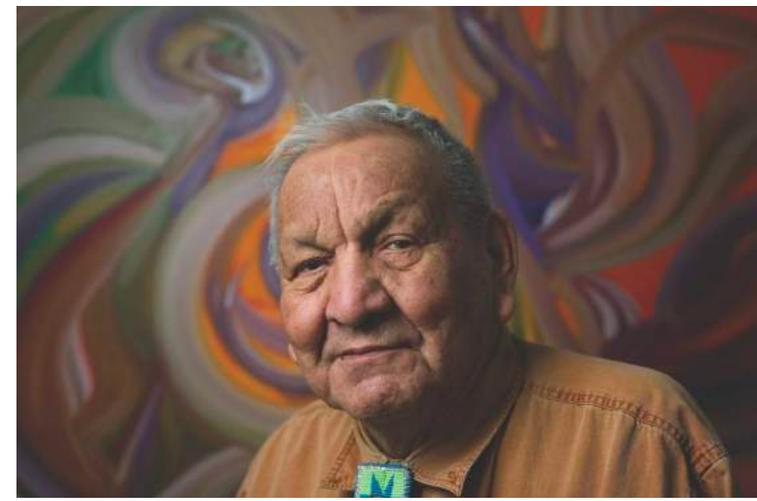
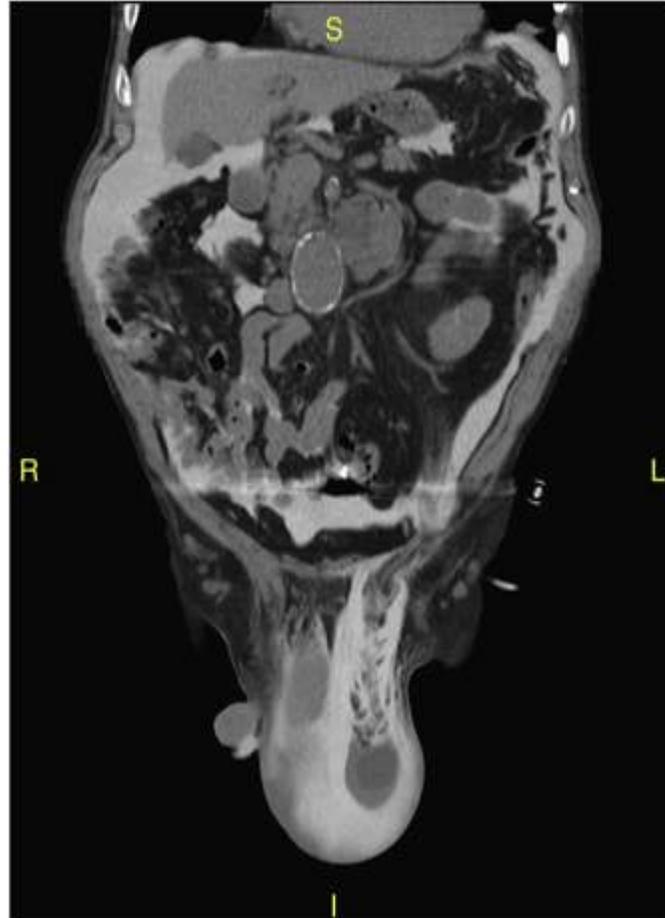


## Case 5: Randy in Moose Factory

→ In Peritoneal dialysis patients, the introduction of fluid into the peritoneal cavity increases intraabdominal pressure and increases possible hernias

Two other PD specific causes of genital swelling include:

1. Pericatheter leak
2. Patent Processus Vaginalis



# When to call Regional Nephrology Program?

- Anytime there is a suspected or confirmed PD complication
- Anytime there is a consideration that PD is not working for the patient
- Anytime the patient asks to talk to them ☺

**Thank you**

# MSEERS: September to December 2021

## **SCHEDULE**     **All topics are based on feedback from Evaluations**

- September 16:     **Everything You Need to Know about Peritoneal Dialysis In a Remote or Indigenous Community**  
*Dr. Ben Thomson, Nephrology and Internal Medicine, Queen's University*
- September 30:     Holidays
- October 14:        TBA: Polypharmacy and Deprescribing, OR Ophthalmology topic OR Alcohol Use Disorders
- October 28:        **Hepatitis B and C in the Indigenous Remote Setting**  
*Dr. Anouar Teriaky, Hepatology and Gastroenterology, Western University*
- November 11:      TBA: Polypharmacy and Deprescribing, OR Ophthalmology topic OR Alcohol Use Disorders
- November 25:      **Evaluation and Management of Cognitive Decline and Aging in Remote/Indigenous Populations**  
*Dr. Mark Lachmann, Geriatric Psychiatry, University of Toronto*
- December 9:        **Evaluation and Management of Thyroid Conditions in Remote Communities**  
*Dr. Sara Awad, Endocrinology, Queen's University*

# MSERS: September to December 2021

- Completion of Evaluations is the BEST way to assure ongoing quality and relevance of topics
- Collaboration with NOSM, University of Toronto for Administrative Support will be coming soon
- **Coming in 2022: Addictions Medicine, Emergency Medicine, Pediatrics Topics**
- To assure credit for Continuous Professional Development, MSERS series has applied for credit from CFPC (pending approval)
- ANY way to improve the sessions- USE the evaluations! Or email me ([ben@benthomson.org](mailto:ben@benthomson.org))
- Updates and supplementary material always available at MSERS website:

<https://apil.ca/multi-subspecialty-education-for-low-resource-settings-msers/>



**Thank you**