UNIVERSITEIT GENT

DAILY MANAGEMENT IN HEMODIALYSIS

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ERKNet The European Rare Kidney Disease Reference Network

european society for paediatric nephrology

Organization Team:
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Co-funded by the European Union

Objectives

Introduction

Starting a child on HD, how the set up the first session

How can adequate HD be obtained?

Common complications during HD

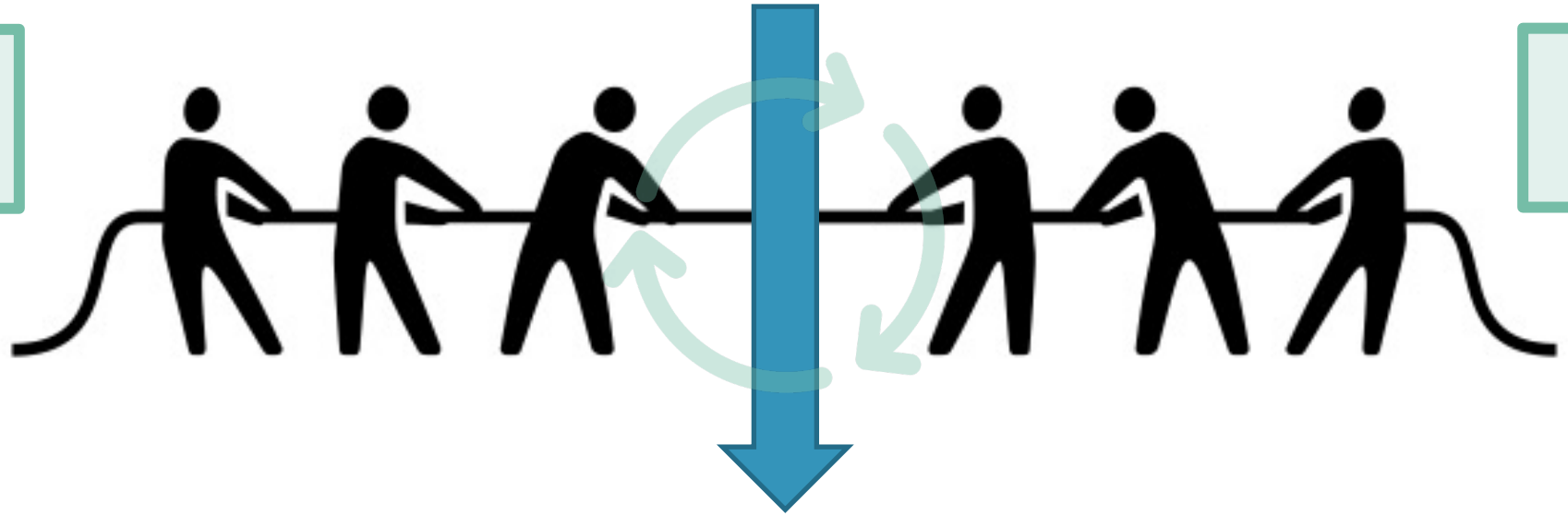
It takes a village to raise a child on chronic dialysis

Take home messages

Introduction

DAILY HD MANAGEMENT

Adequate correction of uremic milieu



Quality of life
Minimal burden
Education

OPTIMAL LONG-TERM OUTCOMES

Created by Lucas Helle from Noun Project

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Rule 1: start slow to prevent Dialysis Disequilibrium syndrome

Rare neurological complication, most commonly affecting patients during HD initiation

Cerebral edema due to intracerebral shifts, diagnosis is challenging (aspecific symptoms)

Prevention: avoidance of rapid fluid/osmotic shifts
- Blood flow ≤ 3 ml/kg/min body weight (90 ml/m²)
- First session max. 2 hours
- Low UF goals to start
- Others: smaller dialyzer, lower dialysate flow
- Decrease osmotic shifts using i.e. mannitol

Table 2 Symptoms, type of dialysis (as initial therapy), and changes in management (post-DDS symptoms) reported among DDS patients in the included studies

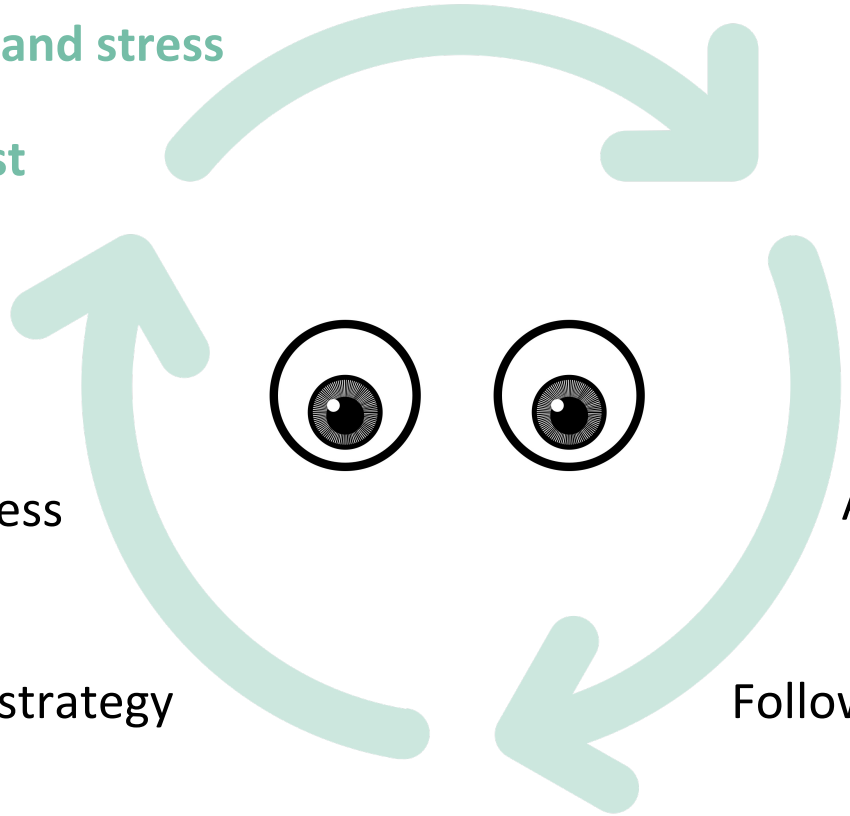
Symptoms	Studies	Sample size	# Present (%)	Range	% Present out of 226 DDS patient
Headache	20	142	56 (39.4%)	10–100%	24.8%
Nausea	19	141	57 (40.4%)	13–100%	25.2%
Vomiting	16	138	54 (39.1%)	12.5–100%	23.9%
Confusion	10	15	10 (66.7%)	20–100%	4.4%
Seizure	9	14	11 (78.6%)	50–100%	4.9%
Affected level of consciousness	6	115	20 (17.4%)	13.6–100%	8.8%
Lethargy	5	6	5 (83.3%)	50–100%	2.2%

Raina et al, 2021 Ped Nephrol

Rule 2: Be around, and keep an eye in following sessions

Minimize anxiety and stress

Revise medication list



Assess vitals, symptoms and tolerability

Assess vascular access

Assess volume management

Assess anticoagulation strategy

Follow-up labs

Created by TNS
from Noun Project

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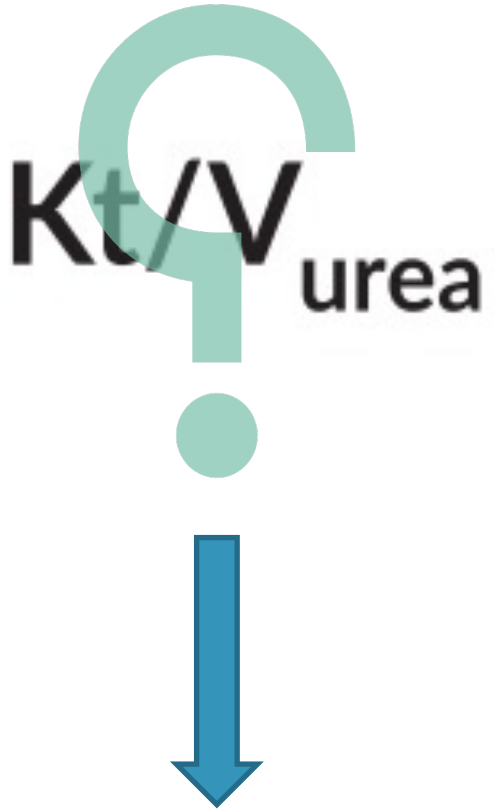
How is adequate hemodialysis defined?



Seminars in Dialysis WILEY

REVIEW ARTICLE

A swan song for Kt/V_{urea}

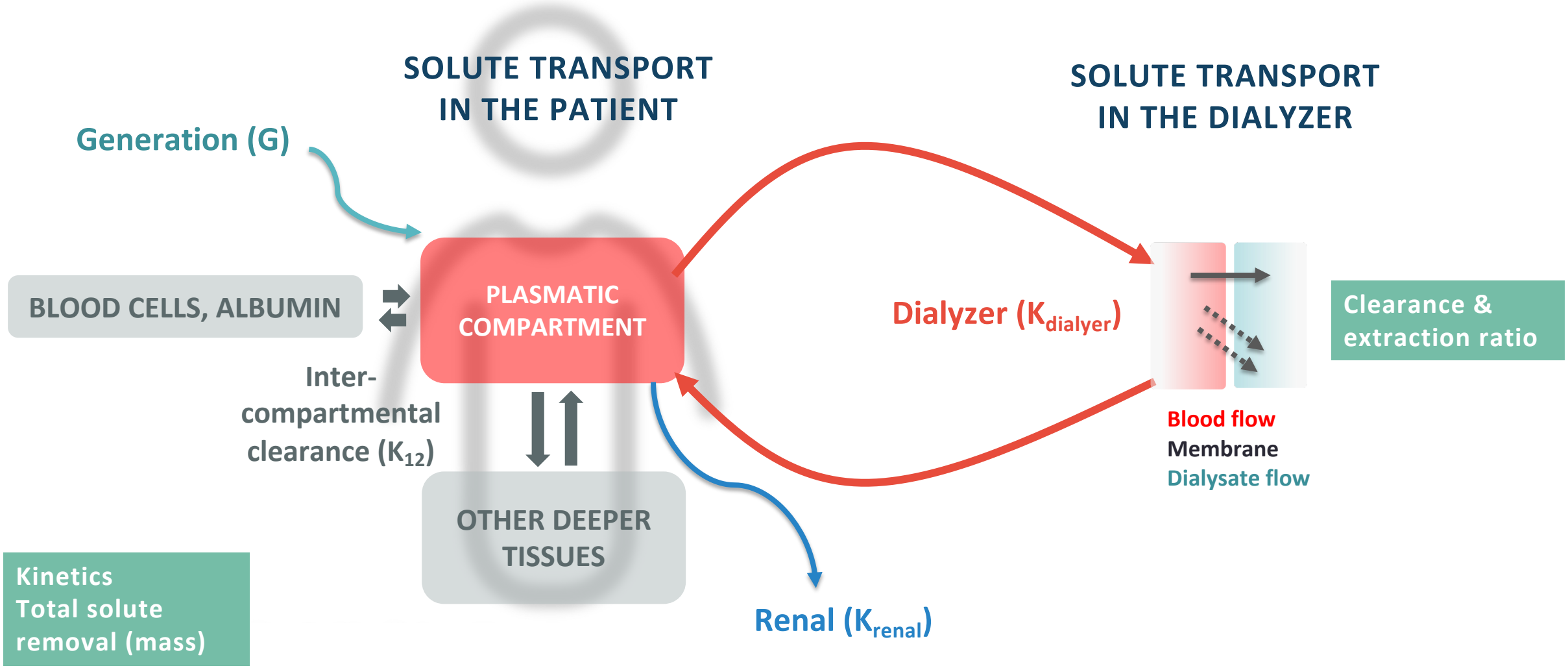
Raymond Vanholder | Wim Van Biesen | Norbert Lameire

Lack of hard evidence to support Kt/V

Invalidity in children

Rees, L. (2019), Ped Nephrol, 34:61-69

How is adequate hemodialysis defined? – a “solute” perspective



Eloot et al., Seminars in Dialysis, 2012

How is adequate hemodialysis defined? – a “solute” perspective

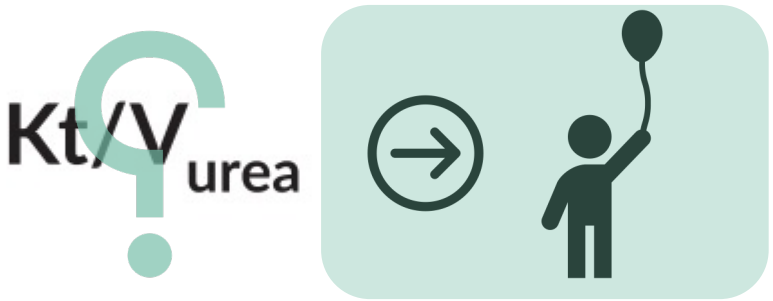
Seminars in Dialysis

A Sad but Forgotten Truth: The Story of Slow-Moving Solutes in Fast Hemodialysis

Sunny Eloot, Wim Van Biesen, and Raymond Vanholder
Nephrology Section, Department of Internal Medicine, Ghent University Hospital, Gent, Belgium

Eloot et al., PLOS one, 2016

How is adequate hemodialysis defined?



Adequate hemodialysis

GOOD NUTRITION AND GROWTH

Monitoring nutritional intake, growth hormone therapy, correct acidosis

CARDIOVASCULAR CONTROL

Normotension, euvolemia, no LVH, avoid IDH, preserve residual kidney function

CKD-MBD & ELECTROLYTES

Normal P & Ca with adequate PTH, no acidosis and normal serum potassium

HEMATOLOGICAL CONTROL

Iron/vitB12/folic acid and EPO, antico strategy without bleeding/clothing

GOOD LONG-LASTING ACCESS

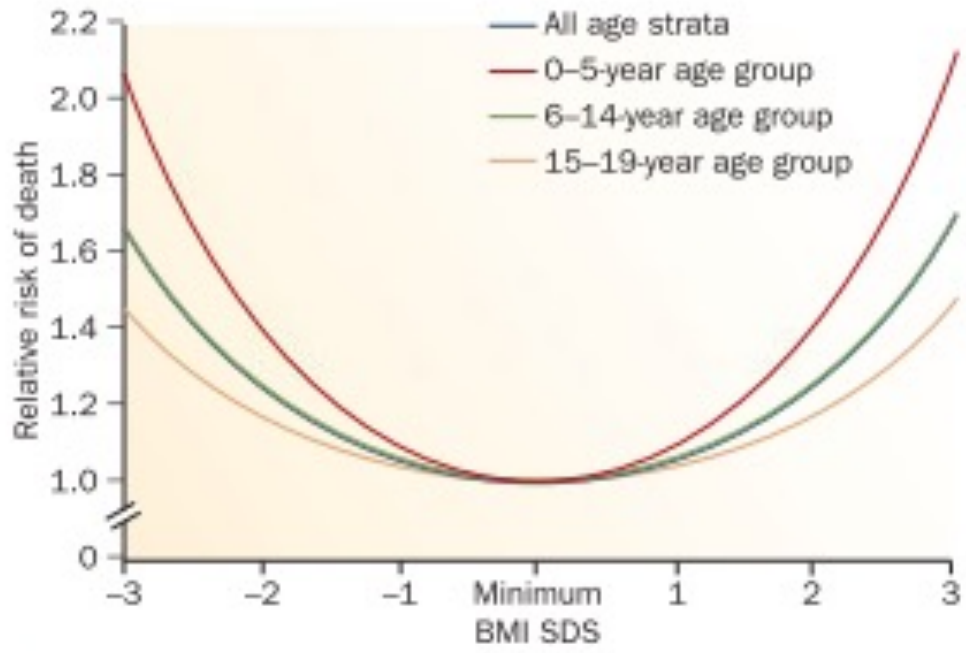
Fistula first, access complications, obtained blood flows

SYMPTOMS, PSYCHOSOCIAL & EDUCATION

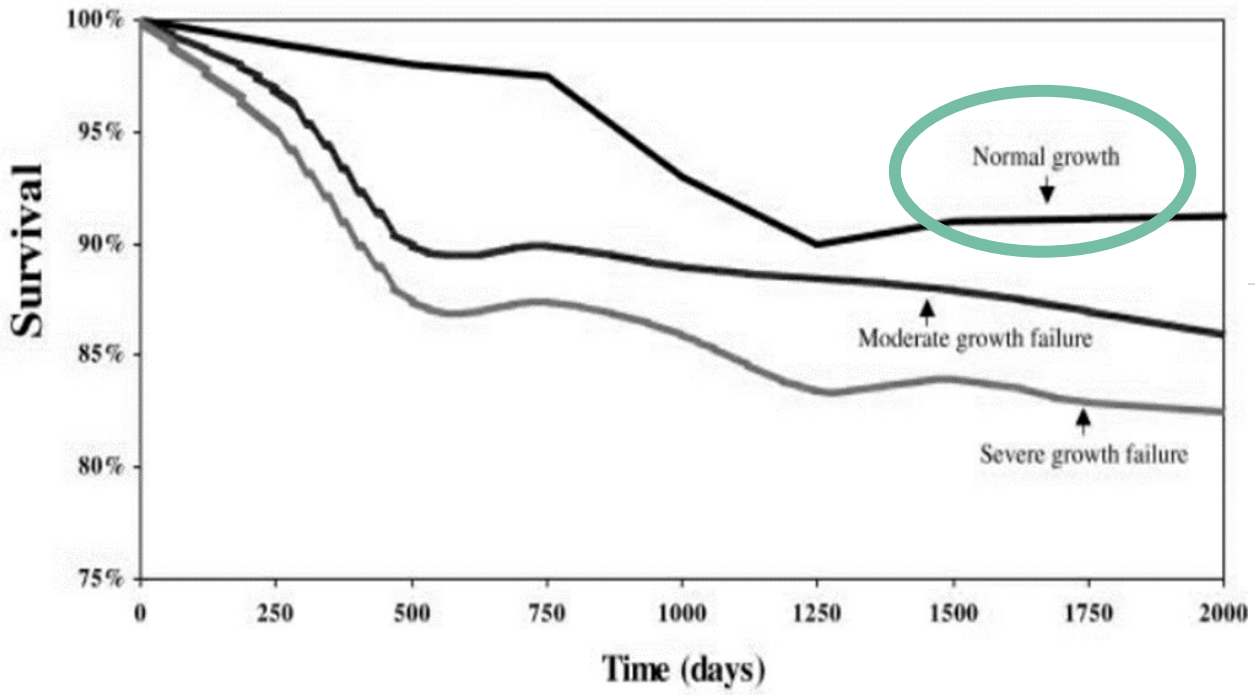
Rees, L. (2019), Ped Nephrol, 34:61-69

Adequate nutrition & growth are closely related to outcome

Adequate hemodialysis



Rees, L. & Mak, R. H. Nat. Rev. Nephrol. 7, 615–623 (2011)



NUTRITION AND GROWTH

The dietary management of calcium and phosphate in children with CKD, McAlister et al., Ped Neph, 2020
Energy and protein requirements for children with CKD, Pediatric Renal Nutrition Taskforce, Shaw et al. 2020 Ped Nephrol

Multiple factors contribute to growth failure/PEW

Adequate hemodialysis

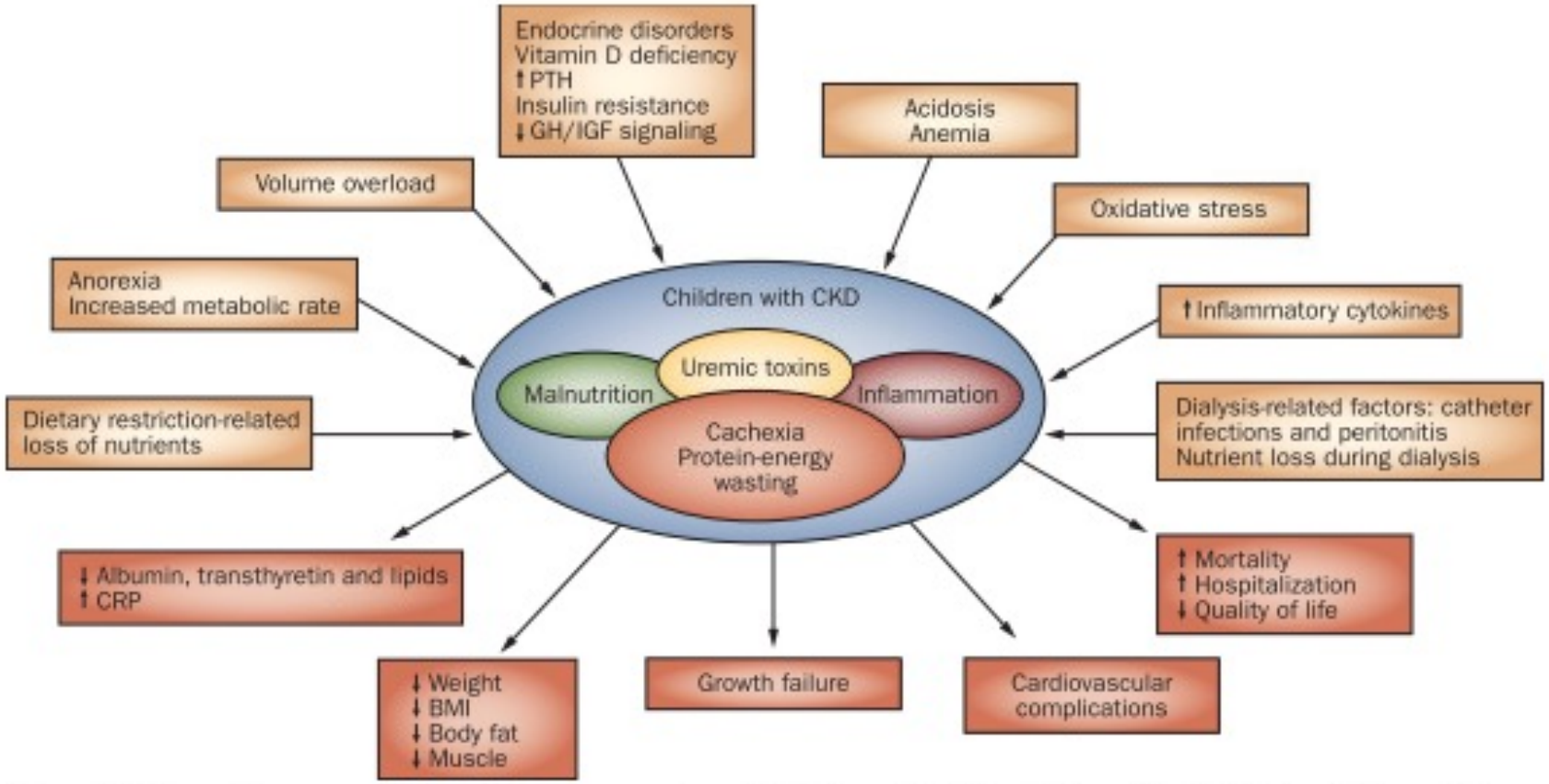


Figure 3 | Schematic representation of the causes and manifestations of PEW in children with CKD. Abbreviations: CKD, chronic kidney disease; CRP, C-reactive protein; GH, growth hormone; IGF, insulin-like growth factor; PEW, protein-energy wasting; PTH, parathyroid hormone. Permission obtained from Springer Science+Business Media © Mak, R. H. *et al. Pediatr. Nephrol.* http://dx.doi.org/doi.10.1007/s00467-011-1765-5.[66]

NUTRITION AND GROWTH

Rees, L. & Mak, R. H. Nat. Rev. Nephrol. 7, 615–623 (2011)

Growth is the best marker of dialysis adequacy

Adequate hemodialysis

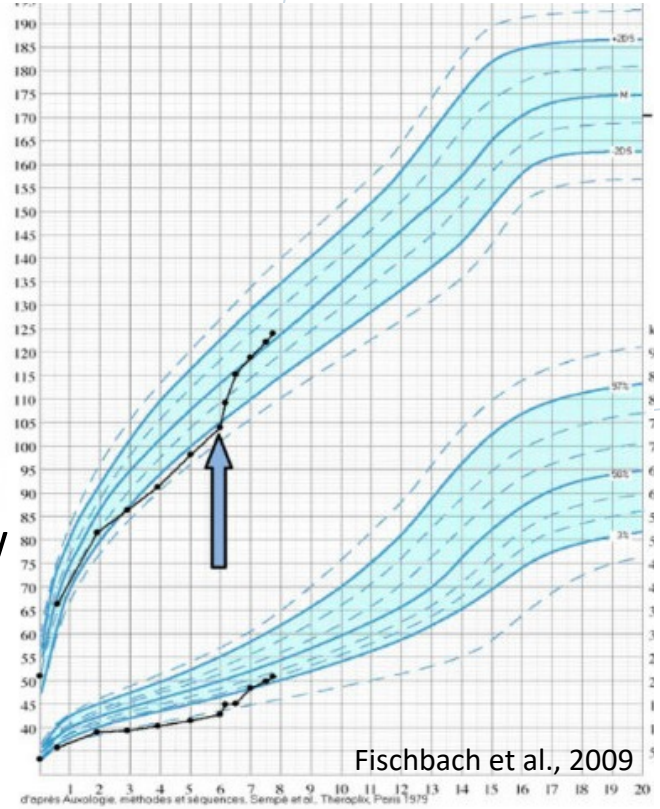
Optimize nutrition, consider GH therapy

Correct Ca/P/PTH & metabolic acidosis

Optimize blood flows (access!)

Optimize dialyzer (high-flux/HDF), dialysate flow

Optimize dialysis TIME



Fischbach et al., 2009

CKD-MBD & ELECTROLYTES

NUTRITION AND GROWTH

Clinical practice recommendations for native vitamin D therapy in children with CKD, Shroff et al., NDT, 2017

Clinical practice recommendations for treatment with active vitamin D analogues in children with CKD, Shroff et al., NDT, 2017

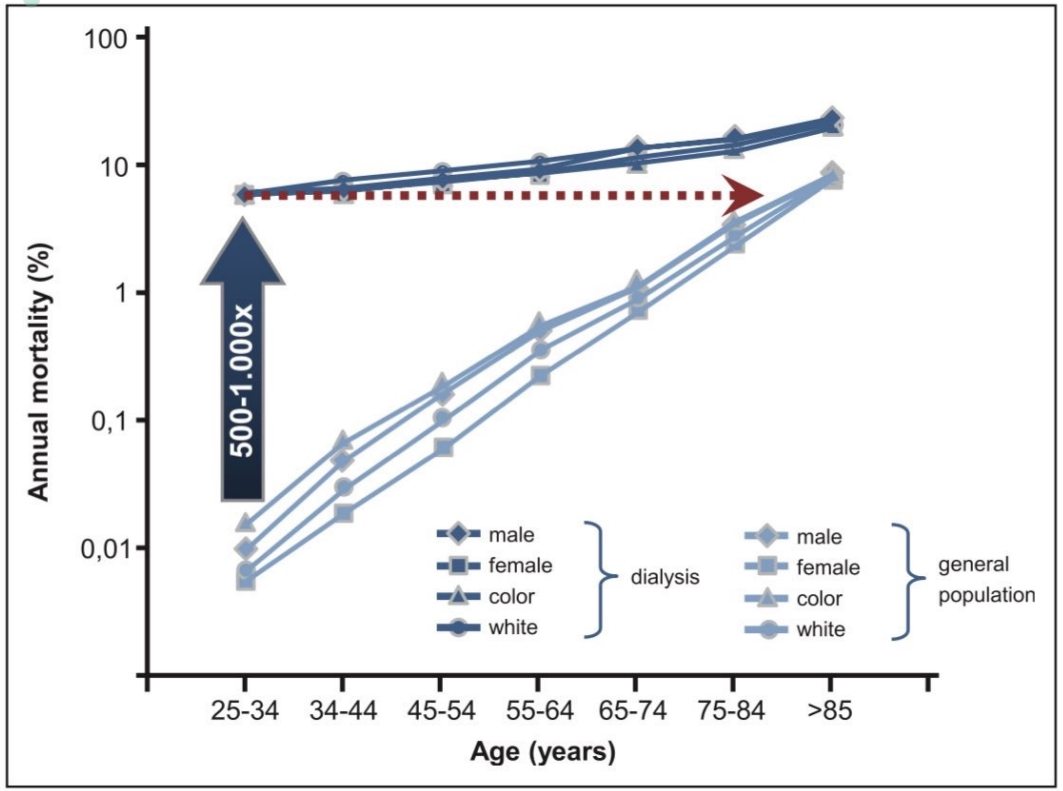
Vascular access in children requiring maintenance hemodialysis, Shroff et al., NDT, 2019

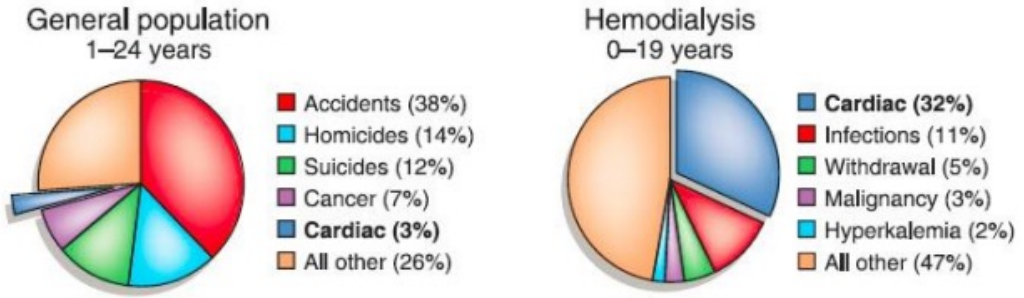
Clinical practice recommendations for growth hormone treatment in children with chronic kidney disease, Drube et al. 2019

Optimize cardiovascular disease management

Adequate hemodialysis

Most important cause of death in pediatric dialysis





Adequate volume management that results in normal blood pressure with no/minimal antihypertensive agents and no LVH

Optimize Ca/P/PTH

Avoiding intra-dialytic hypotension (IDH)

CARDIOVASCULAR CONTROL

Foley et al, Am J Kidney Dis 1998;32:S112-19, Mitsnefes, J Am Soc Nephrol 23: 578–585, 2012

Adequate volume management

Adequate hemodialysis

Dry weight assessment is moving target that needs frequent reassessment

ABPM, orthostatic blood pressure

Bioelectric impedance (body composition monitoring, BCM)

Relative blood volume monitoring

Adherence dietary salt restriction!

Avoid high ultrafiltration rates

CARDIOVASCULAR CONTROL

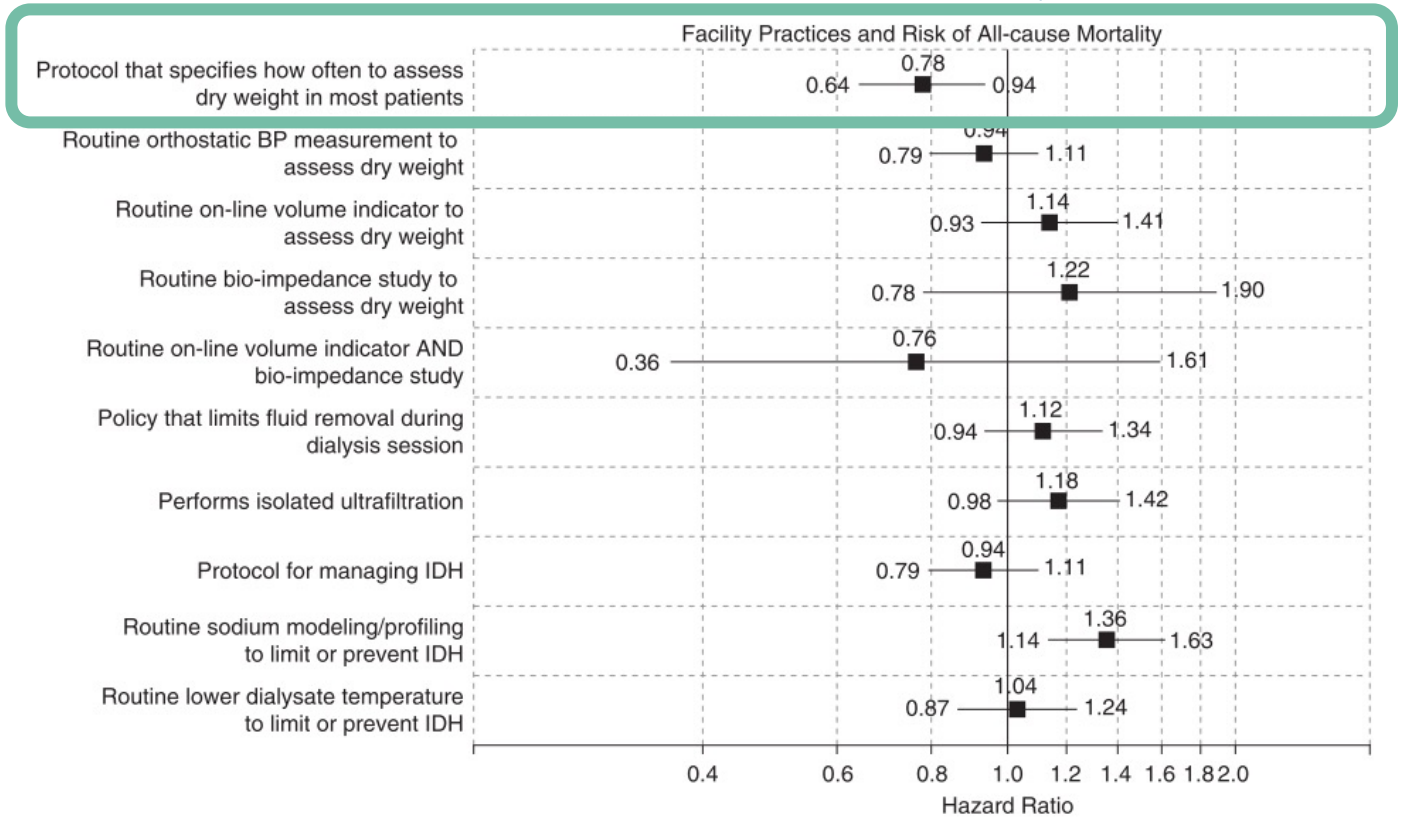


Figure 1. | Associations between facility practices and risk of all-cause mortality (HR and 99% CI, *n*=10,250). Data from patients after multiple imputation for missing data, adjusted for age, sex, country, mean predialysis systolic BP, vintage, smoking status, body mass index, kidney function, vascular access type, and single-pool Kt/V, comorbidities (coronary heart disease, congestive heart failure, other cardiovascular, cerebrovascular disease, hyperlipidemia, peripheral vascular disease, and diabetes). IDH, intradialytic hypotension.

Dasgupta et al., 2019; cJASN

Intra-dialytic hypotension (IDH)

Adequate hemodialysis

= Intradialytic **systolic blood pressure <5th percentile** for age, and/or symptoms triggering
- **fluid bolus** administration or
- **cessation of ultrafiltration**

Acute symptoms

Myocardial stunning

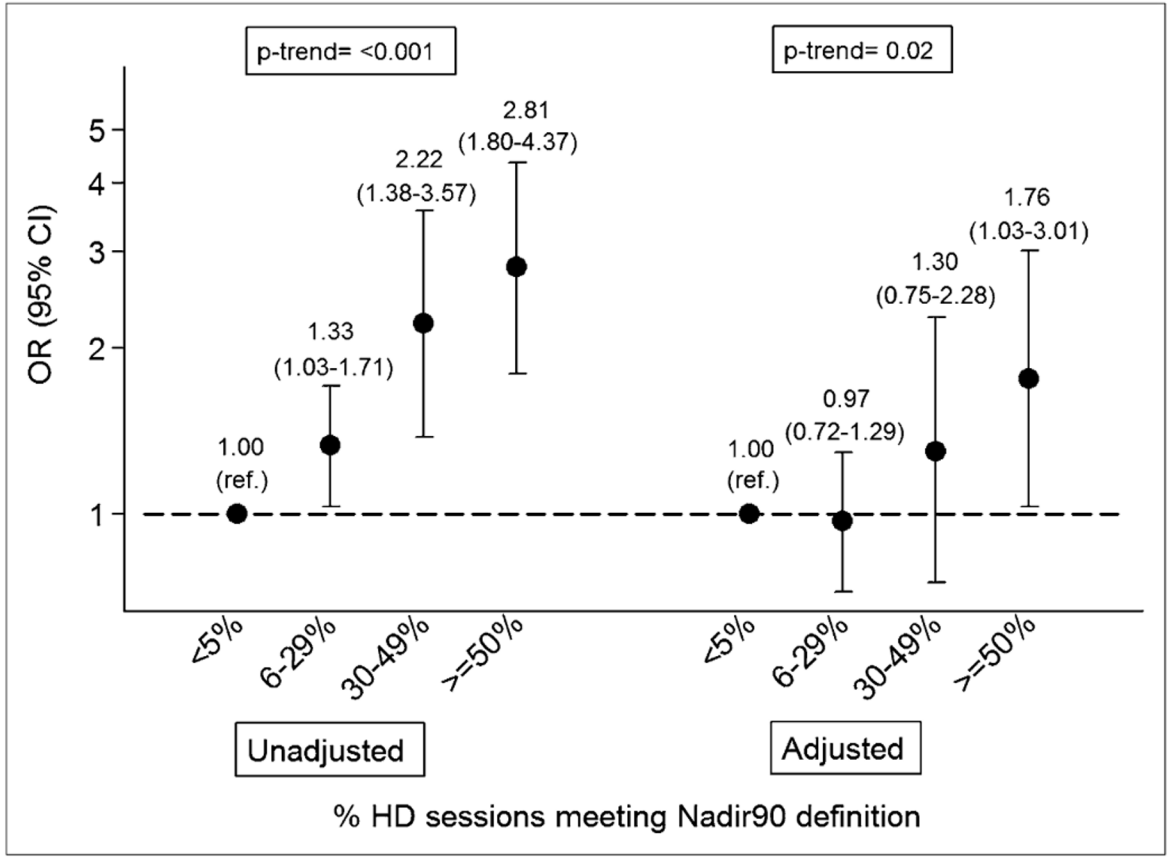
Fluid overload

Reduced solute clearance

Cerebral hypoperfusion

RKF decline

CARDIOVASCULAR CONTROL



Flythe et al. JASN 2015

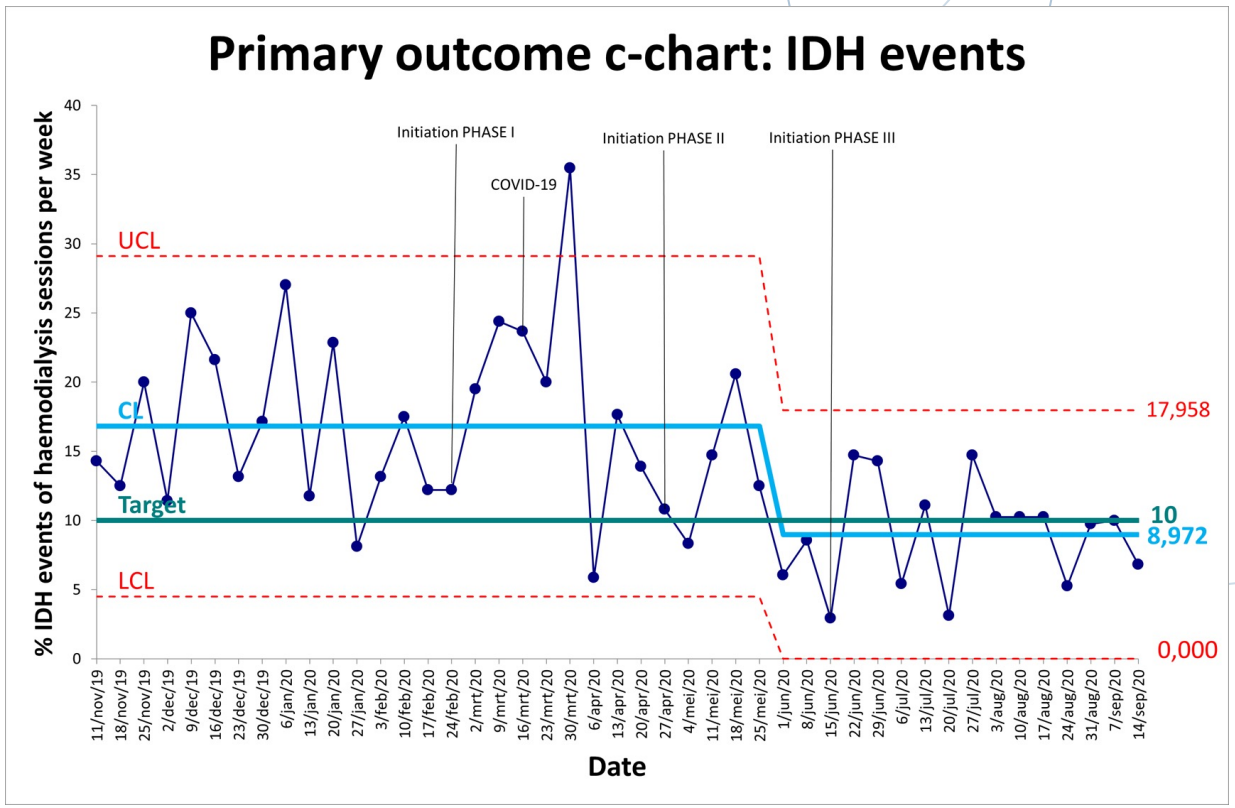
Intra-dialytic hypotension (IDH)

Adequate hemodialysis

- Multidisciplinary approach
- Education of the team
- Embedded in electronic health records

- IDH events from 16,5% to 8,9%
- Antihypertensive use (22,1% to 14,8%)

CARDIOVASCULAR CONTROL



Changing the culture & policy on fluid management have significant benefits for the patients

Snauwaert and Wagner, et al. 2021; Ped Neph

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Complications

INTRADIALYTIC HYPOTENSION

Saline 5mL/kg + UF stop

Assessment volume management!

DISEQUILIBRIUM

Mannitol

ANAPHYLAXIS

STOP dialysis without return of blood

Epinephrine IM ± Hydrocortisone

HEMOLYSIS

STOP dialysis without return of blood

check serum K

AIR EMBOLISM

Clamp off source of air if possible

Lie patient on the left, head and chest down

100% oxygen

Prevention!

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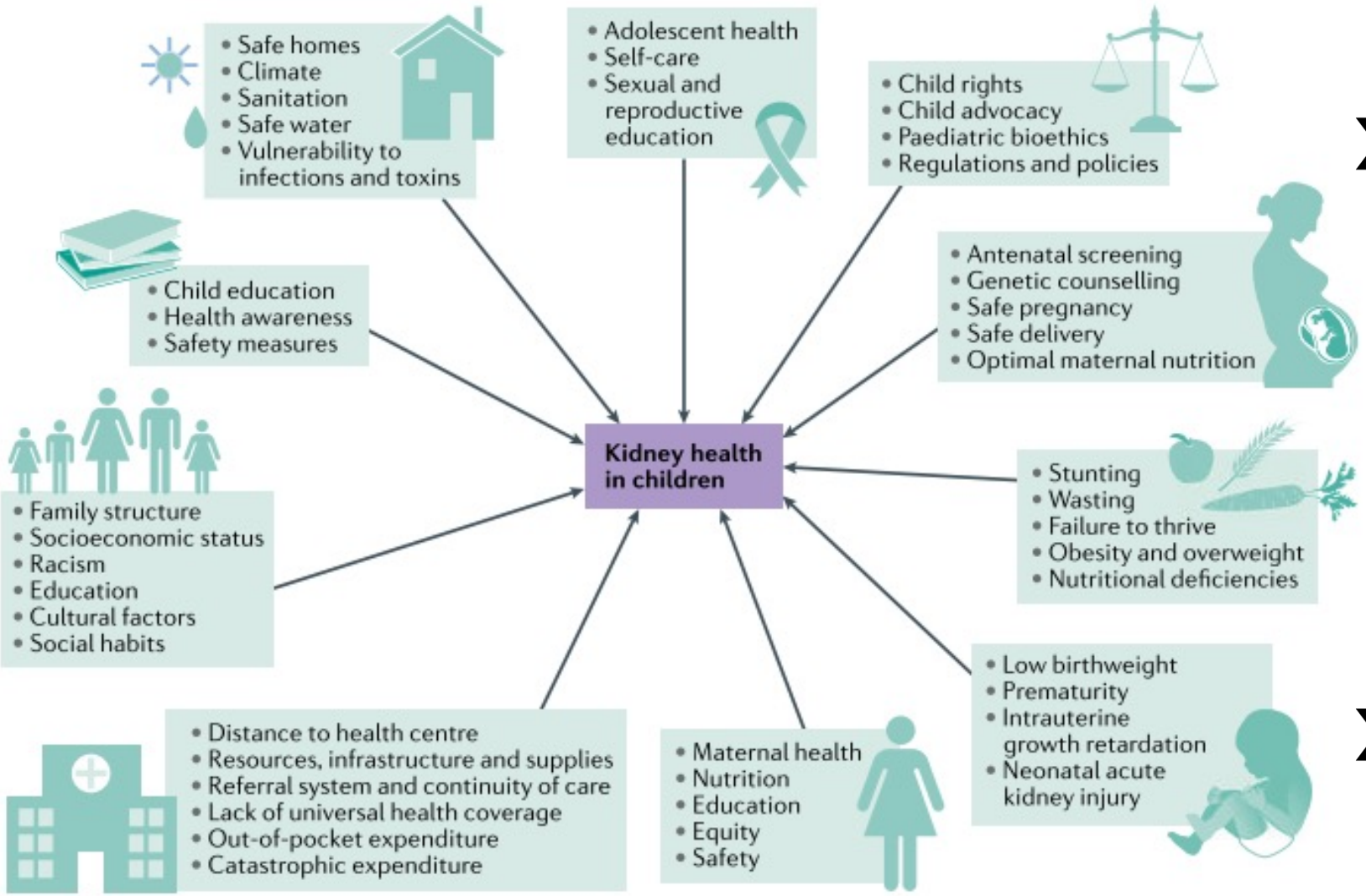
Multiple factors influence health of children & adolescents



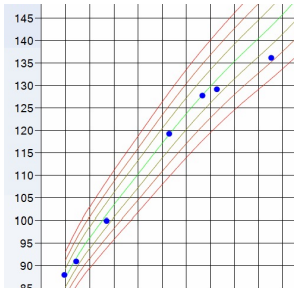
- Particular vulnearable to the negative effects of social determinants
- Dialysis significantly impact children's rights of good education, recreational time to thrive
- Poverty has a significant impact on health
- Healthy & educated parents have healthier children

Luyckx et al. 2021; Nature Reviews; /doi.org/10.1038/ s41581-020-00363-6

It takes a village to raise a child on chronic dialysis

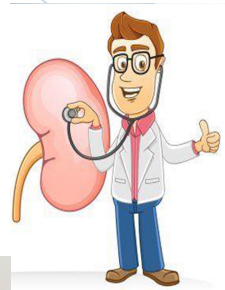
SOCIAL WORKER

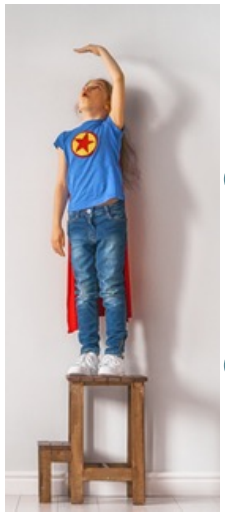
DIETICIAN



NURSES

PEDIATRIC NEPHROLOGIST





CHILD
SIBLINGS
PARENTS
CAREGIVERS

TEACHER, PLAY THERAPIST

PSYCHOLOGIST

VASCULAR SURGEON,
UROLOGIST, NEPHROLOGIST

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Take-home message

Starts slow & **be around** when initiating hemodialysis

Consider **patient-relevant clinical outcomes** to define **“adequate hemodialysis”**. In pediatrics, **growth** is probably the best marker of dialysis adequacy.

Do not forget **“The story of slow-moving solutes in fast hemodialysis”**

Continuous (multidisciplinary) **reassessment** is key

It takes a **multidisciplinary team** to raise a child on chronic dialysis

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THANK YOU!

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