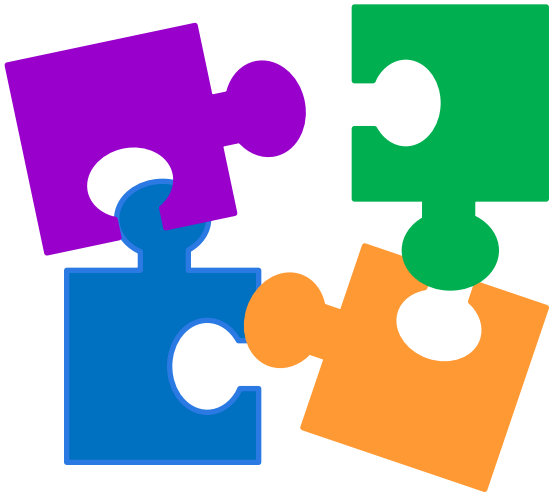
SOUTHAMPTON Children's Hospital

Balancing the nutritional needs in the pediatric patient with obesity on dialysis



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University Hospital Southampton NHS Foundation Trust

University of Southampton

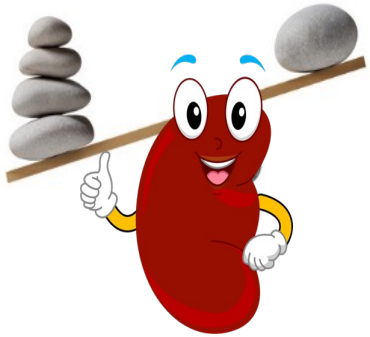
University of Winchester

Disclosures

Caroline Anderson discloses she works with the NHS, Academia, has done projects for Vitaflo Global and is a member of the Pediatric Renal Nutrition Taskforce.

Diet and Nutrition challenges

Energy	Fluid
Protein	Phosphate
Potassium	Salt



Oral	Tube feeding	Vomiting
Appetite	Taste	Stress
Consent advice	Family life	Peer pressure
Quality of life	Patient voice	Medication
Under nutrition	Overweight and obesity	Growth

Kidney from World Kidney Day teaching materials: https://www.worldkidneyday.org/resource/school-kit-6-11yo/


Southampton Children's
Hospital Charity


BBC NEWS


Southampton Children's
Hospital Charity


BBC NEWS

Overview

- What is the problem
- Why is obesity important
- What do we need to consider
- What guidance is there
- How can we optimise nutritional management

CKD obesity is multifaceted and is challenging to manage
Requires a comprehensive multicomponent intervention

Stabouli 2021

What is the problem

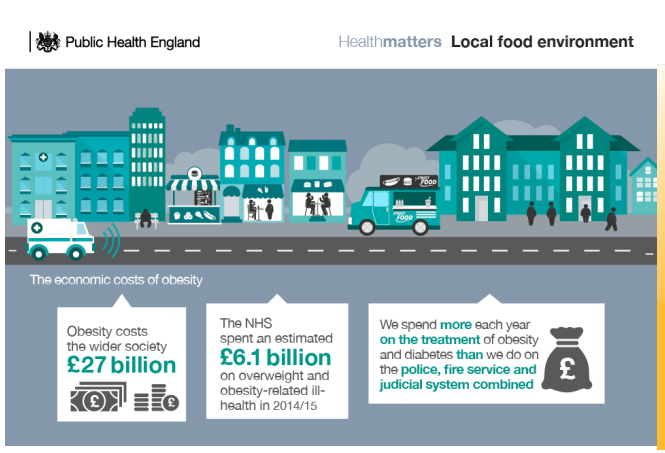
- Cost
- Prevalence
  - Global & CKD
- Definition
  - Global & CKD
- Body composition
  - BMI, waist, muscle mass
- Nutritional requirements
- Nutritional management

11811 World Obesity Healthy Voices Infographics V2_SH

Public health Costs

- UK: NHS $7.4 billion (2050 9.7); Wider 32.5 billion (60.4) (both)[2014-15]
- US: Healthcare $150 billion[2017];
  - Medicaid individual 5m-1.3 billion (2050 9.7); State 8 billion[2017]
- Canada: $4.6 billion (1.98 direct and 2.63 indirect)[2008]

Annual spend on the treatment of obesity and diabetes is greater than the amount spent on the police, the fire service and the judicial system combined [UK].



Global obesity prevalence

	2-5 yrs	4-5 yrs	6-11 yrs	10-11 yrs	6-17 yrs	12-17 yrs	2-19 yrs	10-19 yrs
UK 2021/22		10.1%		23.3%				
US 2017-2020	12.7%		20.7%		22.2%		19.7% (14.7m)	
Canada *2004, 2007	6.3%*		6.4%			10.5%		
WHO 2016	39 million (< 5)		340 million (5-9)					5.6%

World obesity accessed Jan 2023

https://www.cdc.gov/obesity/data/childhood.html#Prevalence

https://www.cdc.gov/mmwr/volumes/69/wr/mm6913a6.htm?s_cid=mm6913a6_w

https://www.gov.uk/government/publications/health-matters-obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2

https://digital.nhs.uk/data-and-information/publications/statistical/national-child-measurement-programme/2021-22-school-year

Global Prevalence

Ranges from 6.3 – 23.3%

UK 2021/22		10.1%		23.3%				
US 2017-2020	12.7%		20.7%		22.2%		19.7% (14.7m)	
Canada *2004, 2007	6.3%*		6.4%			10.5%		
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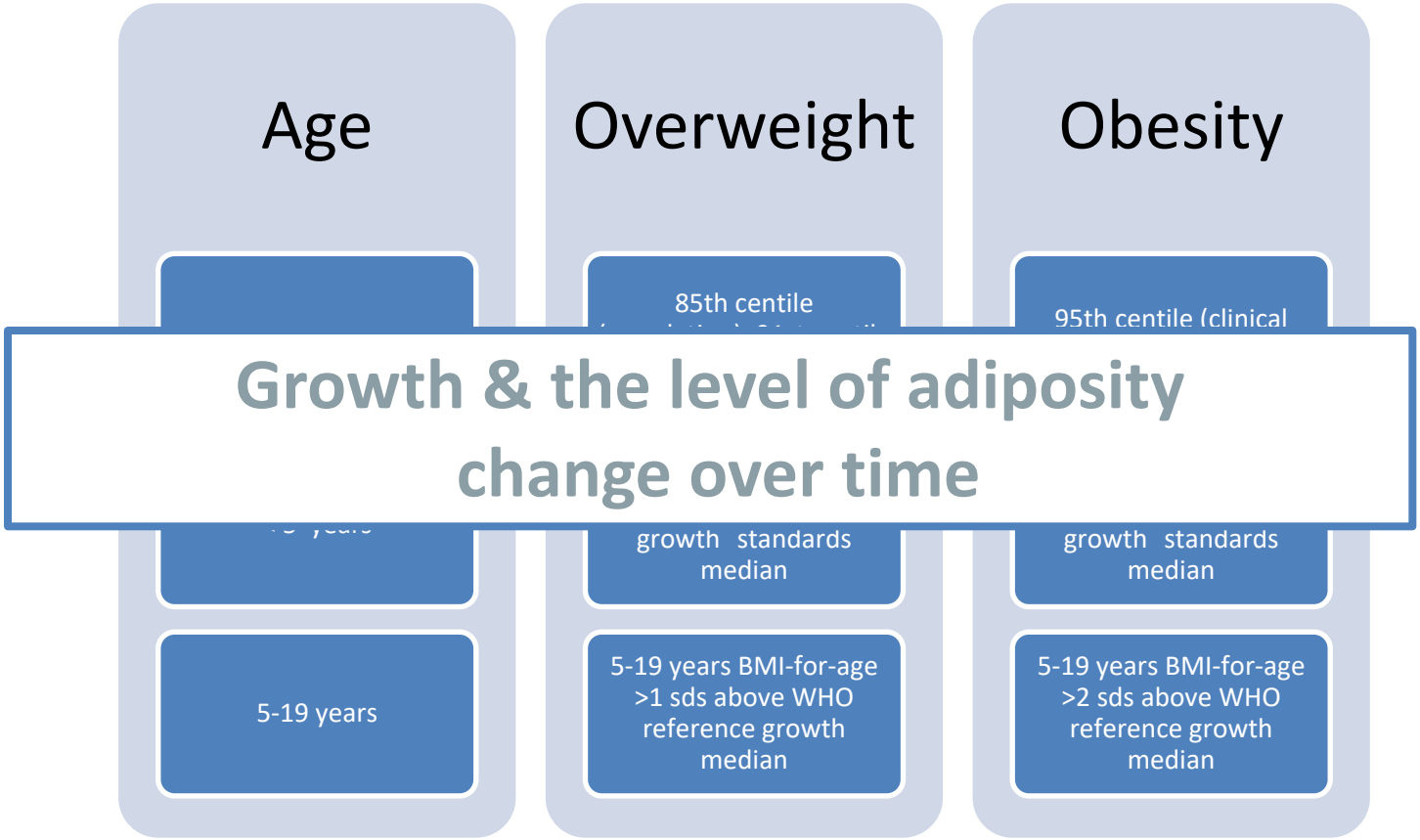
https://digital.nhs.uk/data-and-information/publications/statistical/national-child-measurement-programme/2021-22-school-year

Global definitions

Age	Overweight	Obesity
	85th centile (population), 91st centile (clinical assessment)	95th centile (clinical assessment)
< 5 years	< 5 years weight-for-height >2 sds WHO child growth standards median	< 5 years weight-for-height > 3 sds WHO child growth standards median
5-19 years	5-19 years BMI-for-age >1 sds above WHO reference growth median	5-19 years BMI-for-age >2 sds above WHO reference growth median

Organisations: World health organisation / International obesity taskforce / Country specific

Global definition



Organisations: World health organisation / International obesity taskforce / Country specific

CKD prevalence

Dataset	Overweight	Obesity
UKRR[832]	Dialysis 20% Transplant 22%	Dialysis: 2.5% Transplant: 18%
CKiDS*	All CKD 10.7-23%	All CKD: 11-25.9%
ESPN/ERA-EDTA n=4474 Bonthuis 2013	Dialysis 20%	Dialysis 12.5%
IPPN n=153 2007 Rees & n=1001 Schaefer 2019	Dialysis 19.7% Up to 40% Transplant: 26%	
USRDS n=13172 Ku 2015		All 15-25%. Average 17%

*CKiDS n=891/411, n=524 Rodig et al 2021 n=1079 Kogon et al 2023, n=737 Patel et al 2017

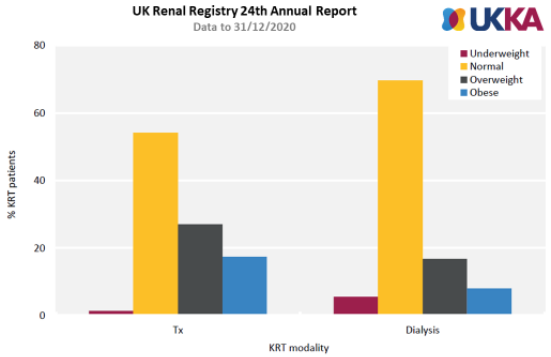


Figure 8.13 Body mass index categorisation of paediatric patients (<16 years old) prevalent to KRT on 31/12/2020 by KRT modality

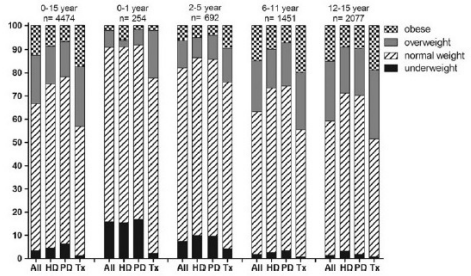


FIGURE 1: Prevalence estimates for underweight, normal weight, overweight and obesity stratified by treatment modality and age category.

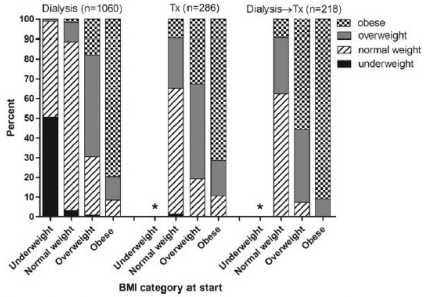


FIGURE 2: Distribution of changes in BMI category between the start of RRT and 6–18 months of follow-up. Patients were grouped by treatment modality: patients who were on dialysis treatment, patients who received a pre-emptive transplant and patients who started on dialysis, but received a transplant during 6–18 months of follow-up. *Very few patients were underweight at the start of RRT in the group of pre-emptive transplantation, as well as in the group who switched from dialysis to transplantation. Tx = Transplantation.

CKD prevalence

Dataset	Overweight	Obesity
	Dialysis 20%	Dialysis: 2.5%
USRDS n=13172 Ku 2015		All 15-25%. Average 17%

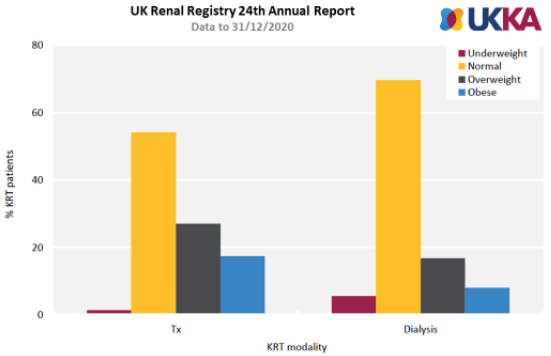


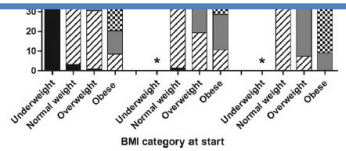
Figure 8.13 Body mass index categorisation of paediatric patients (<16 years old) prevalent to KRT on 31/12/2020 by KRT modality

Obesity (2.5 – 25.9%)

Overweight (10.7 – 40%)

Metabolic syndrome 15-30%

dality and age category.



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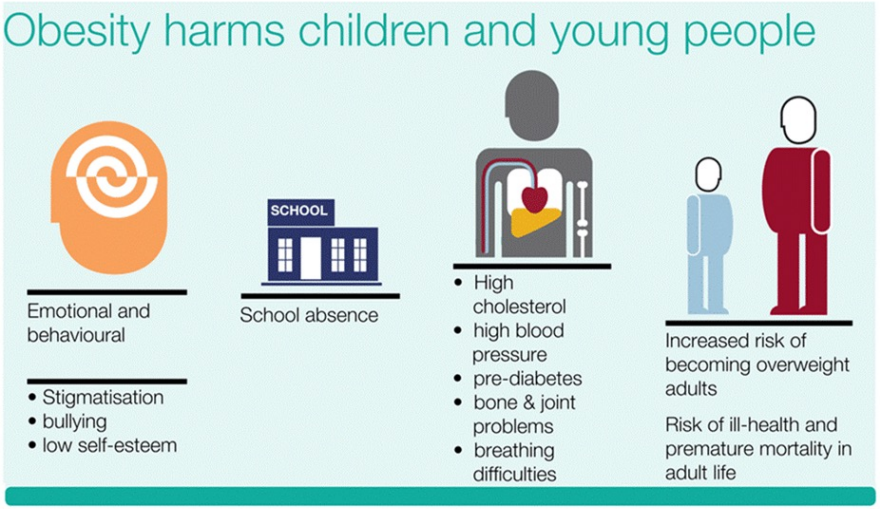
*CKiDS n=891/411, n=524 Rodig et al 2021 n=1079 Kogon et al 2023, n=737 Patel et al 2017

CKD definition

ESPN/ERA-EDTA[2013]: 0-1 year	ESPN/ERA-EDTA[2013]: 2-15 years	IPPN[2007 & 2019]	PRNT[2022]: 2-5 years	PRNT[2022]: > 5 years
Overweight: WFH >+2 sds	**Overweight: BMI** >85th <95th percentile	**Overweight:** WFH/BMI >85th <95th percentile >1.036 to 1.645 sds	**Overweight:** weight-for-height for age >+2SD using WHO child growth charts	**Overweight:** BMI for age > +1SD using WHO growth reference chart / country specific
Obese: WFH >+3sds	**Obese**: BMI >95th percentile	**Obesity:** WFH/BMI >95th percentile / >1.645 sds	**Obesity:** weight-for-height for age >+3SD using WHO child growth charts	**Obesity:** BMI for age > +2SD using WHO growth reference chart / country specific

Why is obesity important: Health

- Public health crisis
- Modifiable factor for adverse health outcomes Rodig 2020
- Health:
  - Hypertension Maggio2008
  - Lipid abnormalities Williams 1992
  - Type 2 diabetes Pinhas-Hamiel 1996
- Adolescence:
  - Increased risk adult-onset CKD Hsu 2006 & Filler 2007



Why is obesity important: CKD

- Public health crisis and modifiable factor for adverse health outcomes Rodig 2020
- CKiD: multiple cardiovascular risk factors
- CKD:
  - CKD progression, mortality, transplantation access, graft function Wong 2000, Ku 2016, Roberts 2019
  - Metabolic syndrome: adverse Cardio-metabolic risk factors + obesity Stabouli 2021
  - CKD: depression and quality of life Kogon 2016 & 2019

What do we need to consider?

- BMI associations
- Body composition
- CKD
- Clinical practice recommendations
- Measurement accuracy

CKD evidence: BMI associations

- **IPPN Rees et al 2007 & Schaefer et al 2019**
  - Initiation PD:
    - eGFR and gastrostomy feeding
    - comorbidities
    - shorter
  - Over time:
    - Increase or decrease
    - Gastrostomy feeding
  - Mortality:
    - Infancy increases mortality (opposite for older children)
  - Younger children highest obesity
  - Overweight: independent of age
- **Wong et al 2000**
  - U shaped association with mortality
- **USRDS Ku et al 2015**
  - 1.17 x greater risk death
  - Less likely to get a transplant overall & from living donors

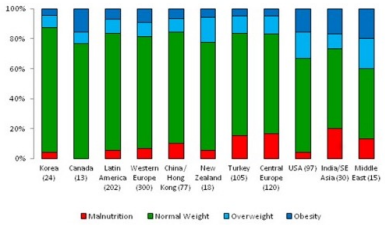


Figure 1. Regional variation of nutritional status at start of CPD, sorted by decreasing fraction of patients with BMI within normal range.

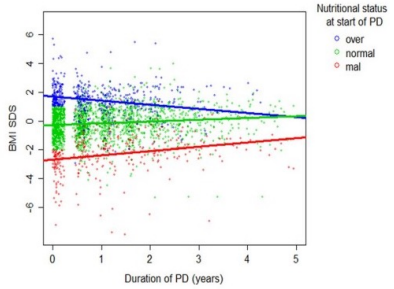


Figure 3. Course of BMI SDS according to nutritional status at start of PD (green: normal BMI, blue: overweight/obese, red: underweight). Regression lines are based on a mixed model predicting BMI SDS from duration of PD, nutritional status at start of PD and their interaction.

Body composition considerations

- **Body composition**
  - BMI: Imperfect measure of body composition
    - Fluid status
    - Abnormal height (BMI height age sds)
    - Inability to discriminate: fat, muscle and ECV
    - Waist circumference (surrogate of visceral fat)*
- **CKiDS*** Patel 2017
  - Good agreement waist circumference and BMI
  - **No** benefit of central obesity measures over BMI
- **IPRN Taskforce Obesity and Metabolic syndrome** Stabouli 2021
  - Waist and PD or with increased abdominal girth limit use

CKD considerations

Dialysis	Other factors	Symptoms	Pathophysiological determinants

• Clinical management
• Nutrient losses
• Dialysate
• Fluid balance
• Growth
• Supplemental feeding
	• Age
	• Disease
	• Comorbidities
	• Healthcare costs
	• Cultural acceptability
	• Food and formula availability
	• Peer
	• School
		• Appetite
		• Activity
		• Taste
		• Gut
		• Nausea/Vomiting
			• Non-modifiable
			• Modifiable
			  • Environmental
			  • CKD specific factors

PRNT: Clinical practice recommendations

Pediatric Nephrology (2022) 37:1–20
https://doi.org/10.1007/s00467-021-05148-y

GUIDELINES

Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Stella Stabouli[1] · Nonnie Polderman[2] · Christina L. Nelms[3] · Fabio Paglialonga[4] · Michiel J. S. Oosterveld[5] · Larry A. Greenbaum[6,7] · Bradley A. Warady[8] · Caroline Anderson[9] · Dieter Haffner[10] · An Desloovere[11] · Leila Qizalbash[12] · José Renken-Terhaerdt[13] · Jetta Tuokkola[14] · Johan Vande Walle[15] · Vanessa Shaw[16] · Mark Mitsnefes[17] · Rukshana Shroff[16]

Define → Assess → Manage → Components → Prevention

PAEDIATRIC RENAL NUTRITION TASKFORCE

*O&MS CPR: Obesity and metabolic syndrome clinical practice recommendation; PRNT: Paediatric Renal Nutrition Taskforce

CKD overweight & obesity definition


Pediatric Nephrology (2022) 37:1–20
https://doi.org/10.1007/s00467-021-05148-y

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Define

PRNT$_{2022}$: 2-5 years

Overweight:

weight-for-height for age >+2SD using WHO child growth charts

Obesity:

weight-for-height for age >+3SD using WHO child growth charts

PRNT$_{2022}$: > 5 years

Overweight:

BMI for age > +1SD using WHO growth reference chart / country specific

Obesity:

BMI for age

> +2SD using WHO growth reference chart / country specific

1.1. BMI-height-age to define overweight or obesity in children who are below the 3rd centile for height and have not reached their final adult.

Assessment


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Assess

Assessment

- Calculate BMI or weight-for-height
- Plot on growth charts
- Calculate z-scores
- Use trends in growth parameters

Measure*

- Blood pressure;
- Fasting triglycerides,
- Fasting high-density lipoprotein,
- Fasting serum glucose

Evaluate

- Lifestyle habits:
- Diet,
- Physical activity,
- Sleep
- Screen time

*Measure if BMI > +1SD and evaluate

Obese sarcopenia


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

- Obesity can mask underlying muscle wasting
- Obese sarcopenia
  - Inadequate protein intake
  - Loss muscle mass and strength
- Risk factors:
    - Disease, Dialysis, Inflammation, Acidosis, Vitamin D deficiency, Catabolism
- Hand grip strength

Risk factors

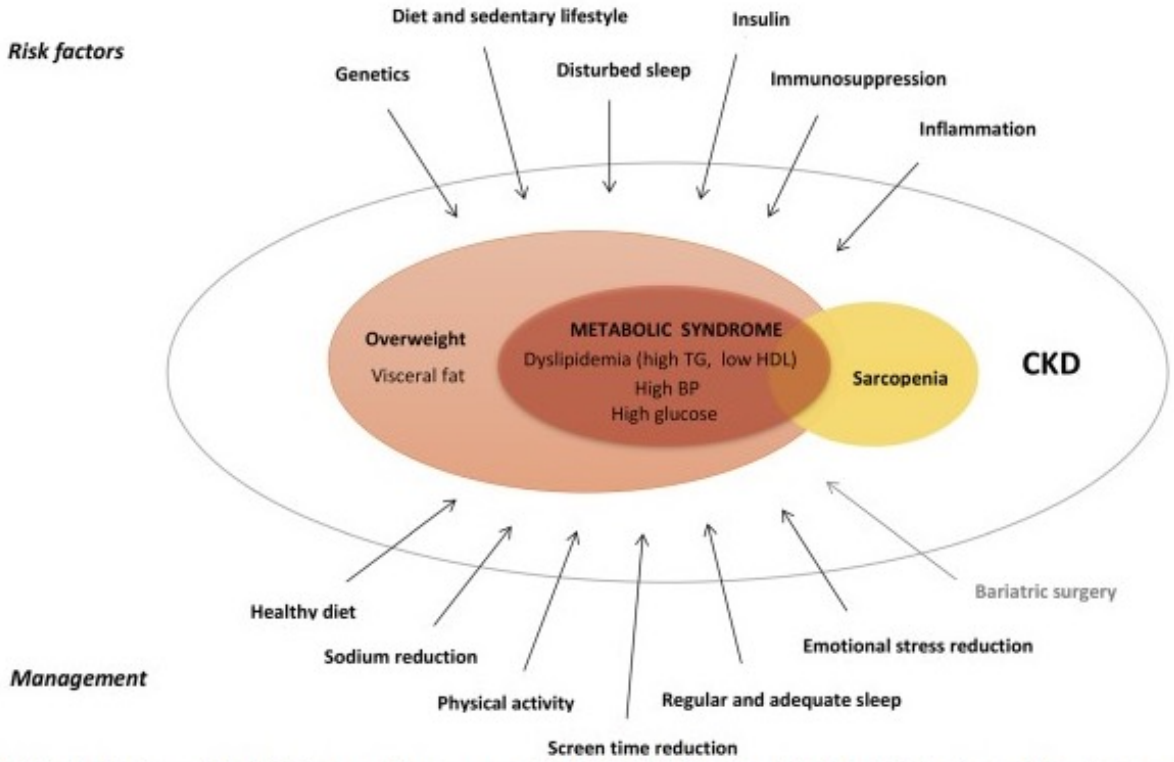

Fig. 1 Traditional and disease-related risk factors and management of O&MS in CKD patients. First line (black) and second line (gray) treatment

Springer

Stabouli et al 2021

Management


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Manage

Assessment and evaluation
- BMI
- Risk factors

Comprehensive multicomponent intervention
- Nutrition care plan
- Physical activity prescription
- Behaviour modification

Diet
- Individualized energy intake
- Diet quality
- Review enteral feeding

Physical activity
- Daily
- Individualise

Behaviour modification
- Sleep
- Screen time
- Psychosocial stressors

Management


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Manage

Diet

Individualized energy intake	Diet quality	Review enteral feeding

Individualise energy intake

- Age, CKD stage, Dialysis, Comorbidities
- PRNT SDI recommendations
- BMI & Weight goals
- Dietary modifications
- Frequency of review especially if enterally fed

Diet quality

- Macro and micronutrients adequacy
- Food group balance
- Empty calories
- Processed foods
- Assess deficiency risk

CKiDS*

- Excess age-appropriate energy, sodium and phosphorous
- Fast foods
- Processed foods high in fat (saturated)
- Excess 'empty calories'
- Nutritional care plan
- Diet quality & frequent review of enteral tube feed energy content

CKiDS cohort dietary risk factors Chen 2017, Hu 2019

Management


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Manage

Physical activity

Daily | Individualise

Physical activity

- 60 minutes
- Mix: Aerobic, stretching, flexibility and balance
- Muscle and bone strengthening
- Understand physical capability
- Intradialytic exercise on maintenance HD
- Ongoing and consistent attention to activity
- *Specify goals: time, duration, intensity*

CKiDS*

- Less physical activity
- 13% met recommendations (60 minutes)
- Less Cardiorespiratory fitness
- Kidney function determinant of exercise capacity
- Poor exercise tolerance and early fatigue

*CKiDS Clark 2016

Management


Assessment and management of obesity and metabolic syndrome in children with CKD stages 2–5 on dialysis and after kidney transplantation—clinical practice recommendations from the Pediatric Renal Nutrition Taskforce

Manage

Behaviour modification

Sleep | Screen time | Psychosocial stressors

Sleep

- *Sleep duration*
- *Lower adiposity and better QoL*
- *Sleep quality*
- *Sleep disturbances in CKD (e.g., Dialysis alarms)*

Screen time

- Poor diet (Increased energy and adiposity)
- Ongoing and consistent attention to activity

Psychosocial stressors

- Emotional or comfort eating
- Lack of sleep
- Impulsive / selective food behaviors

CKiDS*

- Greater screen time
- 98% exceeded recommendations (>2 hours per day)

*CKiDS Clark 2016

Measurement considerations

- Protocols
- Training
- Equipment calibration
- Dry weight

Measurement

- Country specific
- BMI?

Charts

Adapted from work done by Anderson et al for the UK KQuIP and UKRR; KQuIP Kidney Quality Improvement Partnership; UKRR UK Renal Registry

How can we balance nutritional needs?

- Use PRNT* CPR* as guide
- Use dry weights and targets weights if appropriate
- Check nutrient adequacy and quality
- Check for signs and symptoms of clinical deficiency
- Individualize care: energy, activity, behavior
- Practical small achievable steps
- Regular review
- PRNT SDI's* as starting point
  - Adjust for proportionality, direction of change, activity and goals
- Body composition
  - Alternate measures
- Embed behavioral modifications in routine care

Nutritional intervention check list

Define

- Growth, and nutritional status
- Overweight and obesity, proportionality
- Nutrient deficiency and excess
- Healthcare goals and outcome expectations

Assess

- Growth and nutritional status
- Overweight and obesity
- Metabolic risk factors
- CKD stage, care plan, comorbidities, fluid status
- Type of dialysis, dietary modification, , family support, individual needs
- Patient goals

Manage

- Comprehensive intervention
- Nutrition care plan:
  - Energy intake
  - Diet quality
  - Dietary adequacy
- Physical activity prescription
- Behaviour modifications:
  - Sleep,
  - Screen time,
  - Psychosocial support

Anderson et al for the Paediatric Renal Nutrition Taskforce

Practical application

- 16-year-old boy new diagnosis
- AKI on CKD
- Peritoneal to hemodialysis to home HD
- Lives with mother
- Fluid overload requiring hospital admissions
- Dry weight estimations
- Hypertension
- 13 medications (including steroids)
- In transition to adults
- Anxiety
- Low energy levels, poor appetite
- Hobbies: TV, gaming and friends
- Activity: dog walking and stairs

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- Hobbies: TV, gaming and friends
- Activity: dog walking and stairs

- Weight: +2.37 SD
- Height: +0.82 SD
- BMI: +2.35SD

- Bloods: High Urea and phosphate
- Diet quality.
  - Multiple dietary modifications
  - Mix home cooked and convenience foods
- Personal target weight loss to 82.0kg (current 91.6kg)
- Milk substitutes
- Youth worker and family therapist (low mood and motivation).
- Support activities: food, activity and wellbeing related

Practical application

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difications

nd convivence

ss to 82kg

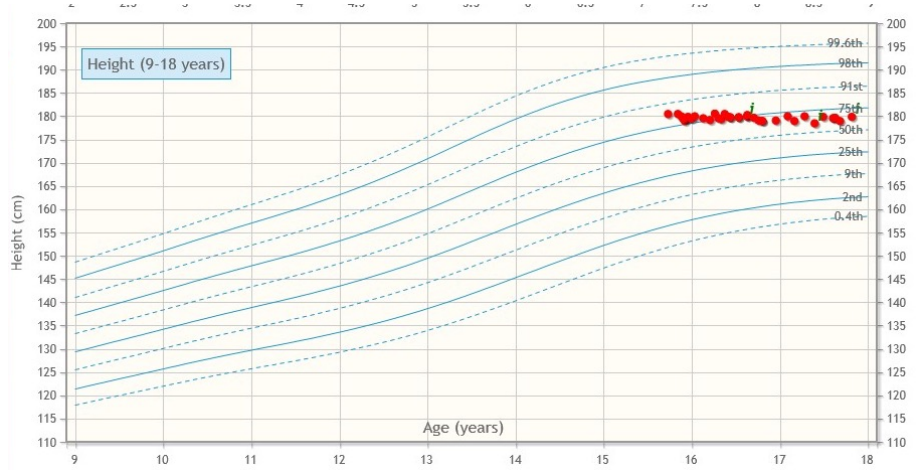
therapist (low

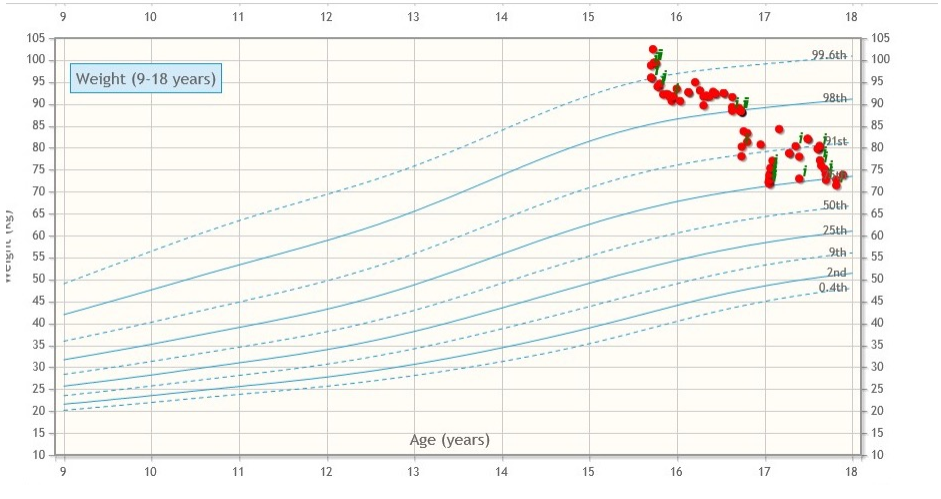
- Support activities: food, activity and wellbeing related

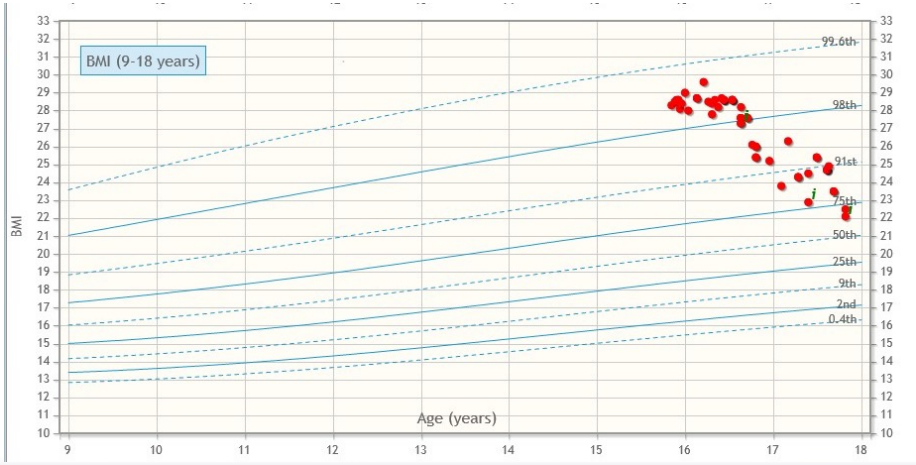
Considerations and advice:

Family dynamics and support network
Physical activity ability and achievable targets
Portion size control
Rationalize dietary modifications
Check nutrient adequacy
Patient preferences and choices
Support: Youth workers and family therapy

Growth outcomes over the last 2 years







Adult Brain VS Teenage Brain

Our Frontal Lobe

- Judgement
- Decision making
- Reasoning
- Problem solving
- Impulse control
- Emotions and emotion control

Teenage Frontal Lobe

- Underdeveloped as the brain matures back to front
- Last the part of the brain to mature (at about 24 years of age; males and females differ)
- This occurs during a time they are trying to form their own identity

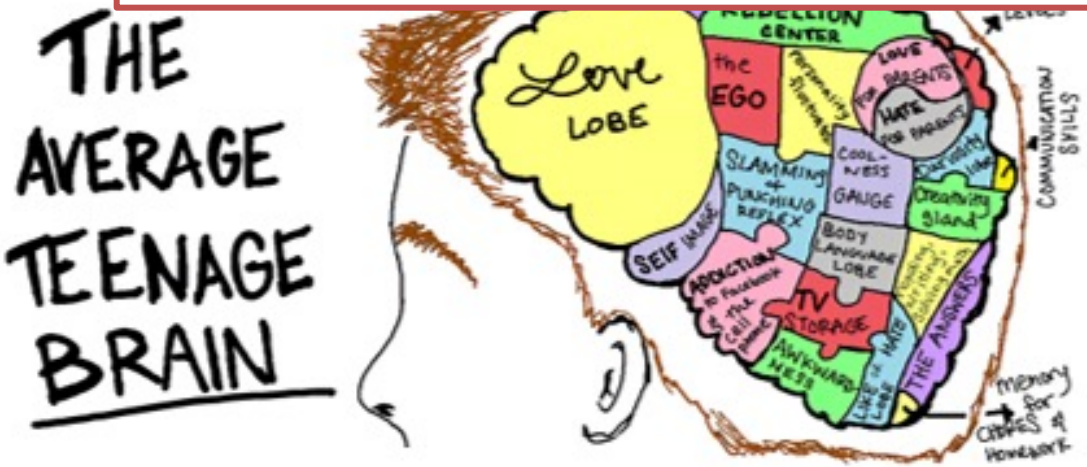
Adult Brain VS Teenage Brain

Our Frontal Lobe

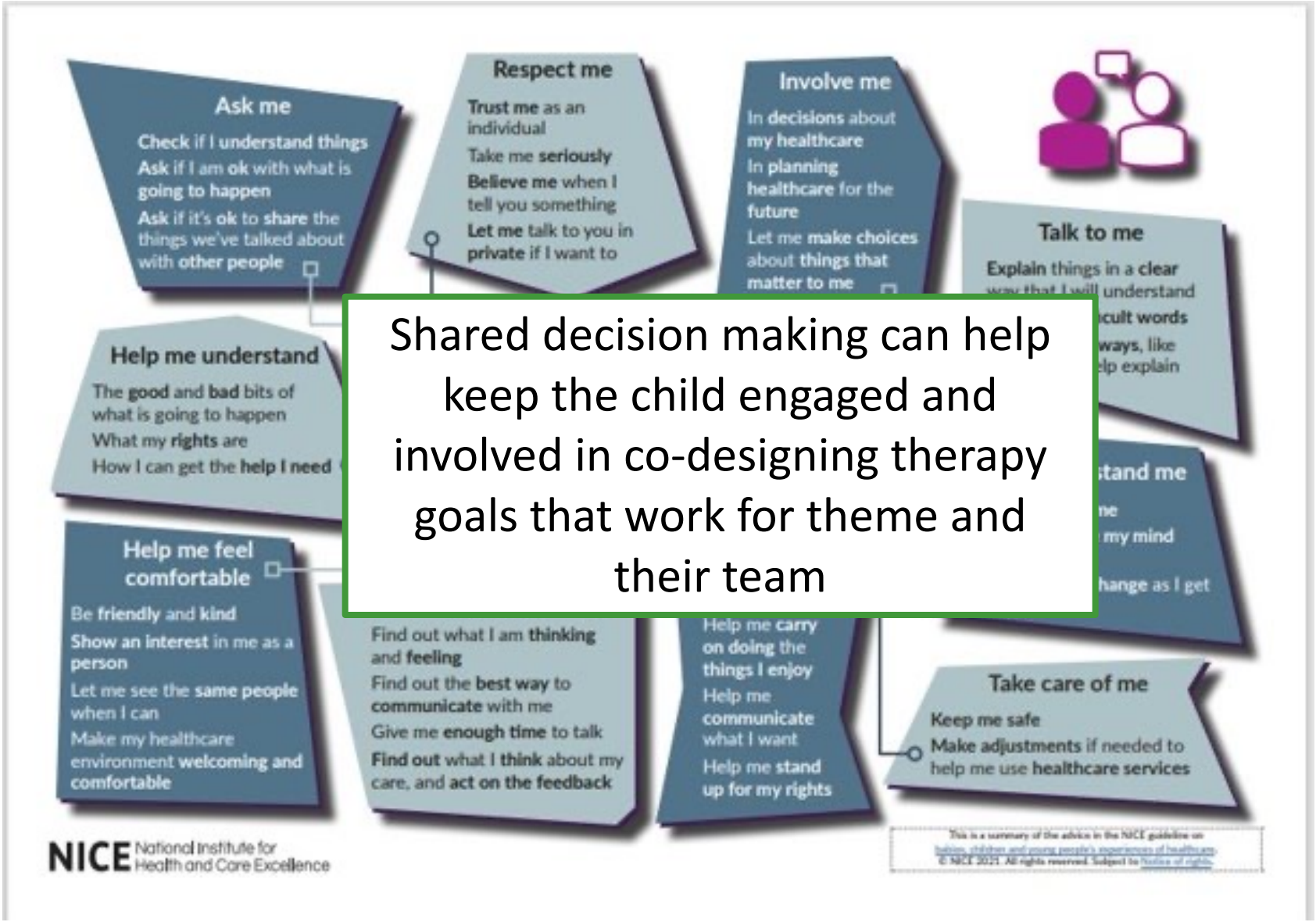
- Judgement
- Decision making
- Reasoning
- Problem solving
- Impulse control
- Emotions and emotion control

Teenage Fro
- Underde
back to f
- Last the
(at about
females
- This occu
trying to

We ask children and young people to make decisions when their brains are still developing these skills



https://www.nice.org.uk/guidance/ng204/resources/visual-summary-pdf-9204587245



https://www.nice.org.uk/guidance/ng204/resources/visual-summary-pdf-9204587245

Take home messages

- Not all weight / BMI measurements are equal
- Dietary quality is important
- Dietary deficiencies exist in obesity and overweight CKD
- Lifestyle needs consideration and review
- CPRs* can help guide clinical decision making
- Dialysis poses extra challenges
- Tailored practical advice, small steps, good support, patient centered goals and shared decision making are key

Thank you

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