



Addressing Cardiometabolic Risk in Children and Adolescents: CHALLENGES AND SOLUTIONS

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Prevention of Pediatric Obesity

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Objectives:

Review factors contributing to the relatively high prevalence of childhood obesity.

Review guideline-based dietary recommendations for achieving and maintaining ideal cardiometabolic health.

Provide guidance on initiating comprehensive and individualized treatment plans for pediatric patients with cardiometabolic disease risk factors.

Background, Obesity During Childhood and Adolescence:

Estimated prevalence in the United States between 12 and 19 years of age (National Health and Nutrition Examination Survey (NHANES) data) is 21% .

Globally, 124 million school-aged children and adolescents have obesity (>10-fold higher compared to the 1970s).

Predictor of premature cardiovascular events, independent of later adult body mass index (BMI).

Estimated cost to society (all obesity), \$140 billion per year.

Background, Severe Obesity During Childhood and Adolescence:

Severe obesity: BMI \geq 120th percentile of the 95th percentile (4.5million children)

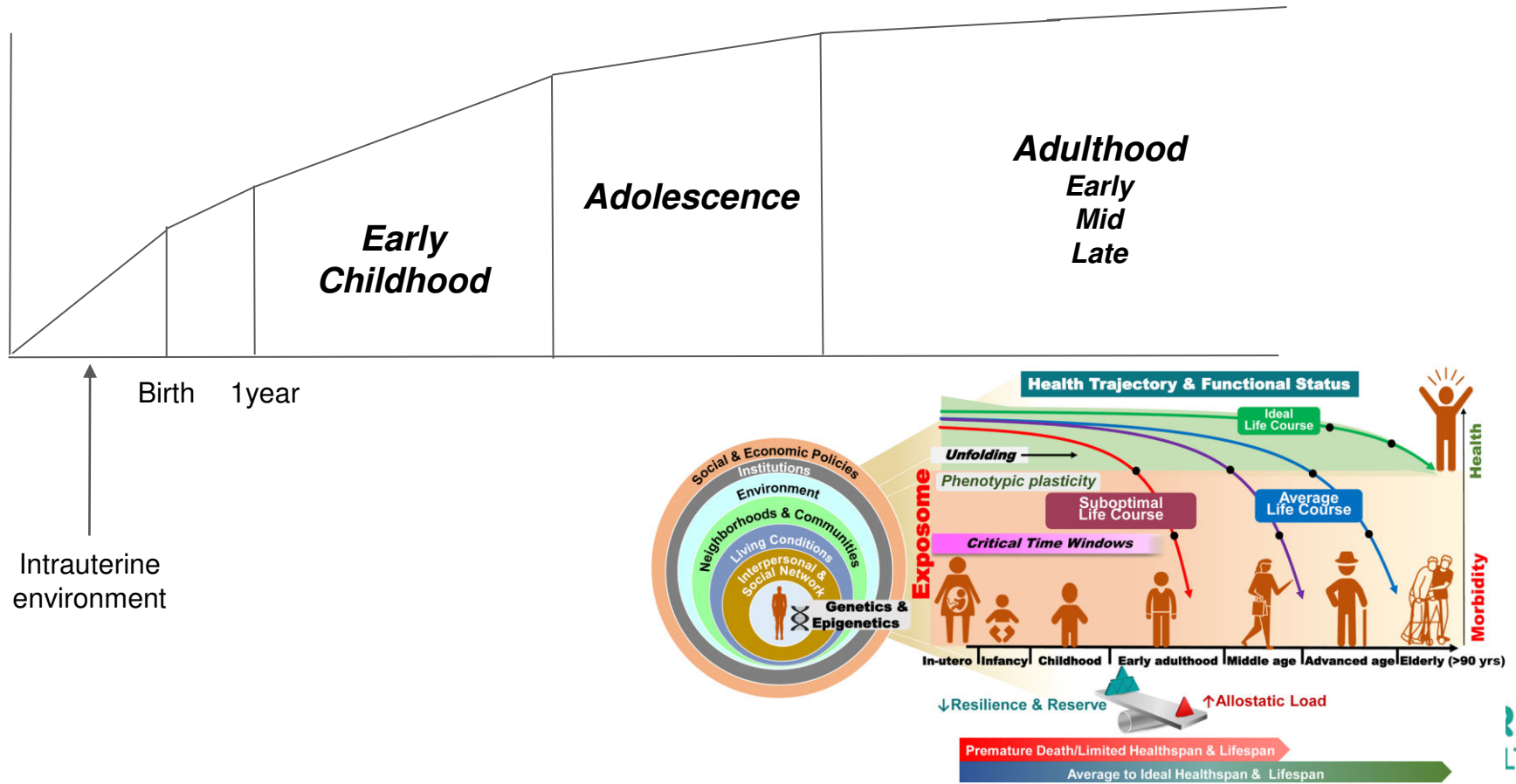
- Fastest growing subcategory of obesity in children and adolescents

Complications of Pediatric Obesity

Sleep apnea, bone and joint problems, type 2 diabetes, non-alcoholic fatty liver disease, elevated blood pressure/systemic hypertension, elevated serum TG and low HDL-c (i.e., dyslipidemia of obesity), social and psychological problems, etc.

17 times more likely to have obesity during adulthood (along with associated risk for systemic hypertension, diabetes, high cholesterol, atherosclerosis, heart failure, and cancer).

Obesity Tracks from Childhood Into Adulthood



Risk Factors: Across the Lifespan

Prenatal	Birth	Infancy	Early Childhood	Later Childhood/ Adolescence
Maternal Health: Obesity (pre-pregnancy BMI; gestational weight gain) Mental Health (depression) Smoking (?stress) Gestational diabetes	Maternal BMI Maternal (antenatal) depression	No or <6 months breastfeeding Maternal BMI Early introduction of solids	Diet quality Diet pattern Maternal factors	Diet quality Dietary pattern Socioeconomic status Mental Health Maternal obesity status Area deprivation/ Neighborhood deprivation

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Antenatal depression associated with 2-3X increased risk of childhood overweight/obesity at 7 years of age.

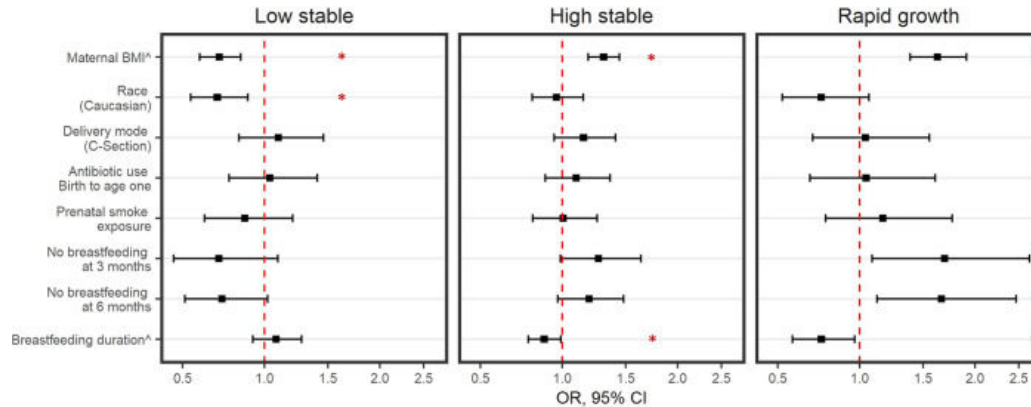
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Risk Factors: Across the Lifespan

Infancy:

- Parental physical activity (beneficial), sedentary lifestyle (not-beneficial) and higher parental BMI (not-beneficial), associated with higher BMI in the child within the first 1 year of life (Versele)
- Higher maternal BMI (not beneficial)
- Breastfeeding at least for the first 6 months of age (beneficial) (Reyna)



Risk Factors for Pediatric Obesity: Across the Lifespan (cont'd)

Infancy:

- **Rapid weight gain (RWG) during the first 3 ½ years** associated with increased odds of **obesity at 9 years of age** (Giles)
- Low, intermediate, high and accelerating growth trajectory groups (Giles)
 - Low trajectory: 2.4% with overweight; 1.2% with obesity
 - Intermediate trajectory: 9% w/ overweight; 1.2% with obesity
 - High trajectory: 23.2% w/ overweight; 8.2% with obesity
 - Accelerating trajectory: 31.8% w/ overweight; 27.3% with obesity
- By **multivariate analysis**, lower rates of RWG during the first year of life were associated with breastfeeding ≥ 6 months (0.45, 95% CI: 0.38, 0.53) (beneficial), introduction of solids ≥ 6 months (OR 0.77 95% CI: 0.63, 0.93) (beneficial), while maternal smoking during pregnancy was associated with increased rate of RWG (OR 1.6, 95% CI: 1.28, 2.01) (beneficial). (Zheng)

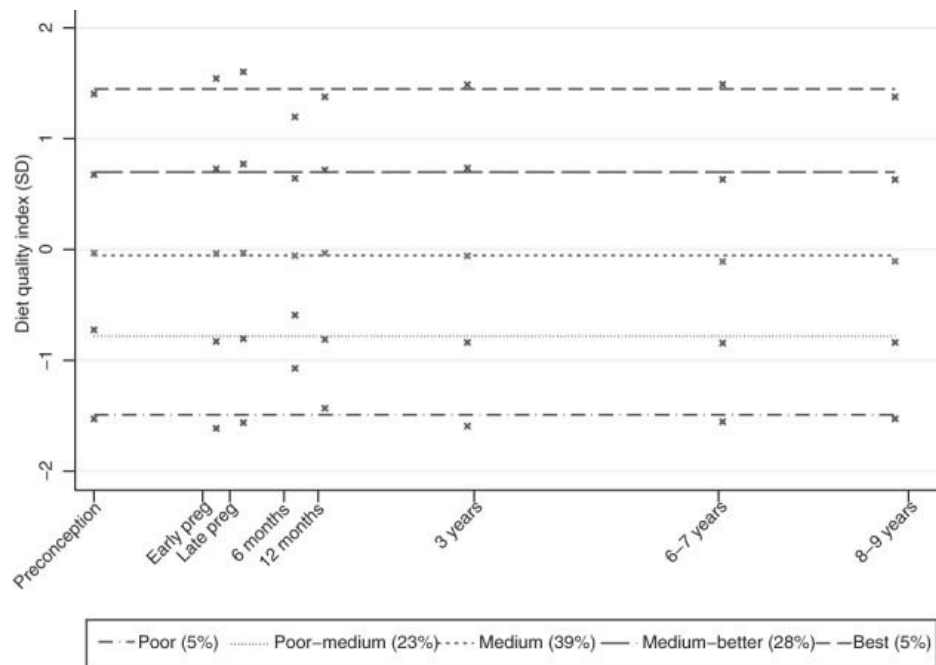
Definitive Strategies: Across the Lifespan

Prenatal	Birth	Infancy	Early Childhood	Later Childhood/ Adolescence
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Early childhood diets high in energy-dense, high-fat and low-fiber foods have been consistently associated with overweight and obesity in later childhood, adolescence and adulthood.

Intersection between social determinants and early childhood obesity

Maternal-child dyads



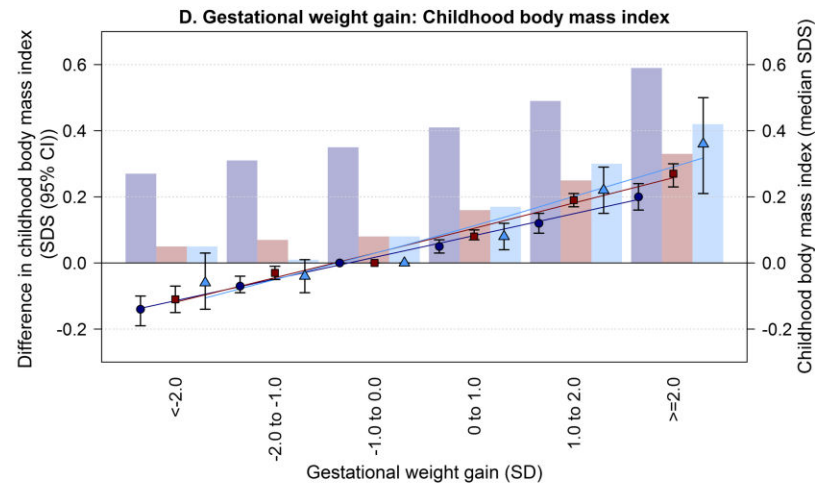
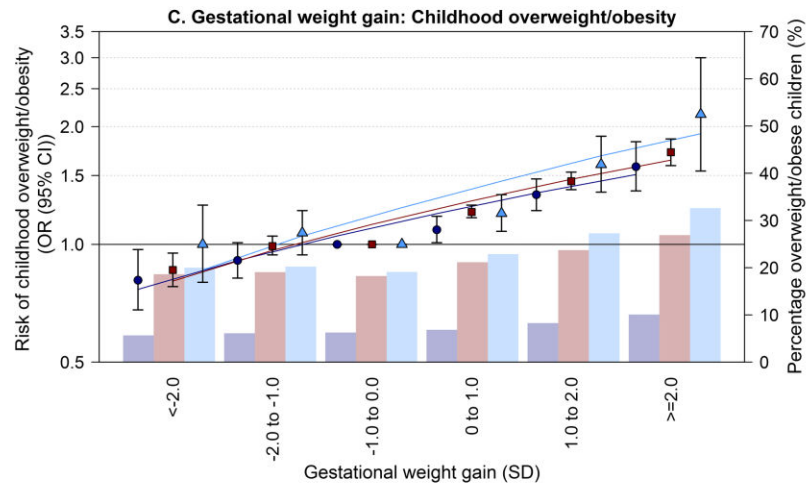
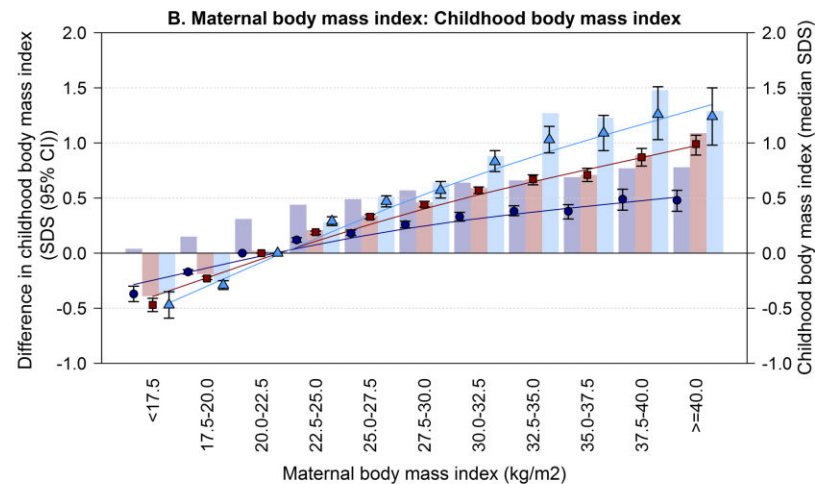
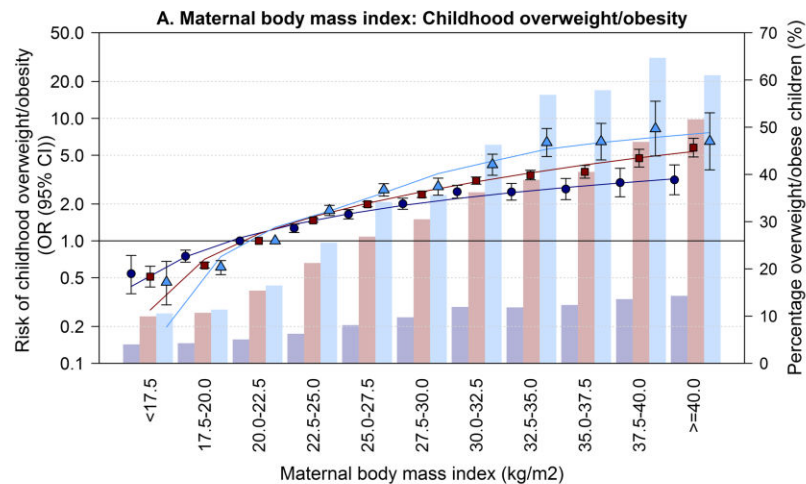
Dalrymple KV *et al.* Int J Obes 2022.

Maternal Factors: Higher maternal pre-pregnancy BMI [OR 1.05 (95% confidence interval (CI) 1.03, 1.06)], smoking in pregnancy [6.68 (5.45, 8.19)] and multiparity [2.63 (2.29, 3.01)], lower maternal age at birth [0.89 (0.87, 0.90)], lower educational attainment (all $p < 0.001$) and lower dominant social class (all $p < 0.001$) all associated with poorer diet quality in the offspring.

Offspring Factors: Breastfeeding >1 month [OR 0.24 (95% CI: 0.21, 0.28)], gestational age (weeks) [OR 0.96 (95% CI: 0.92, 0.99)].

Definitive Strategies: Across the Lifespan

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● Early childhood ■ Mid childhood ▲ Late childhood

Psychosocial Factors and Childhood Obesity



Food Insecurity and Pediatric Obesity

Systematic Review: Longitudinal association between food insecurity and childhood obesity

- Food insecurity during preschool age associated with obesity
- Food insecurity at multiple time points during childhood associated with obesity

(None addressed food insecurity during adolescence; health disparities)

Prevention Strategies

As classified by the World Health Organization:

General prevention

Selective prevention

Targeted prevention

Behavior-oriented prevention

Community/environment-based prevention

Types of prevention	Target	Measures
General prevention (primary prevention)	Target group: General public Target: Counteracting the development of obesity	Creating awareness of obesity as an illness Establishing healthy surroundings (e.g. health-promoting school environments) Education and behavioral training in day care centers, schools and through mass media Improving physical activity opportunities in schools and communities Health orientation in politics (e.g. economic and agriculture policies) Removal of advertising in children's TV programming Cooperation of interest groups (e.g. food industries, health insurances, media and sport clubs)
Selective prevention (secondary prevention)	Target group: Potentially at-risk group of general public Target: Obesity prevention along with the prevention of associated comorbidities	Early identification of and discussion with at-risk individuals through pediatricians and family doctors or physicians at public health offices Routine checkups for the purpose of offering and including in family-oriented training programs
Targeted prevention (tertiary prevention)	Target group: Overweight children and adolescents with high health risks or already obese Target: Weight stabilization and improvement of comorbidities	Interdisciplinary programs and measures (see recommendations under primary and secondary prevention) Support through the above-mentioned measures for general obesity prevention as well as measures of general health promotion
<i>Within the scope of the prevention offerings will be differentiated between:</i>		
Behavior-oriented prevention	<i>Personalized measures:</i> Addressing individual behavior and habits	<i>Education in nutrition</i> Promotion of movement during school lessons as well as educational programs for enhancing physical activities
Community-/environment-based prevention	<i>Context related measures:</i> Facilitating health-related decision making	Provision of facilities and equipment in the school environment (e.g. playgrounds, healthy school meals and snacks)

Strategies for Prevention and Intervention:

Lifelong treatment and prevention efforts are needed.

Most effective intervention strategies are **parental/family-based interventions** in conjunction with **modification of child's diet and physical activity** and **home-based** (vs childcare/school, community, E-health, and mixed).

During adolescence, interventions are more effective when **adolescents** are **addressed directly**.

Summary of Pediatric Obesity Practice Guidelines:

Use **body mass index (BMI)** and Centers for Disease Control (CDC) normative BMI percentiles to assess and **diagnose** children (<2 years of age) or adolescents with obesity.

Overweight if the BMI \geq 85th %ile but < 95th%ile for age and sex

Obese if the BMI is \geq 95th %ile

Extremely obese if BMI \geq 120% of the 95th %ile or \geq 35kg/m².

Evaluate children or adolescents with a BMI \geq 85th %ile for obesity related comorbidities.

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Nutrition:

Breastfeeding for infants

Avoid energy-dense- nutrient poor foods

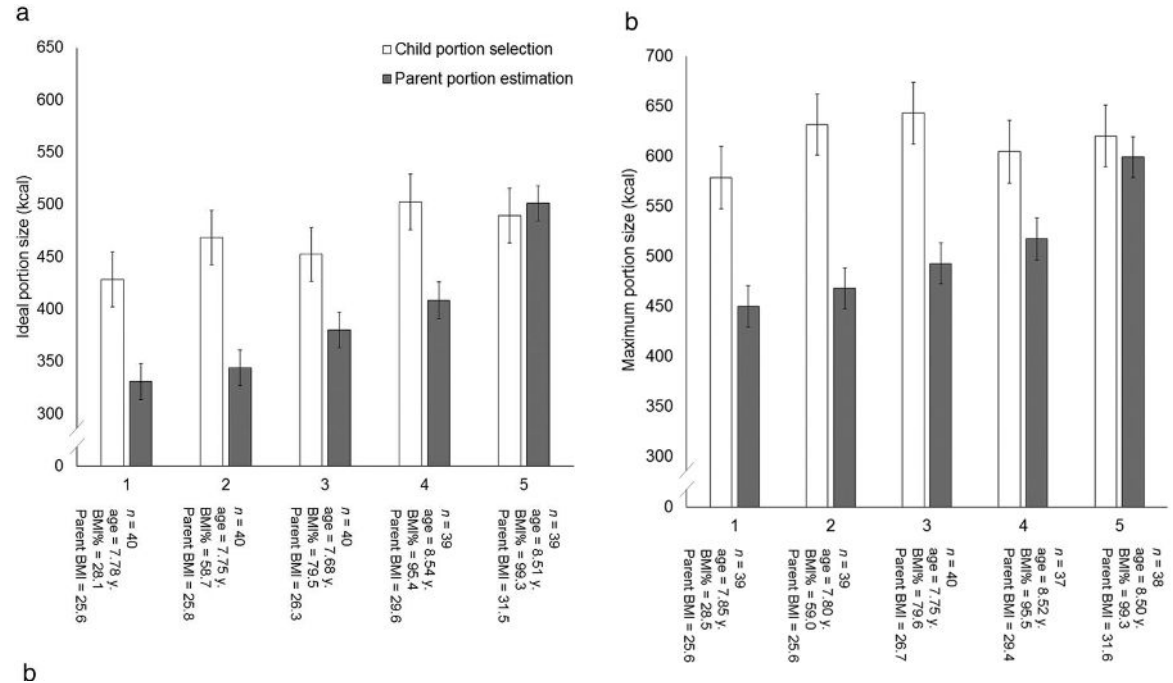
Encourage consumption of **whole fruits rather than fruit juices**

Increase intake of **dairy products** and **saturated fats** (avocado, olive oil, salmon, walnuts, almonds)

Emphasize appropriate portion size, address frequency of eating, repeated exposure to food, the role of marketing on food choices

Early Childhood: Importance of Portion Size

Parents who believed that their child had larger ideal portions were more likely to have a child with overweight or obesity status.



Summary of Pediatric Obesity Practice Guidelines (cont'd):

Physical Activity:

Optimal physical activity is **60 minutes of vigorous activity** at least **5 days per week**

Limit technology related screen time; Balance unavoidable technology-related screen time in children and adolescents with **increased opportunities for physical activity**

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Sleep:

- Healthy sleep pattern

- Screen for sleep disordered breathing

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Behavior Modification:

Staff and clinicians to use **motivational interviewing** techniques as a tool for encouraging behavior change

Highlight role of parental and family modeling in food intake, availability of foods within the home, social contexts for eating, and family rules.

The “OARS” acronym highlights four essential aspects of motivational interviewing.

1. Ask open-ended questions instead of “yes” or “no” questions. ...
2. Offer affirmations. ...
3. Practice reflective listening. ...
4. Summarize the visit.

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Multi-disciplinary team model *focusing on behavioral interventions, self-regulation, stimulus control, problem solving*

PCP, registered dietitian, psychologist/mental health provider, exercise physiologist(s), physical therapist(s), social worker(s)

Child and family participation

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Increased contact (\geq **26 hours**) between family and program

Longer duration of **treatment program** (minimum of **6 months to 1 year**)

Programs to include diet/nutrition, physical activity and behavioral components

To consider programs within the clinical setting as well as outside of the clinical setting

Adolescents with severe obesity may require tertiary care and refer early to Metabolic and Bariatric Surgery (MBS) Center

Polfuss ML, et al J Pediatr Health Care 2020

Henry BW, et al J Acad Nutr Diet 2018

US Preventive Services Task Force 2017

Styne DM et al J Clin Endocrinol 2017

Pratt JSA et al Surg Obes Relat Dis 2018

Summary of Pediatric Obesity Practice Guidelines (cont'd):

Treatment

Bariatric Surgery:

To consider bariatric surgery if between 10 and 19 years of age:

- a. BMI ≥ 40 kg/m² (class III obesity; $\geq 140\%$ of 95th percentile) or BMI ≥ 35 kg/m² (class II obesity; $\geq 120\%$ of 95th percentile) with significant extreme comorbidities (e.g., CV disease, OSA, T2 diabetes, NAFLD, GERD, impaired quality of life)
- b. Extreme obesity and comorbidities despite compliance with a formal program of lifestyle modification with or without pharmacotherapy

Pre-surgical psychological evaluation to confirm the stability and competence of the family unit; ensure patient does not have underlying psychiatric illness and patient can adhere to principles of healthy dietary and activity habits.

Facts Regarding Nonnutritive Sweeteners

Nonnutritive sweeteners (NNSs) are ubiquitous

> 15% of the population beginning at age 2 yrs
consumes a form of NNS

Up to 95% of persons with diabetes consume NNS

Majority of intake is in the form of diet beverage

NNSs provide sweet taste but little to no added ca
and low cost

Limit intake



POLICY STATEMENT Organizational Principles to Guide and Define the Child Health
Care System and/or Improve the Health of all Children

American Academy
of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The Use of Nonnutritive Sweeteners in Children

Carissa M. Baker-Smith, MD, MPH, FAAP,* Sarah D. de Ferranti, MD, MPH, FAAP,* William J. Cochran, MD, FAAP*

Non-nutritive sweeteners (cont'd)

NNSs are ubiquitous (and use is growing)

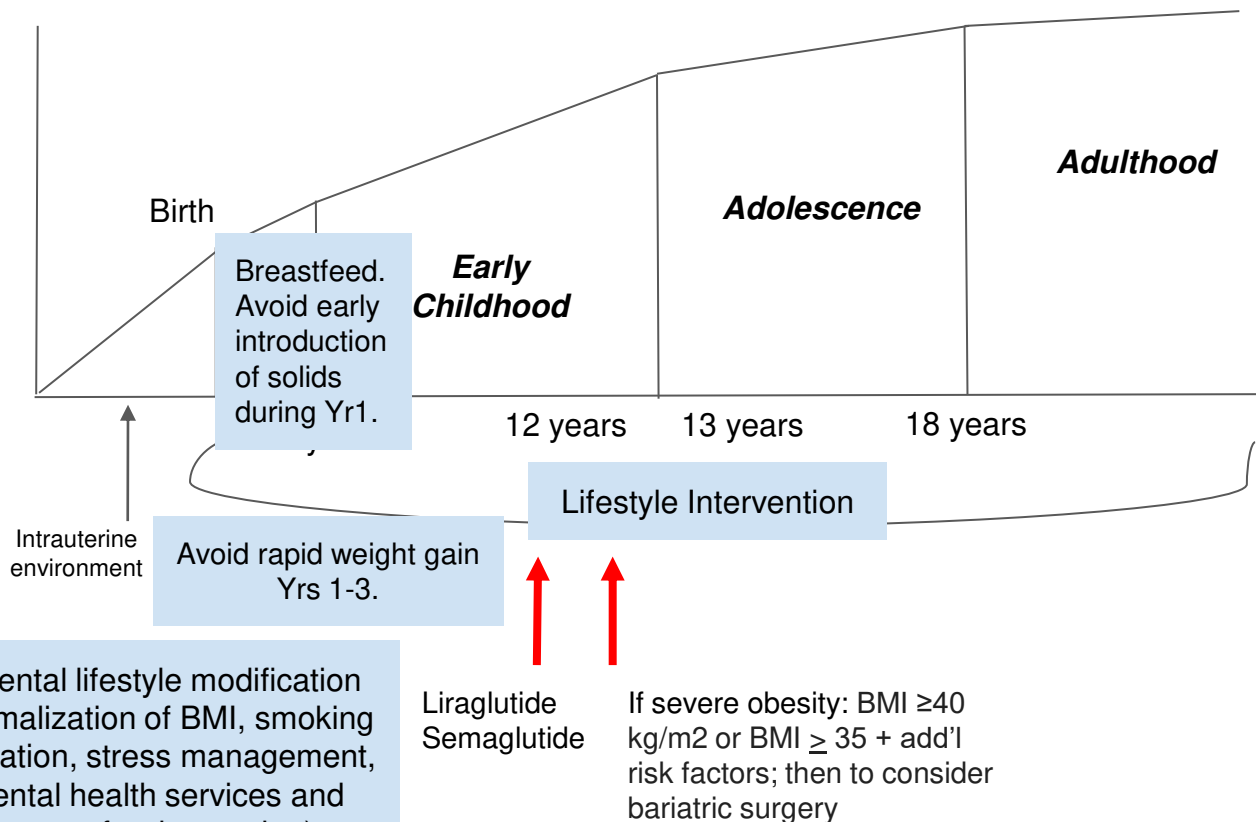
There are acceptable dietary intake levels but there is no mechanism for clearly

“There is no clearly established benefit regarding NNS use and metabolic syndrome or dyslipidemia.”

Baker-Smith, *et al* 2020

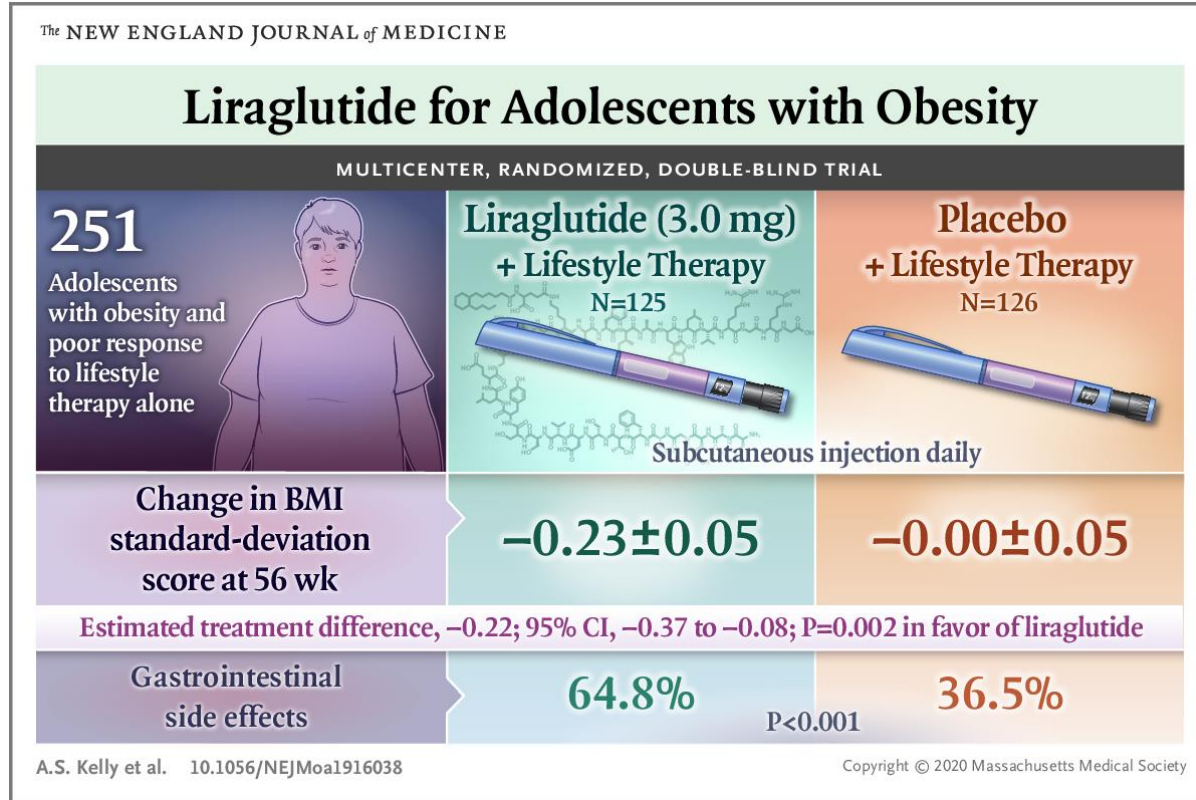
There is no clearly established benefit regarding NNS use and metabolic syndrome or dyslipidemia.

Strategies for Prevention and Intervention: Non-pharmacologic and pharmacologic



Long term follow-up to prevent recurrence.

Medical Management of Obesity (cont'd):



Medical Management of Obesity

Liraglutide:

Population: 12 to <18 years of age with obesity and a poor response to lifestyle therapy alone.

Intervention: Randomized controlled trial (RCT), liraglutide (3.0 mg) or placebo subcutaneously once daily, in addition to lifestyle therapy.

Mechanism of Action: Glucagon-like peptide 1 (GLP-1) analogue, increases the postprandial insulin level in a glucose-dependent manner, reduces glucagon secretion, delays gastric emptying, and induces weight loss through reductions in appetite and energy intake

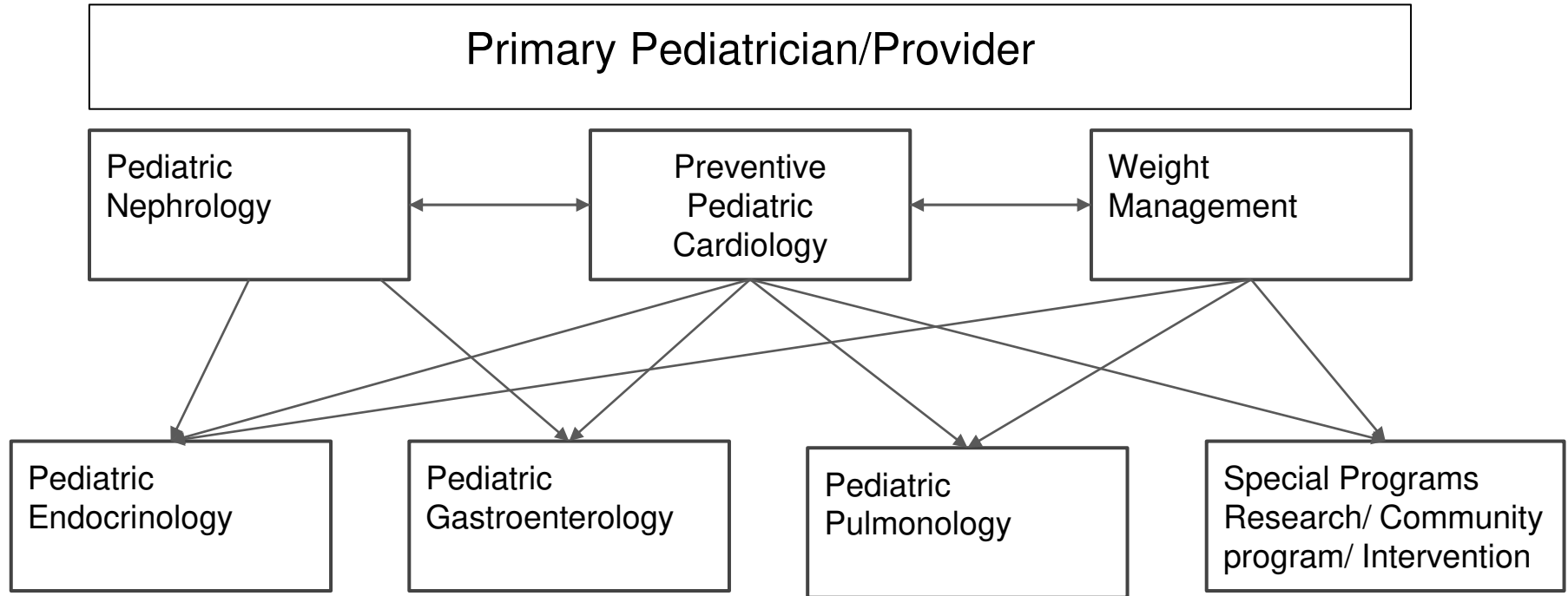
Endpoint: Change from baseline in the body-mass index (BMI); standard-deviation score at week 56.

Recommendation(s):

Individualized Plan	Breakfast	Lunch	Dinner
__Breakfast	1 serving fruit	1 serving vegetable	2 servings vegetable
__Lunch	Yogurt w/ walnuts	1 serving fruit	Whole grains, protein
__Dinner	(or) oatmeal	Whole grains, Protein	Side salad, broccoli,
	(or) smoothie with Chia	Salad w/ tuna or salmon	grilled protein, whole
	seeds	(or) Sandwich on whole	wheat pasta
		wheat wrap; Water	
4-5 servings of vegetables/fruits (fresh or frozen)			
Whole Grains: whole wheat, oats/oatmeal, rye, barley, corn, popcorn, brown rice, buckwheat, quinoa			
Protein Source: nuts, legumes, fish vs red meat, chicken, processed or unprocessed meats			
Oils: canola, olive			

Exercise 1 hour per day + muscle and core body strengthening;
Avoid vaping/smoking

Flow Diagram: Nemours' Model



Family physicians, Gynecologists??? Community engagement; Evidence based intervention programs

Preventing Obesity in the Child....Take Home Points

1. First address the obesity in the parent at an early stage; best to address during adolescence (breaking the cycle may be tough)
2. Educate and advocate for the importance of breastfeeding
3. Assess for rapid weight during first 1-3 years of age and educate parents regarding importance of avoiding and addressing rapid weight gain.
4. Team based model for intervention (e.g., dietician, referral to subspecialty care when needed)
5. Advocate for safer places to exercise, healthier sources of food particularly within underserved communities.
6. Seek intervention approaches that include the entire family.
7. Consider pharmacologic therapy and surgical referral for refractory cases and for higher risk patients, respectively.

Final Take Home Message

Pediatric obesity is not result of a single etiology.

