



NCCOR WORKSHOP

Revisiting Rapid Infant Growth: Assessing Growth in Children Under Age 2

**Panel: Clinicians & Applied Researchers:
Use of Rapid Infant Growth Measures in Practice**



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Ian Paul, MD, MSc
Penn State College of Medicine



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Pediatrics*



Moderator
Kirsten Herrick, PhD, MSc
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Revisiting Rapid Infant Growth: Assessing Growth in Children Under Age 2

Clinical Considerations for Rapid Infant Growth Assessment

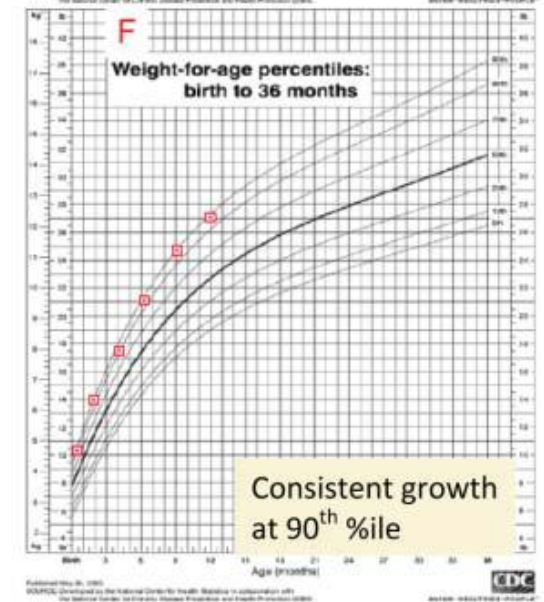
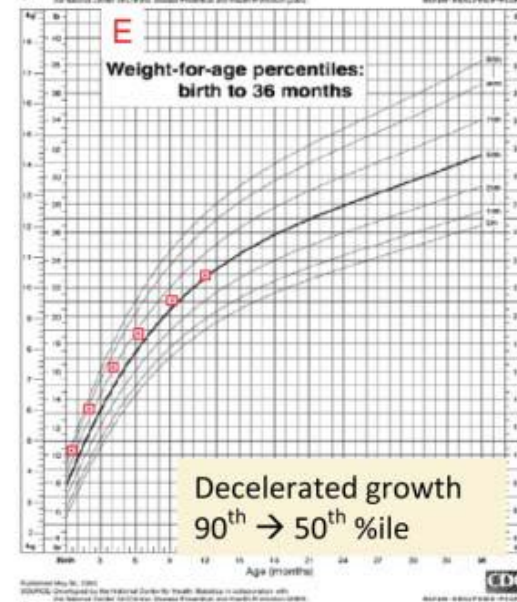
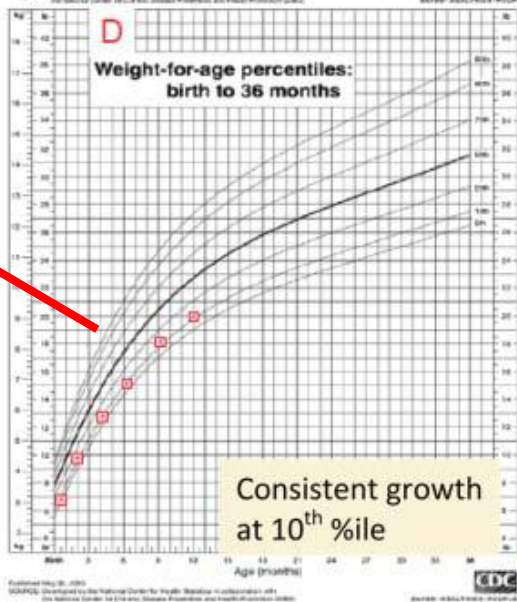
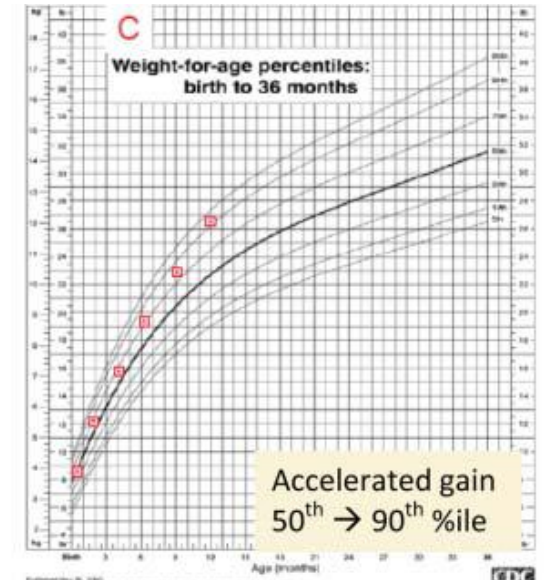
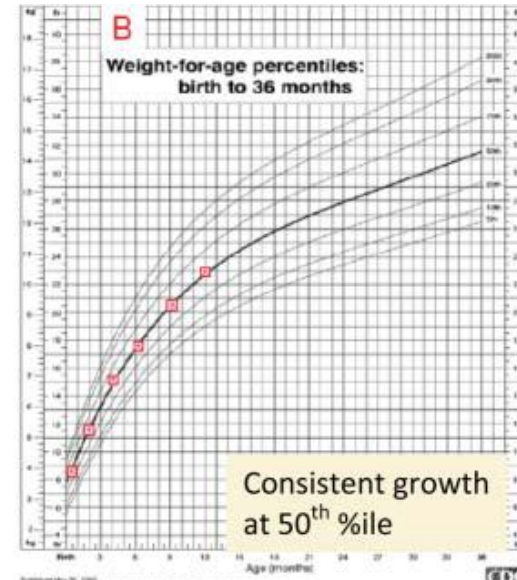
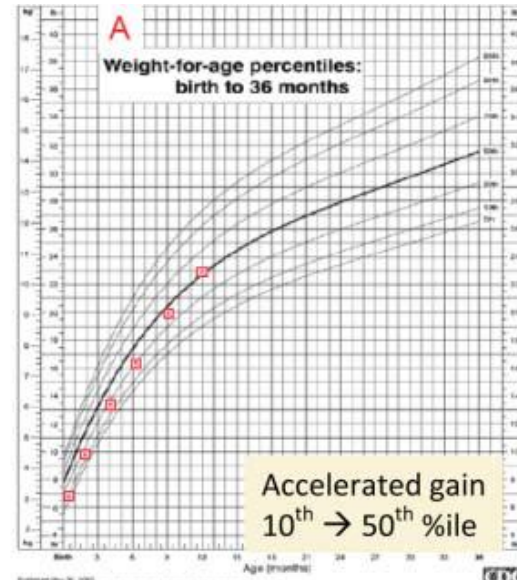
Ian M. Paul, MD, MSc

Penn State College of Medicine, Hershey, PA, USA

Real-World Scenarios: 1 year well-child visits

- Healthy 1-year-old female, born at 41 weeks gestational age, birthweight 2,750 g (~12th percentile)
 - Exclusively breastfed for first 6 months
 - Mother (PhD) – 5’1”, father (MD surgeon) – 5’6”
 - Baby consistently between 10th–15th percentile for weight and length
 - Parents concerned about poor growth ...
- Healthy 1-year-old male, born at 38 weeks gestational age, possible placental insufficiency, birthweight 2,800 g (~12th percentile)
 - Some breastfeeding for a few months
 - Mother (former college athlete) – 5’8”, father (former college athlete) – 6’5”
 - Baby shows consistent upward trending of weight and length; at 1 year weight-for-age at 55th percentile
 - Parents concerned about poor growth ...

What do parents (N=279) of infants and toddlers think healthy growth looks like?



47% say chart D “least healthy”
vs. 5% for chart A
and 16% for chart C
(10% say chart E)

Majority (58%) say chart B
“healthiest”; 19% say chart F

Parent Preferences

Table 2. Parent Impression of Their Own Child's Weight and Desired Weight Percentile Range

	Entire Cohort, N = 279	Children <25th Percentile, n = 83	Children 25th to 75th Percentile, n = 144	Children >75th Percentile, n = 52	P
Parent's feeling about child's weight, n (%)					<.0001
Much too low	6 (2.2)	5 (6.0)	1 (0.7)	0 (0)	
Low	60 (21.5)	42 (50.6)	17 (11.8)	1 (1.9)	
Just right	200 (71.7)	36 (43.4)	124 (86.1)	40 (76.9)	
High	13 (4.7)	0 (0)	2 (1.4)	11 (21.2)	
Much too high	0 (0)	0 (0)	0 (0)	0 (0)	

- Infants with weights in top quartile – 79% believe child's weight is “just right” or “low”

Parent Preferences

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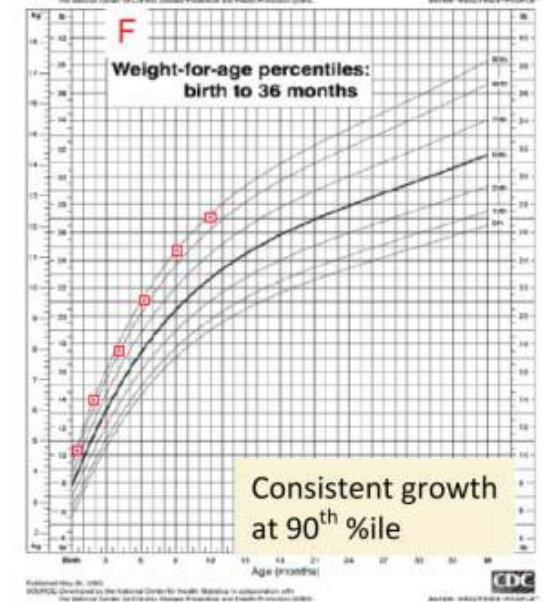
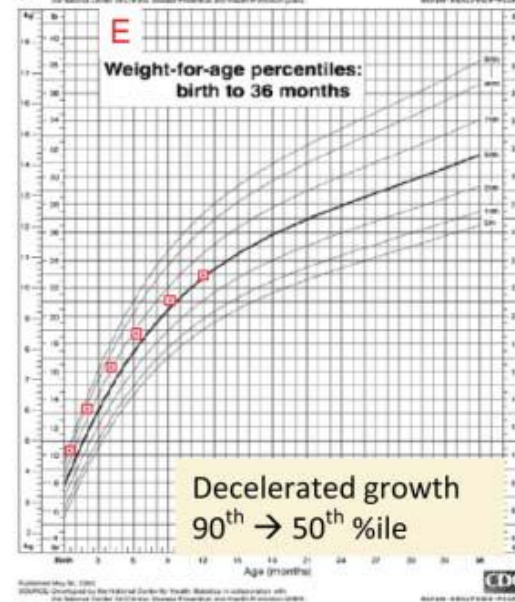
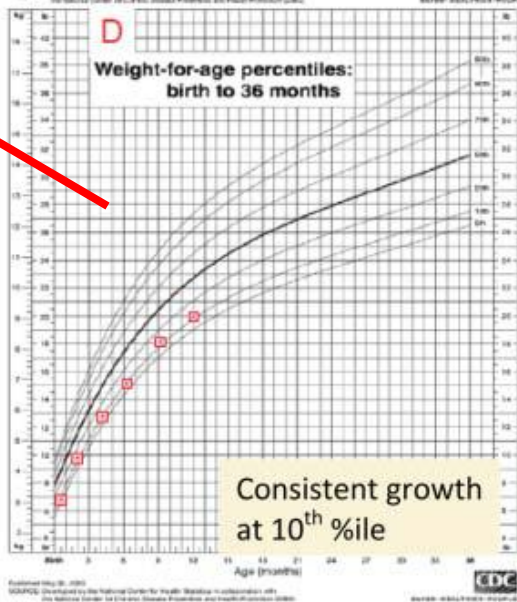
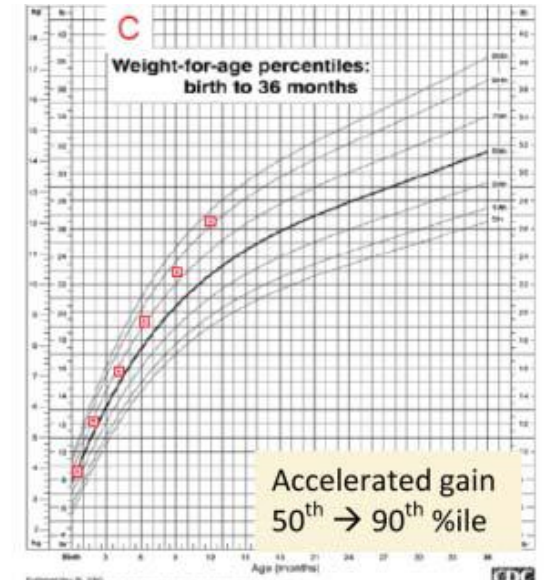
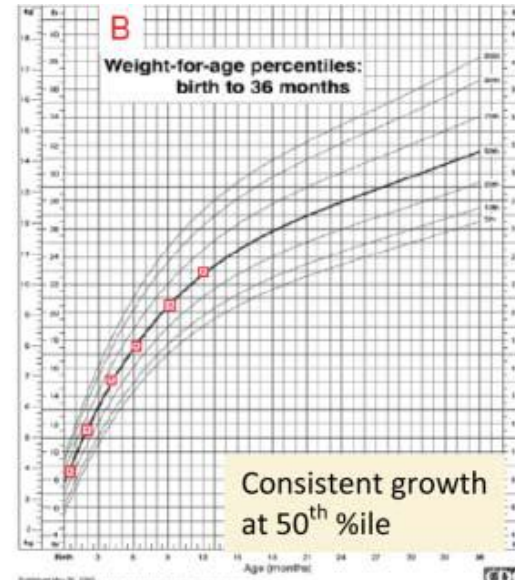
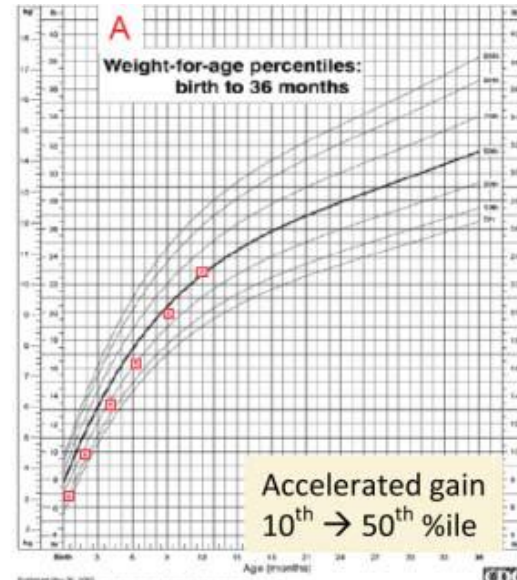
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Much too high	0 (0)	0 (0)	0 (0)	0 (0)	

- Infants with weights in top quartile – 79% believe child's weight is “just right” or “low”
- Infants with weight in the bottom quartile – 57% believe child's weight is “low” or “much too low”

What do urban parents (N=222) think healthy growth looks like?

58% say chart D “least healthy”
vs. 6% for chart A
and 9% for chart C

For “healthiest”
34% for chart B
32% for chart F



Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT) Study

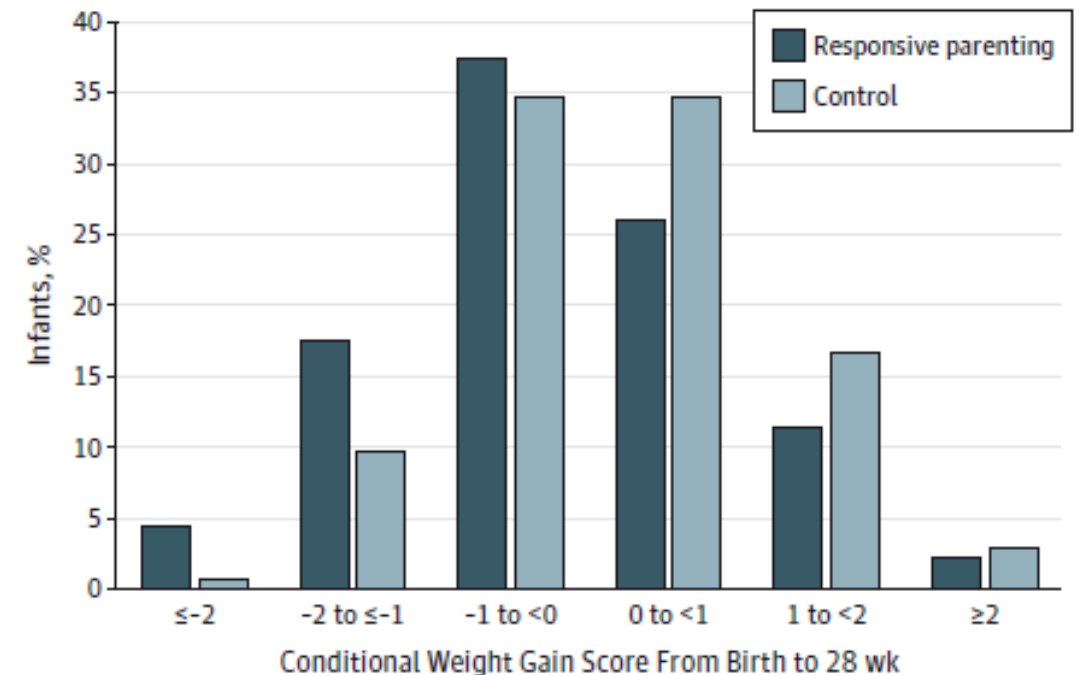
- RCT with responsive parenting intervention designed for obesity prevention vs. safety control
 - Primary outcome – BMIz at 3 years
 - Key secondary outcome – prevention of rapid infant weight gain birth → 28 weeks

Table 2. Effect of Study Group (Model 1) and Feeding Mode^a (Model 2) on CWG^b

Variable	Model 1 (n = 262)	P Value
	Mean CWG (95% CI)	
Study group	NA	.04
Responsive parenting	-0.18 (-0.36 to 0)	NA
Control	0.18 (0.02-0.34)	

^b Conditional weight gain scores are the studentized residuals from the model: weight for age at 28 weeks = weight for age at birth + length for age at birth + length for age at 28 weeks + infant age at 28 weeks + gestational age + intent to breastfeed declared at 2 weeks.

Figure 2. Effect of Responsive Parenting Intervention on Rapid Weight Gain



Responsive parenting group infants had lower conditional weight gain scores reflecting slower, less rapid weight gain. Conditional weight gain scores from birth to 28 weeks greater than 0 indicates faster weight gain.

How can we communicate risk of rapid infant weight gain?

- Agreed-upon definition
 - Weight, weight-for-length, BMI? Something better?
 - Time frame – 1 week, 4 months, 6 months, 1 year, longer? All of the above?
- Understandable to clinicians and families
 - Most don't know what a z-score is!
- Support from authoritative bodies
 - WHO, AAP, CDC ...
- Tool/calculator to share it with parents/families?

Bilitool – an example of what works



Based on 2022 Guidelines

Latest Features

RISK FACTORS

- Neurotoxicity <
- Hyperbilirubinemia <

RESOURCES

- 2022 AAP Guidelines <
- AAP Flowcharts <

ABOUT BILITOOL

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Newborn values: Reset

—option one—

Birth date: **Birth time:**

Sampling date: **Sampling time:**

—option two—

Age (hours) at sampling:

Total Bilirubin: **Units:**

Gestational age:

Other Neurotoxicity Risk Factors:

☒ ETCoc in ppm

- ☐ Isoimmune (or other) hemolytic disease or G6PD deficiency
- ☐ Sepsis or clinical suspicion of sepsis
- ☐ Albumin < 3.0 g/dL (30 g/L)
- ☐ Significant clinical instability in the previous 24 hours

2022 AAP Hyperbilirubinemia Guidelines

What's new?

- Highlights the challenge of identifying G6PD deficiency in infants.
- Bases follow-up testing on the difference between bilirubin level and the phototherapy threshold. No more risk zones!
- Raises thresholds for phototherapy and exchange transfusion.
- Includes gestational age and risk factors for neurotoxicity in the thresholds.
- Adds when to check for rebound after stopping phototherapy.
- Offers how to provide intensive phototherapy and when home phototherapy is an option.
- Introduces “escalation of care” for serum bilirubin close to exchange transfusion level.

About Neurotoxicity Risk Factors
(updated May 2024)

- Selection of one or more of these risk factors (*optional*), including an elevated ETCoc (end-tidal carbon monoxide, corrected to ambient CO), will give guideline recommendations for the *presence* of neurotoxicity risk factors.
- Gestational age (*required*) automatically provides the appropriate recommendation from the AAP guideline.

Keep everyone in sync.

[Start free trial](#)

Client Research

Sent

Adobe

Bilitool – an example of what works



Based on 2022 Guidelines

Latest Features

RISK FACTORS

- Neurotoxicity <
- Hyperbilirubinemia <

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Patient Summary

Age at sampling:	59 hours
Total Bilirubin:	19.3 mg/dL
Bilirubin trend:	Not available (Learn more >>)
ETCOC:	Not provided
Gestational Age (GA):	38 weeks
Neurotoxicity Risk Factors:	No

Recommendations

	Recommendation	Threshold
If using TcB, confirm with TSB?	Yes	14.5 mg/dL
Phototherapy?	Yes	17.4 mg/dL
Escalation of Care? (More >>)	No	23 mg/dL
Exchange Transfusion?	No	25 mg/dL

Postdischarge Follow Up

Neonatal Early-Onset Sepsis Calculator


KAISER PERMANENTE | DIVISION OF RESEARCH

Neonatal Early-Onset Sepsis Calculator (2024 Update)

[Updated EOS Calculator 2024](#)
[Classification](#)
[References](#)
[FAQ](#)
[Original EOS calculator \(2017\)](#)

Probability of Neonatal Early-Onset Sepsis Based on Maternal Risk Factors and the Infant's Clinical Presentation

The tool below is intended for the use of clinicians trained and experienced in the care of newborn infants. Using this tool, the risk of early-onset sepsis can be calculated in an infant born ≥ 35 weeks gestation. The interactive calculator produces the probability of early onset sepsis per 1000 babies by entering values for the specified maternal risk factors along with the infant's clinical presentation.



Please enter details below.

Predictor	Scenario
Calculator Version [?]	☐ Original (2017) - No Universal GBS Screening ☒ Updated (2024) - Universal GBS Screening
Incidence of Early-Onset Sepsis [?]	0.50/1000 live births (CDC national incidence) [?]
Gestational age [?]	38 weeks 4 days
Highest maternal antepartum temperature [?]	38.5 Celsius [?]
ROM (Hours) [?]	38
Maternal GBS status [?]	☐ Negative ☒ Positive ☐ Unknown
Type of Intrapartum antibiotics [?]	☐ Broad spectrum antibiotics > 4 hrs prior to birth ☐ Broad spectrum antibiotics 2-3.9 hrs prior to birth

Calculate »

Clear

Risk per 1000/births

EOS Risk @ Birth

11.95

EOS Risk after Clinical Exam	Risk per 1000/births	Clinical Recommendation	Vitals
Well Appearing	4.34	Empiric antibiotics	Vitals per NICU
Equivocal	42.29	Empiric antibiotics	Vitals per NICU
Clinical Illness	149.23	Empiric antibiotics	Vitals per NICU

Classification of Infant's Clinical Presentation [Clinical Illness](#)
[Equivocal](#) [Well Appearing](#)

Original EOS Calculator [2017 version](#)

Adult – Cardiovascular Risk Calculator

The American Heart Association PREVENT™ Online Calculator

About the PREVENT Equations

[Online Calculator](#)

CVD

ASCVD

Heart Failure

Sex*

☒ Male ☐ Female

Age (years)*

30-79

SBP (mmHg)*

90-200

Total Cholesterol (mg/dL)*

130-320

HDL Cholesterol (mg/dL)*

20-100

eGFR (mL/min/1.73m²)*

15-140

BMI (kg/m²)*

18.5-39.9

Diabetes

Any history of diabetes.

☒ No ☐ Yes

Current Smoking

Any cigarette use within the last 30 days

☒ No ☐ Yes

Lipid-lowering medication

Current use of statin medication to lower cholesterol

☒ No ☐ Yes

Anti-hypertensive medication

Current use of any medication for hypertension

☒ No ☐ Yes

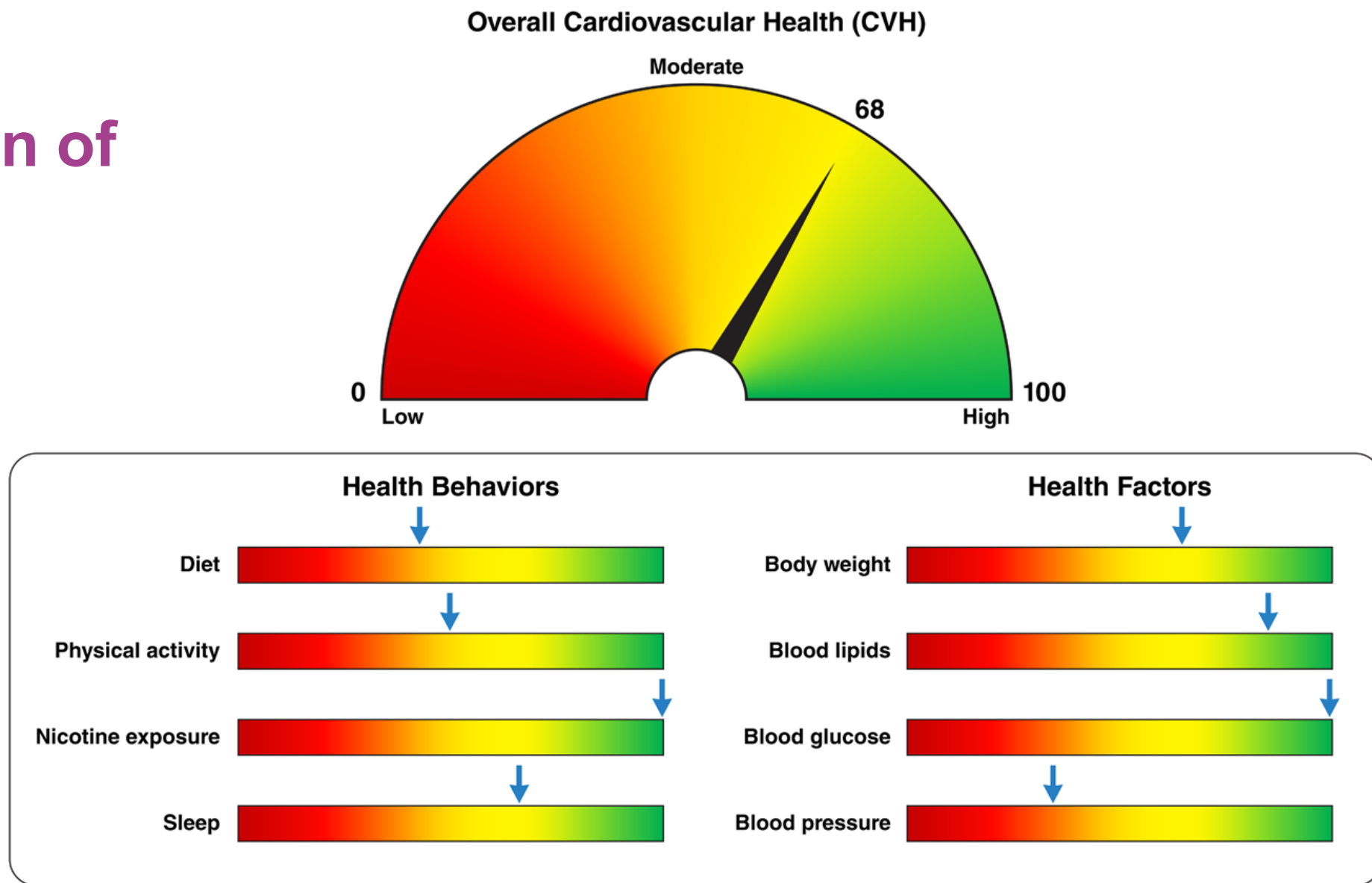
American Heart Association: Life's Essential 8

4 health factors, 4 health behaviors

- Each scored from 0–100
- Composite score for cardiovascular health (CVH) generated



Example presentation of CVH Score



CVH score for infants?

- “... in theory, CVH scoring could be done using routine measurements of a subset of 5 metrics (4 behaviors + BMI) at all ages.” Suggest 0–100 score for:
 - Diet quality 6–23 months – 5 questions from Mediterranean Eating Patterns for Americans plus question on milk source
 - Physical activity 1–5 years – total active play averaged over 7 days
 - Nicotine exposure (all ages) – secondhand smoke
 - Sleep ≥ 4 months – based on age-specific optimal sleep duration per AAP
 - Weight – Suggestion for Scoring of Weight Metric at ages < 2 years old

	Age 1-6 months	Age 6-23 months
Optimal (100 pts)	WFL or BMI $< 97.7^{\text{th}}$ percentile	WFL or BMI $< 97.7^{\text{th}}$ percentile AND increase in WFL or BMI z-score of < 0.67 since prior routine visits (e.g., since age 1 month)
Worst (0 pts)	N/A*	WFL or BMI $\geq 99.7^{\text{th}}$ %ile percentile AND increase in WFL or BMI z-score of ≥ 0.67 since prior routine visits
Middle scores	WFL or BMI $\geq 97.7^{\text{th}}$ %ile but $< 99.7^{\text{th}}$ %ile: score = 75 points WFL or BMI $\geq 99.7^{\text{th}}$ %ile: score = 50 points	Subtract 25 points if WFL or BMI $\geq 97.7^{\text{th}}$ %ile but $< 99.7^{\text{th}}$ %ile Subtract 50 points if WFL or BMI $\geq 99.7^{\text{th}}$ %ile Subtract 25 points if increase in WFL or BMI z-score of ≥ 0.67 since prior routine visits (e.g., since age 1 month)

*Given limited data for this age group, it is not recommended that the weight metric receive a score of 0.

Moving Ahead: Rapid Infant Weight Gain in Clinical Practice

- What are we trying to communicate? Obesity risk, cardiovascular health risk across the life course, or both?
- How can we communicate this to clinicians and families?
- How do we implement this into routine clinical care?

Thank you!

Excess body weight among infants and toddlers: challenges for public health surveillance

Cynthia L. Ogden, PhD, MRP
NHANES Analysis Branch Chief

NCCOR Workshop

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September 1-2, 2026



CAN'T DISCUSS EXCESS WEIGHT SURVEILLANCE IN
INFANTS AND TODDLERS WITHOUT TALKING ABOUT
SURVEILLANCE IN PRESCHOOLERS



SURVEILLANCE DEFINITIONS
Challenges & considerations



US PREVALENCE

DEFINITIONS: CHALLENGES & CONSIDERATIONS

Anthropometric
measurements

Indicators

Growth
references

Cut off

How do they
compare?



Anthropometry: Body weight



Anthropometry: Recumbent length



Anthropometry: Standing height

MEAN DIFFERENCE BETWEEN STANDING HEIGHT AND RECUMBENT LENGTH

0.8 cm

DEFINITIONS: CHALLENGES & CONSIDERATIONS

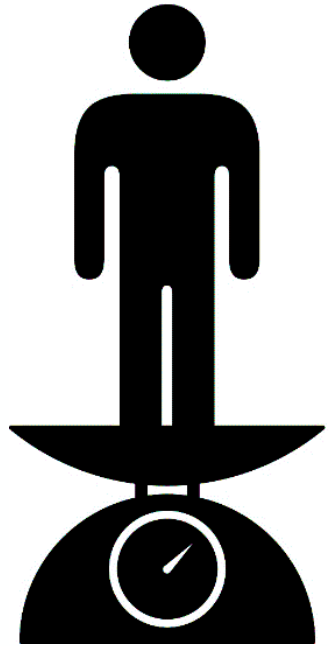
Anthropometric
measurements

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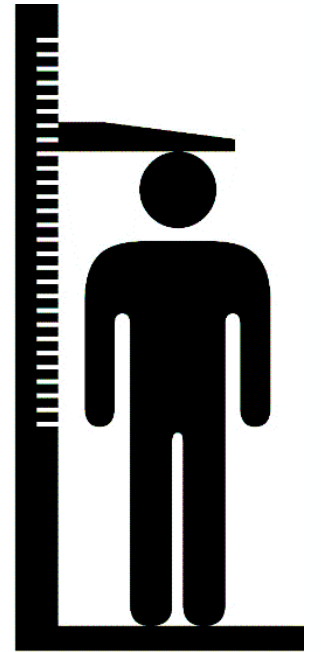
Growth
references

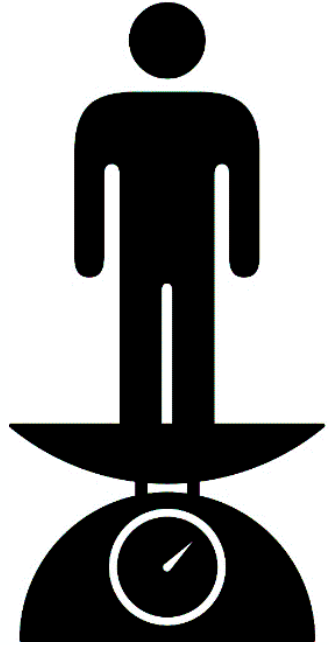
Cut off

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compare?

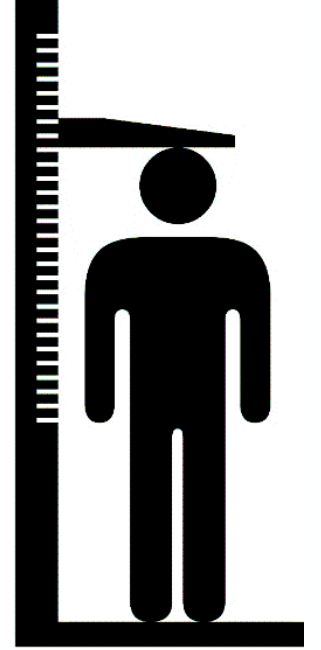


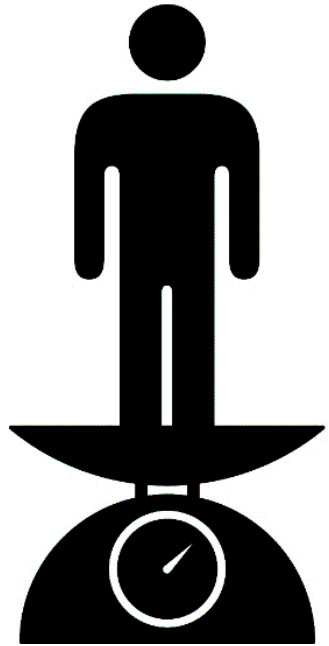
Sex specific Weight-for-age



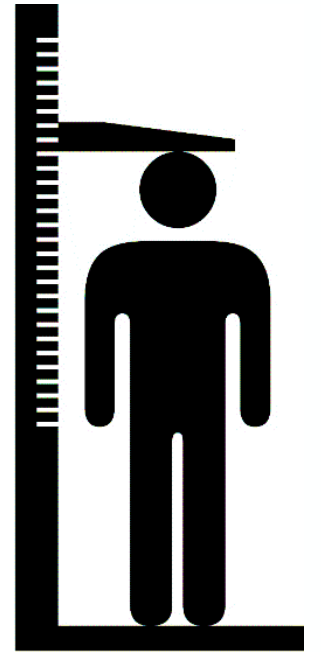


Sex specific Weight-for-recumbent length





Sex specific Body mass index (BMI)-for-age



DEFINITIONS: CHALLENGES & CONSIDERATIONS

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The background features a series of overlapping, wavy, teal-colored lines that create a sense of movement and depth. These lines are composed of a fine, dotted pattern, giving them a textured appearance. The lines flow from the top left towards the bottom right, with some lines curving upwards and others downwards, creating a dynamic, organic feel. The overall color palette is a range of teal and green tones, from light to dark.

MANY GROWTH CHARTS EXIST

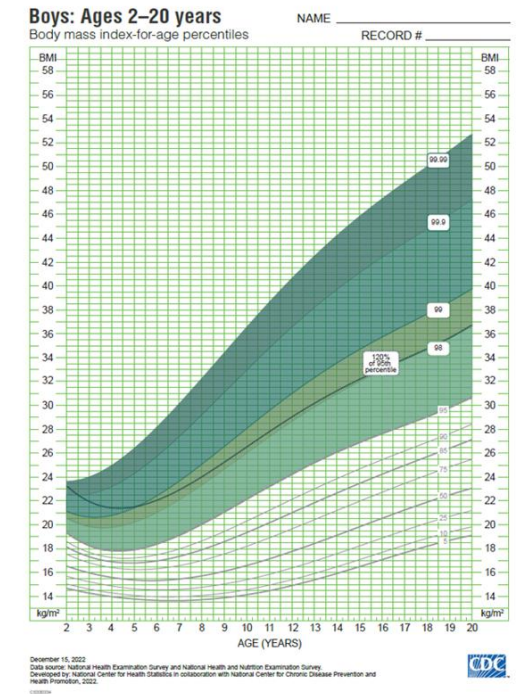
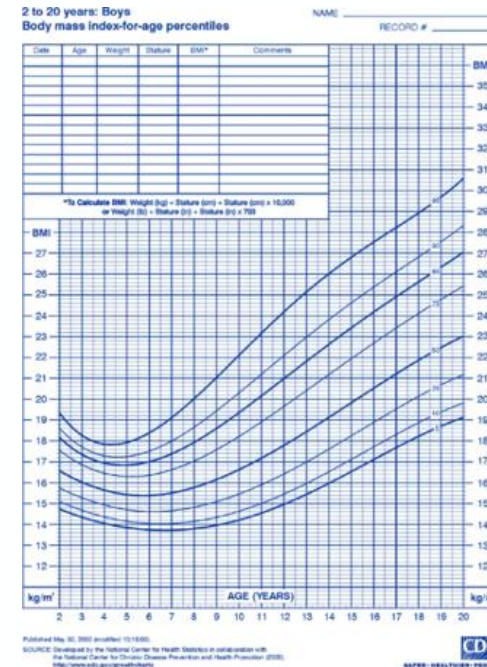
2000 CDC GROWTH CHARTS: A REFERENCE

- **Data**

- Cross-sectional, Nationally representative US, 1960-94

- 2-20 years

- Weight-for-age
- Stature-for-age
- BMI-for-age
- Extended BMI-for-age



WHO GROWTH CHARTS, B-5 Y: A STANDARD

■ Selection

- Optimal nutrition
- Optimal environment
- Optimal care

■ Data

- Longitudinal (b-24 m) & cross-sectional
- Pelotas, Brazil; Accra, Ghana; S Delhi, India; Oslo, Norway; Muscat, Oman; Davis, CA, US

■ Infants, birth-60 m

- Weight-for-age
- Length/Height-for-age
- Weight-for-length/Height
- BMI-for-age
- Subscapular/Triceps Skinfold-for-age (3-60m)
- Weight velocity (b-24m, weight, length, head circumference)

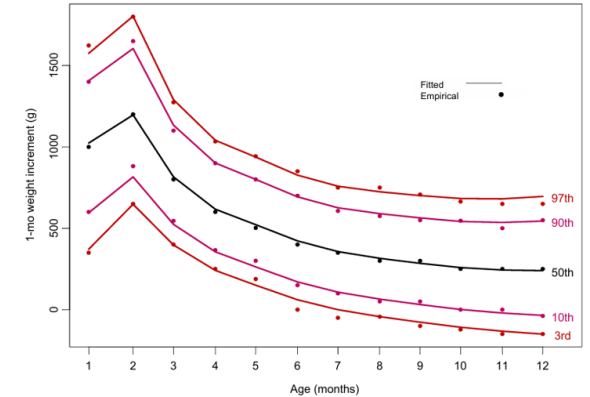
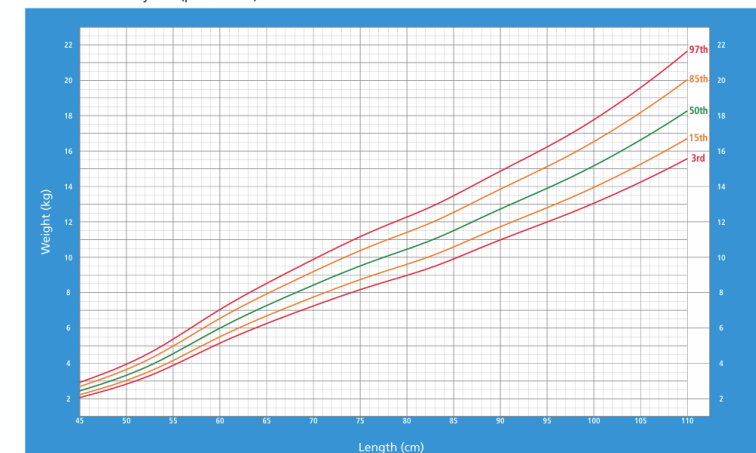


Figure A3.3 3rd, 10th, 50th, 90th, 97th smoothed centile curves and empirical values: 1-month weight velocity for boys

Weight-for-length BOYS

Birth to 2 years (percentiles)



INTERNATIONAL OBESITY TASK FORCE (IOTF), 2-5 Y: A REFERENCE

■ Data

- Brazil, Hong Kong, the Netherlands, Singapore, United Kingdom, United States (growth charts data)

■ 2-5 y

- BMI-for-age

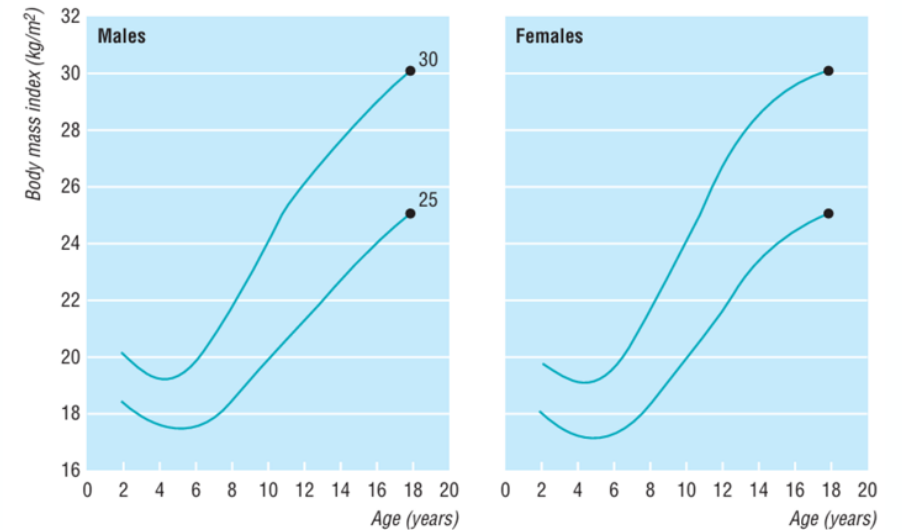


Fig 6 International cut off points for body mass index by sex for overweight and obesity, passing through body mass index 25 and 30 kg/m² at age 18 (data from Brazil, Britain, Hong Kong, Netherlands, Singapore, and United States)

REFERENCES, BIRTH-5

	Weight-for-length	BMI-for-age	Weight-for-age
CDC	Birth-36 m	2-5 y	Birth-5 y
WHO	Birth-5 y*	Birth-5 y*	Birth-5 y
IOTF	NA	2-5 y	NA

*at age 2 years recumbent length is replaced by standing height

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BMI CUT-OFFS USING THE DIFFERENT REFERENCES

TABLE 1 BMI z-score cut-off definitions of child obesity according to the IOTF, WHO and CDC references¹²

Reference	Sex	Obesity
IOTF 2–18 years	Boys	+2.29 (30) ^d
	Girls	+2.19 (30) ^d
WHO 0–5 years ^e	Both	+3
WHO 5–19 years	Both	+2
CDC 2–20 years	Both	+1.64 (95th centile)

[Cole TJ, Lobstein T. Exploring an algorithm to harmonize International Obesity Task Force and World Health Organization child overweight and obesity prevalence rates. *Pediatr Obes.* 2022Jul;17\(7\):e12905. <https://onlinelibrary.wiley.com/doi/epdf/10.1111/ijpo.12905>](https://onlinelibrary.wiley.com/doi/epdf/10.1111/ijpo.12905)

US DEFINITIONS, EXCESS WEIGHT, BIRTH-5 YEARS

	Birth-<24 m	2-5 y	
Indicator	Weight-for-length	BMI-for-age	
Reference	WHO growth standards	CDC growth charts	
Cut point	≥ 2 SD (97.7 th percentile)	$\geq 95^{\text{th}}$ percentile	Obesity
		$\geq 120\%$ of 95 th percentile	Severe Obesity

High weight-for-length

SMALL DIFFERENCE CAN LEAD TO PERCENTILE CHANGE: MEASUREMENT MATTERS

53.5 cm boy, weight/length

Weight (kg)	WHO percentile
4.39	75 th
4.63	90 th
4.79	95 th
4.95	97.7 th

<https://www.cdc.gov/growthcharts/who-data-files.htm>

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CDC BMI-FOR-AGE Z-SCORES HIGHER THAN WHO; DISJUNCTION WHEN MOVE FROM LENGTH TO HEIGHT

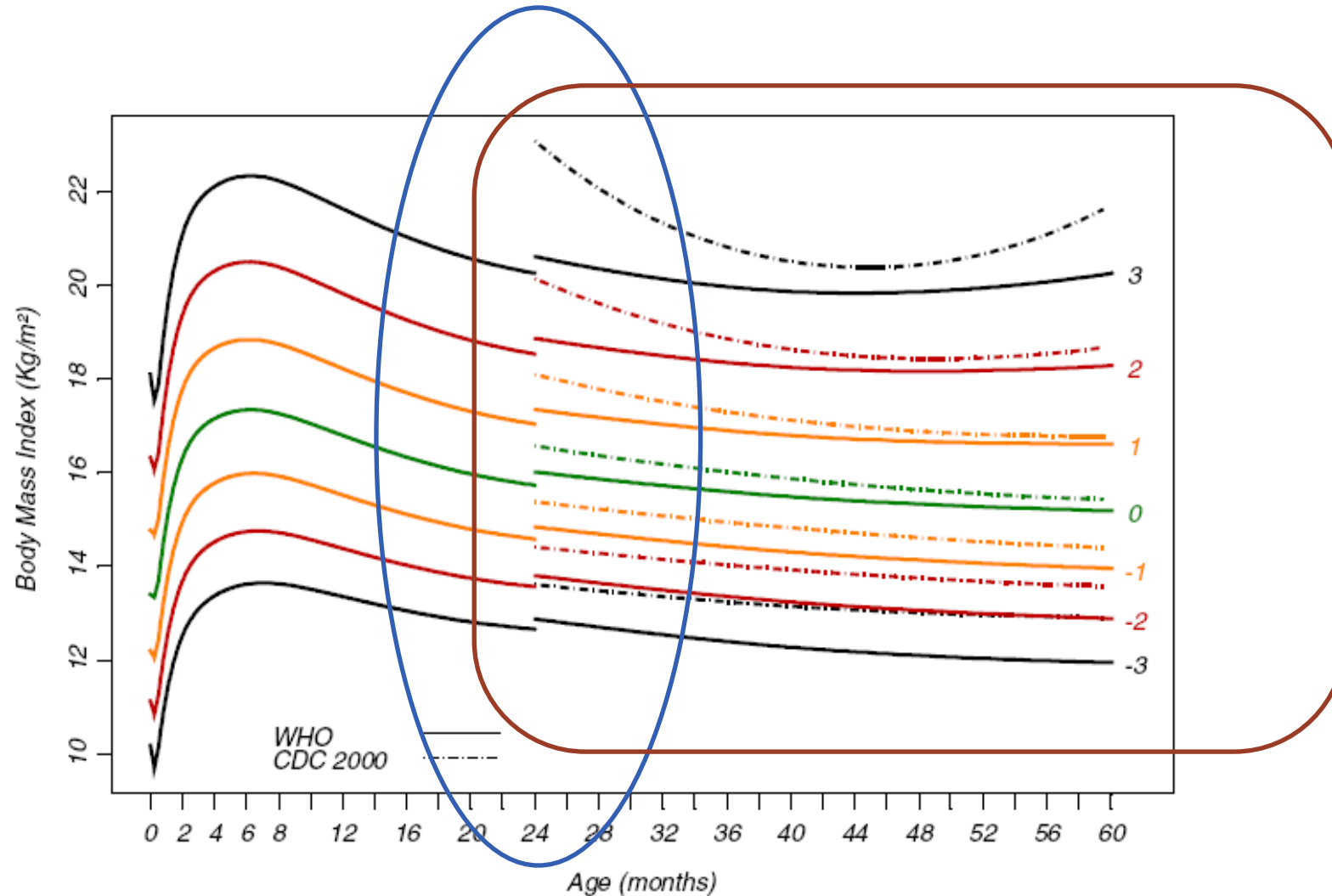
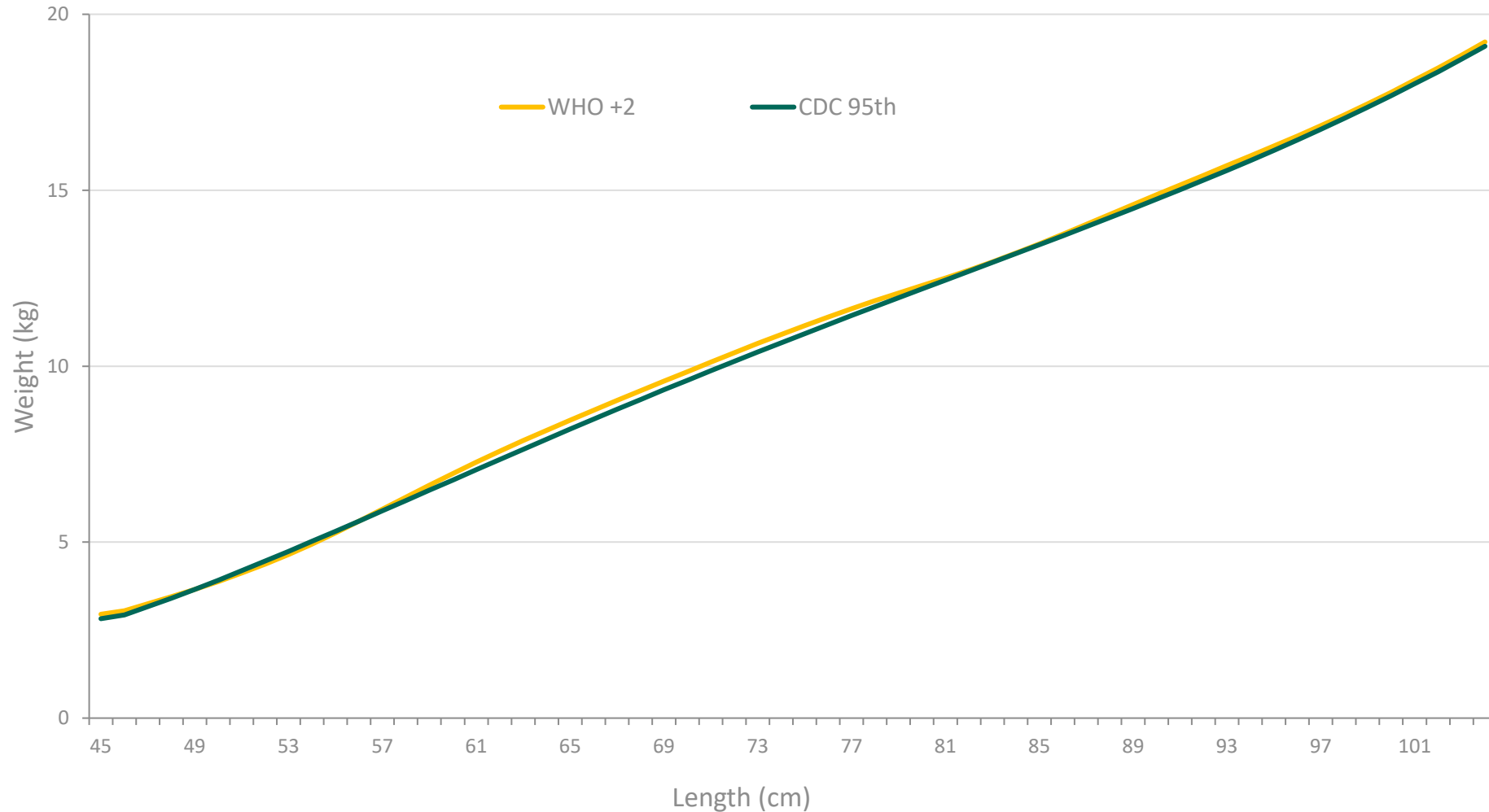


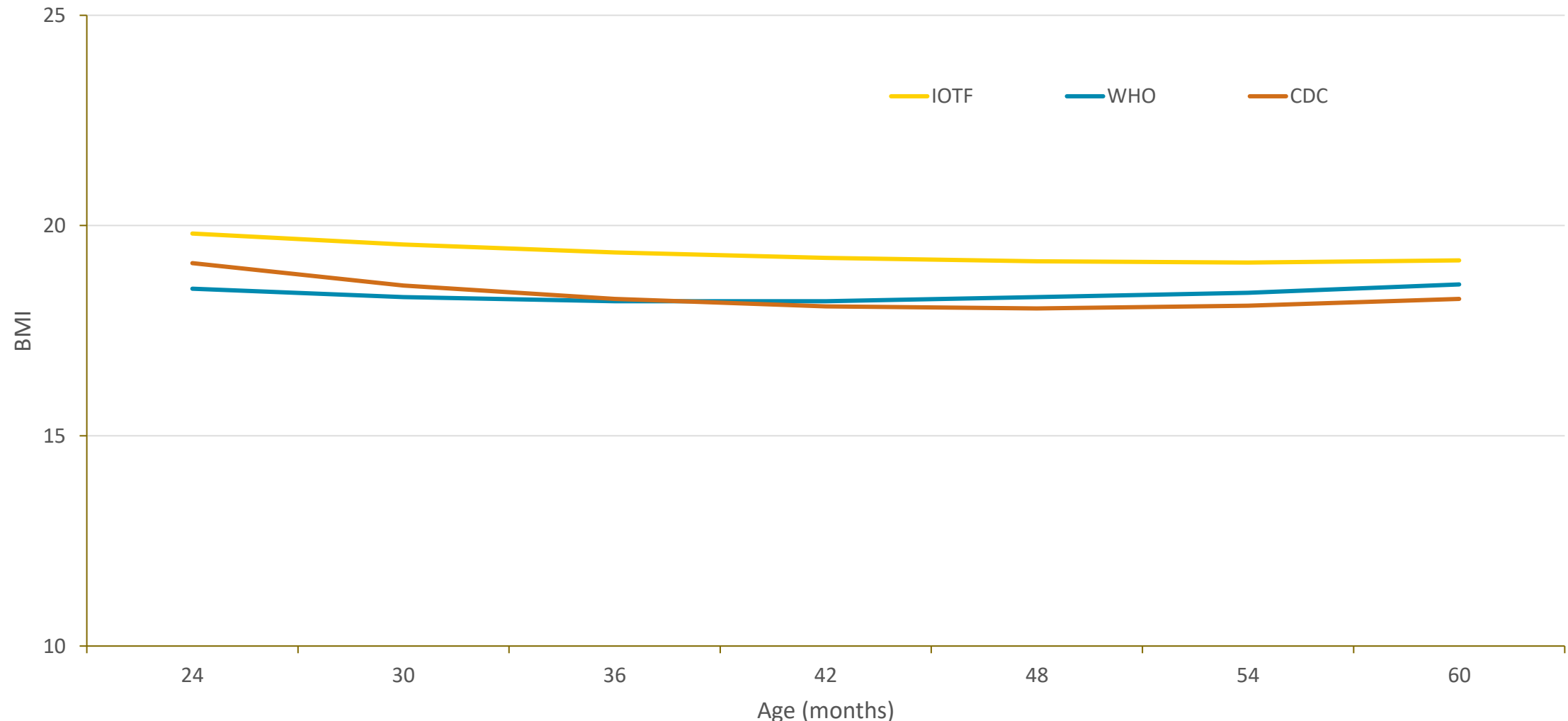
Figure 115 Comparison of WHO with CDC 2000 BMI-for-age z-scores for boys

LITTLE DIFFERENCE BETWEEN WHO AND CDC WEIGHT-FOR-LENGTH CUTPOINTS FOR BOYS



<https://www.cdc.gov/growthcharts/>

IOTF OBESITY CUTPOINT FOR 2-5 YEARS IS HIGHER THAN WHO AND CDC (GIRLS)



<https://www.cdc.gov/growthcharts/> ; Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000 May 6;320(7244):1240-3.

1

SURVEILLANCE DEFINITIONS
Challenges & considerations

2

US PREVALENCE



Nationally
representative



Examination data



24-hour recall



10,000



2-year cycle



n=238
Birth<24 mo

n=503
2-5 y

**In Aug 2021-
Aug 2023 with
weight &
height**

PROVIDING DATA FOR 65 YEARS

<i>Survey</i>	<i>Dates</i>	<i>Ages</i>
NHES I	1960-62	18-79 years
NHES II	1963-65	6-11 years
NHES III	1966-70	12-17 years
NHANES I	1971-75	1-74 years
NHANES II	1976-80	6 mo-74 years
NHANES III	1988-94	2 mo +
Continuous NHANES	1999-Mar 2020	all ages
Most recent released	Aug 2021-Aug 2023	all ages



IN 2025, A REDESIGNED NHANES WAS BACK IN THE FIELD FOR A 3-YEAR CYCLE

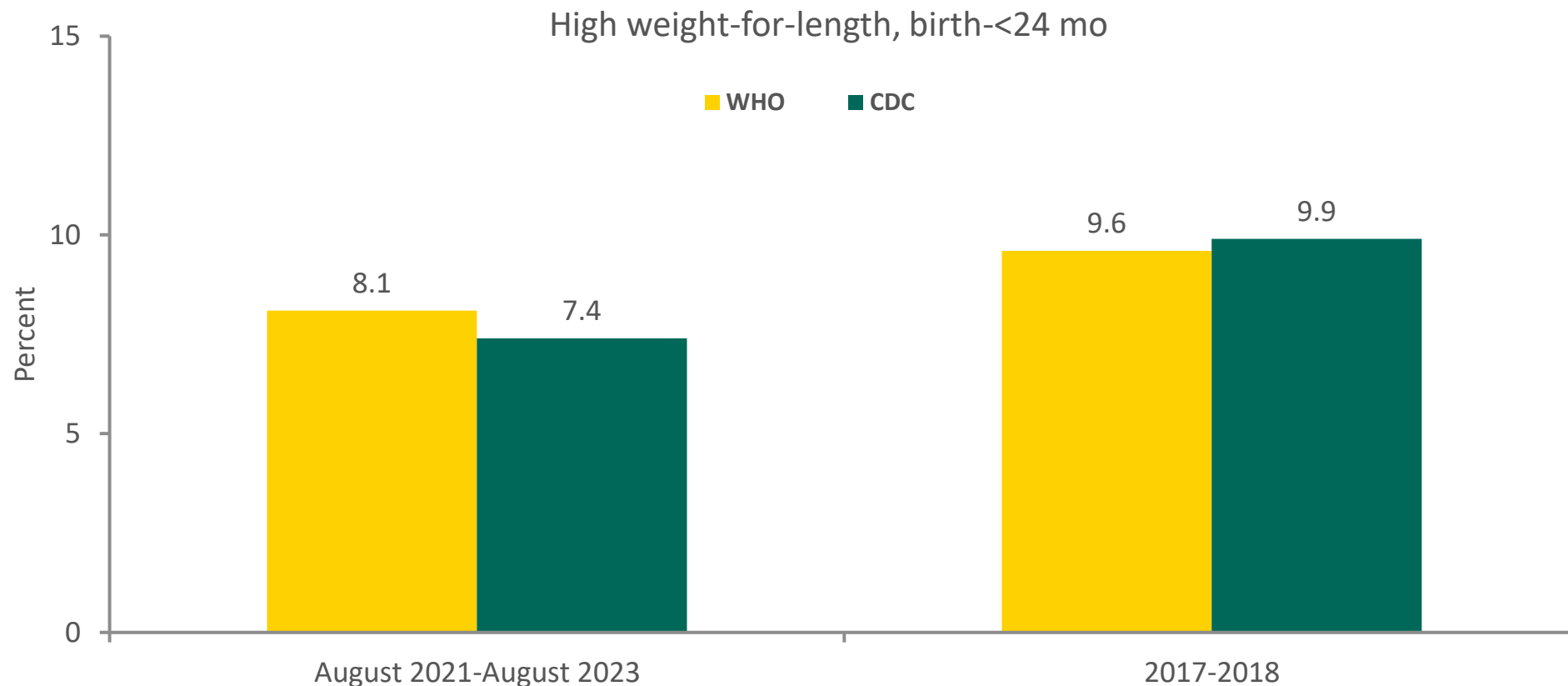


with excess weight/obesity

8.9% infants/toddlers

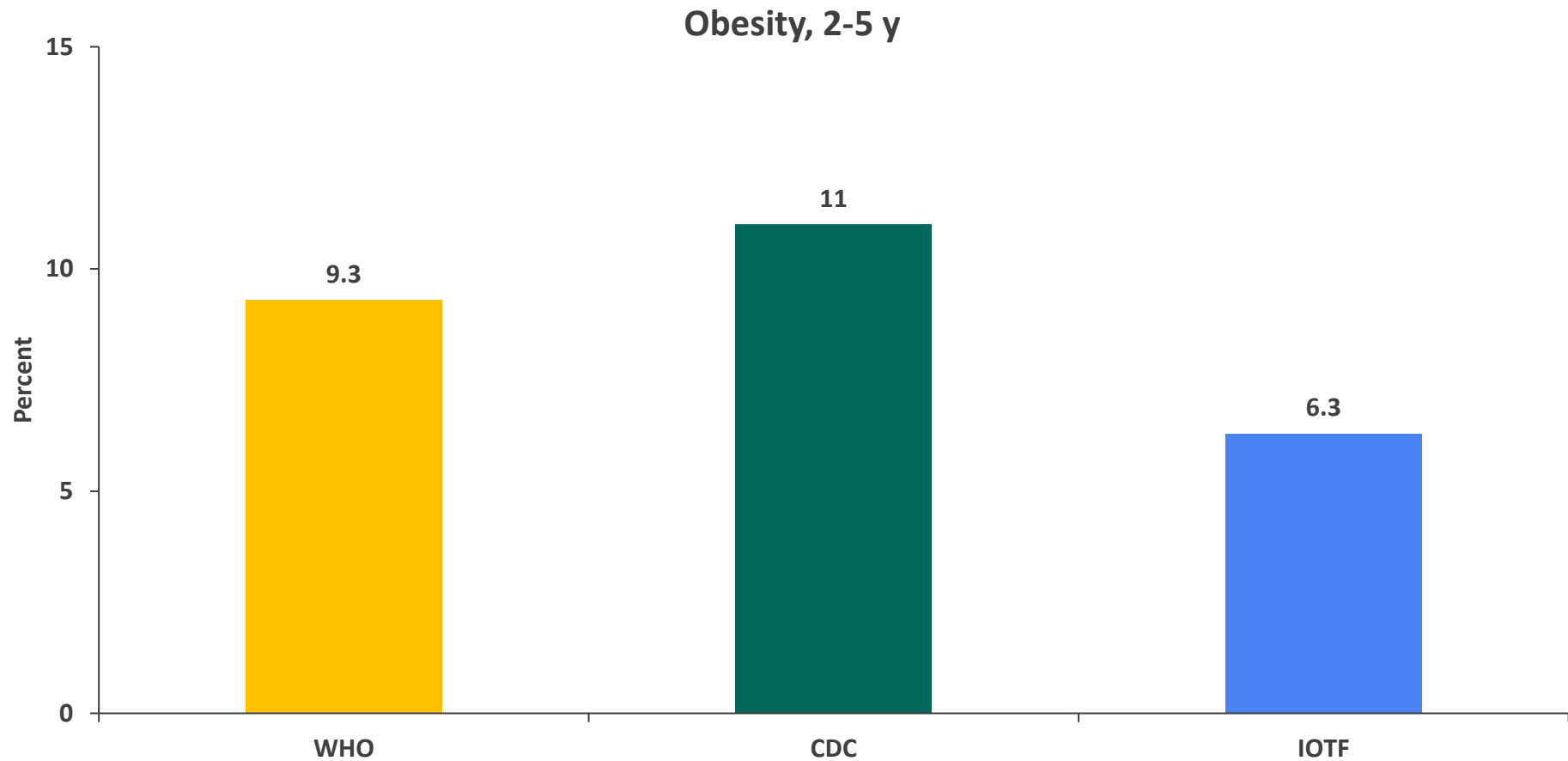
14.9% pre-schoolers

PREVALENCE OF HIGH WEIGHT-FOR-LENGTH SLIGHTLY DIFFERENT USING DIFFERENT CHARTS AND CUT POINTS



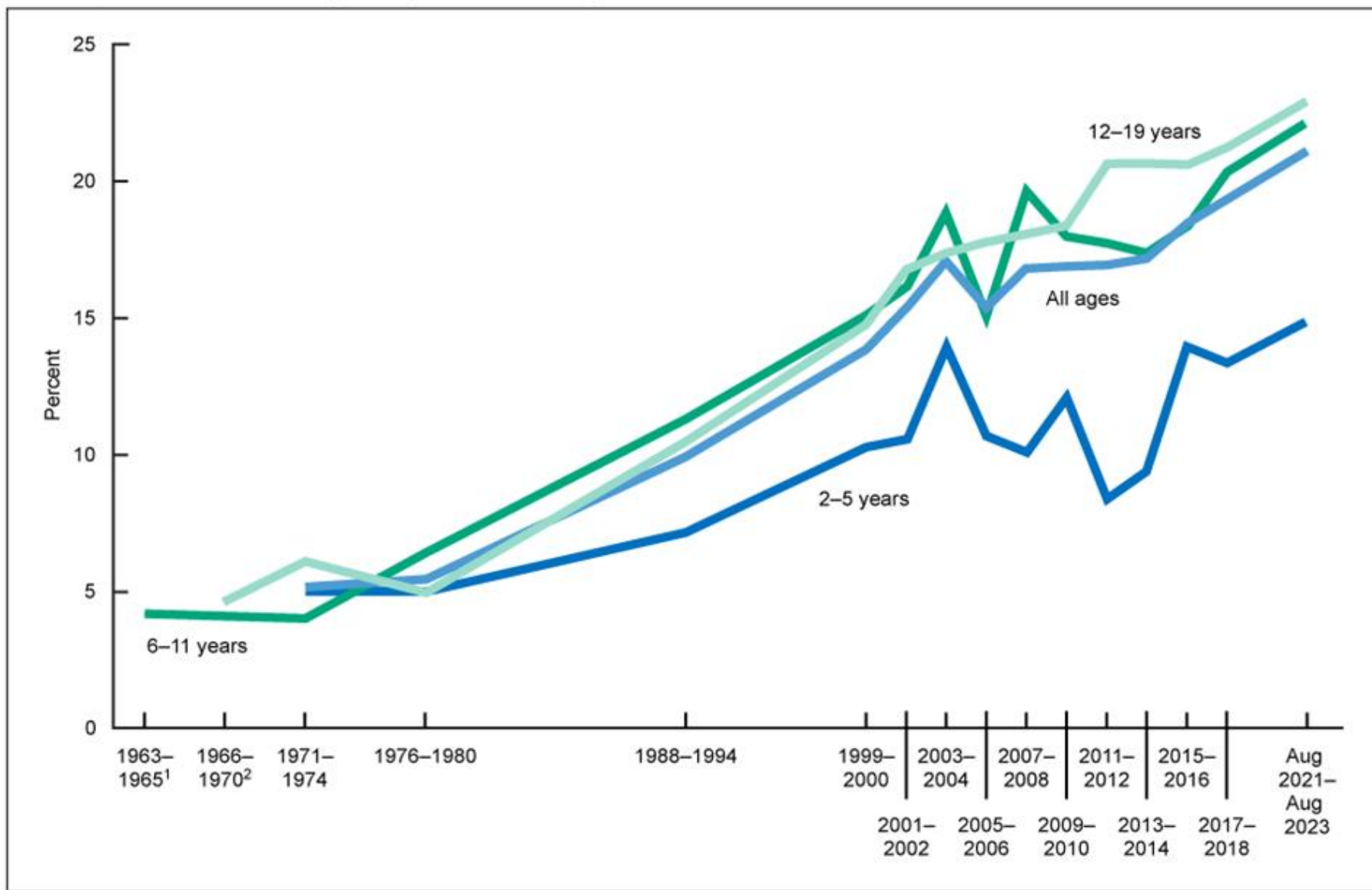
Data source: NHANES [Prevalence of High and Low Weight-for-recumbent Length, and Low Recumbent Length-for-age and Weight-for-age, Among Infants and Toddlers: United States, 1971–1974 Through August 2021–August 2023](#)

PREVALENCE OF OBESITY DIFFERENT USING DIFFERENT CHARTS AND CUT POINTS



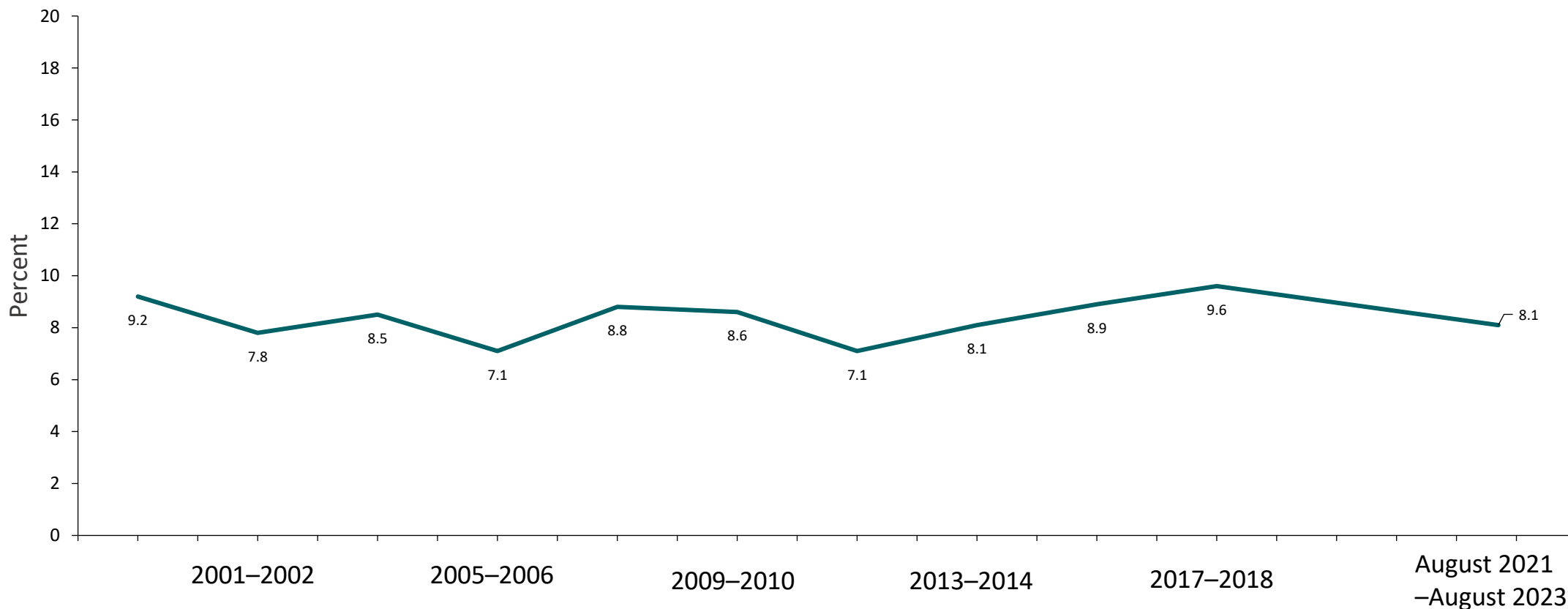
Source: CDC/NCHS, National Health and Nutrition Examination Surveys 2017-2018 (unpublished analyses)

CHILDHOOD (2-19 Y) OBESITY TRENDS FROM EARLY 1960S



<https://www.cdc.gov/nchs/data/hestat/hestat112.htm>

NO CHANGE IN HIGH WEIGHT-FOR-LENGTH IN INFANTS AND TODDLERS OVER LAST ~25 YEARS



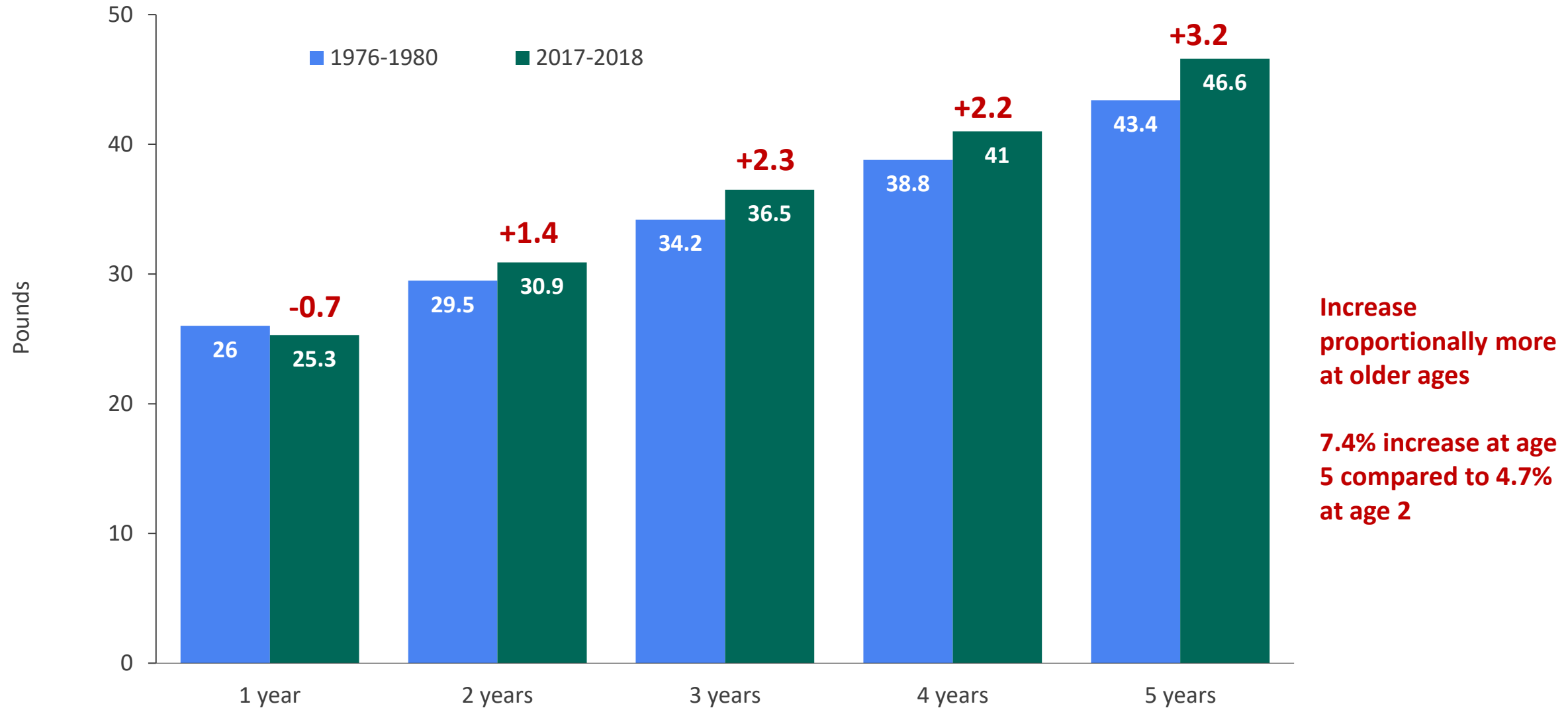
Source: NHANES; <https://www.cdc.gov/nchs/data/hestat/hestat118.htm>

OVER LAST DECADE, INCREASE IN OBESITY AMONG CHILDREN 2-5 YEARS

	2013-2014		2015-2016		2017-March 2020		2021-2023		Annual change ^b	P value for trend ^c	
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	% (95% CI)	Linear	Quadratic
Children and adolescents aged 2-19 y											
Obesity (≥95th percentile on sex-specific CDC growth charts)											
2-5 y	843	9.4 (6.8 to 12.6)	814	13.9 (11.6 to 16.5)	1141	12.7 (10.8 to 14.8)	503	14.9 (11.9 to 18.3)	0.50 (0.11 to 0.89)	.01	.27

<https://jamanetwork.com/journals/jama/fullarticle/2830299>

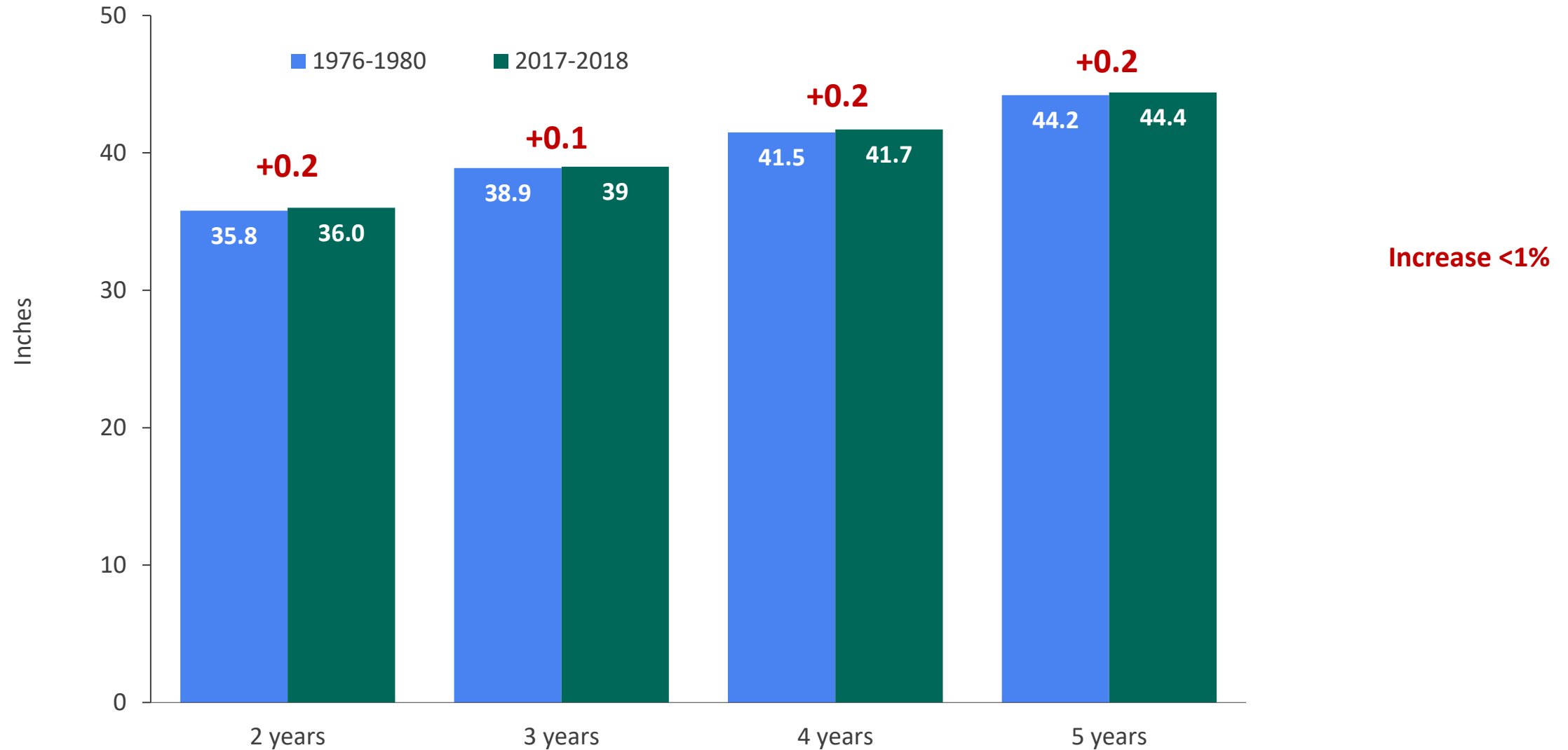
WHAT ABOUT CHANGES IN MEAN WEIGHT? AMONG BOYS INCREASES IN 1-5 Y



Source: CDC/NCHS, National Health and Nutrition Examination Survey

www.cdc.gov/nchs/data/ad/ad347.pdf; http://www.cdc.gov/nchs/data/series/sr_11/sr11_252.pdfhttps://www.cdc.gov/nchs/data/series/sr_03/sr03_039.pdfwww.cdc.gov/nchs/data/series/sr_11/sr11_238.pdf

INCREASE IN MEAN HEIGHT LESS THAN MEAN WEIGHT



Source: CDC/NCHS, National Health and Nutrition Examination Survey, boys 2-5 years

www.cdc.gov/nchs/data/ad/ad347.pdf; http://www.cdc.gov/nchs/data/series/sr_11/sr11_252.pdfhttps://www.cdc.gov/nchs/data/series/sr_03/sr03_039.pdfwww.cdc.gov/nchs/data/series/sr_11/sr11_238.pdf

Surveillance of body weight in US infants, toddlers & pre-schoolers, DIFFERENT:

1

Measurements

2

Indicators

3

Reference populations

4

Cut offs

US Prevalence

1

Birth-24 m: 8.9%, no significant change in high weight-for-length over 24 years

2

2-5 y: 14.9%, increase in high BMI-for-age (obesity) over the last 10 years

Thank you!



NCCOR WORKSHOP

Revisiting Rapid Infant Growth: Assessing Growth in Children Under Age 2

Use of Infant Growth Measures in Practice: Experience in a Multi-round Quality Improvement Collaborative

Sandra G. Hassink, FAAP

Medical Director AAP Institute for Healthy Childhood Weight



Desire among pediatricians to address infant growth

- **Background:**

- First 1,000 days are important to healthy lifestyles/weight.^{1,2}
- Comprehensive pediatric practice on early nutrition, feeding, and growth can be improved.³
- Maintaining comprehensive, tailored care is critical.⁴
- The *Optimize Infant and Toddler for Obesity Prevention* (“Optimize Feeding”) project was launched in 2020 to help address these gaps.
 - 6 annual rounds completed (Round 7 currently underway)
- **Global aim:** Improve primary care practice related to fostering healthy behaviors and healthy weight in children from birth to age two; foster a lifelong trajectory of optimal health.
- **Objective:** Examine overall improvements to care and provider satisfaction across Rounds 1–7.

1. Baidal JAW, et al. Risk factors for childhood obesity in the first 1,000 days: a systematic review. *Am J Prev Med*. 2016;50(6):761-779.

2. Schwarzenberg SJ, Georgieff MK. Advocacy for improving nutrition in the first 1000 days to support childhood development and adult health. *Pediatrics*. 2018;141(2):e20173716.

3. Boundy EO, et al. US pediatrician practices on early nutrition, feeding, and growth. *Journal of Nutrition Education and Behavior*. 2020;52(1):31-38.

4. Hagan JF, et al. ed. *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2017.

AAP Clinical Practice Guidelines (CPG) for the Evaluation and Treatment of Children and Adolescents With Obesity

- The CPG does **not discuss primary obesity prevention**, as no studies reporting results of obesity prevention interventions met the inclusion criteria for the evidence review.
- The CPG also **does not include guidance for overweight and obesity evaluation and treatment of children younger than 2 years**.
 - Children under age 2 were not part of the inclusion criteria for the evidence review, **because it is difficult to practically define and measure excess adiposity in this age group**.
- Nonetheless, the topics of obesity prevention and evaluation and treatment of children younger than 2 years are very important to reduce this threat to children's current and future health.

Hampf S, Hassink S, Skinner A, et al. Clinical Practice Guideline for the Evaluation and Treatment of Children and Adolescents With Obesity. *Pediatrics* February 2023; 151 (2): e2022060640. 10.1542/peds.2022-060640

Quality Improvement Project Design

Structure: Virtual, 19-week, team-based quality improvement (QI) collaborative

Supports: Online training modules, suite of tools/resources, technical assistance, peer discussions, and MOC 4 & CME incentives

Teams: Complete educational modules, attend project webinars, hold meetings, conduct Plan-Do-Study-Act cycles, submit periodic reports

On demand training modules



Social media assets



Infographics (English and Spanish)

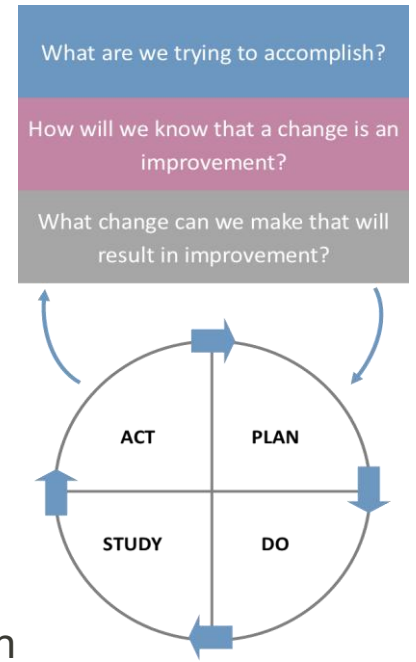


Bright Futures Resources

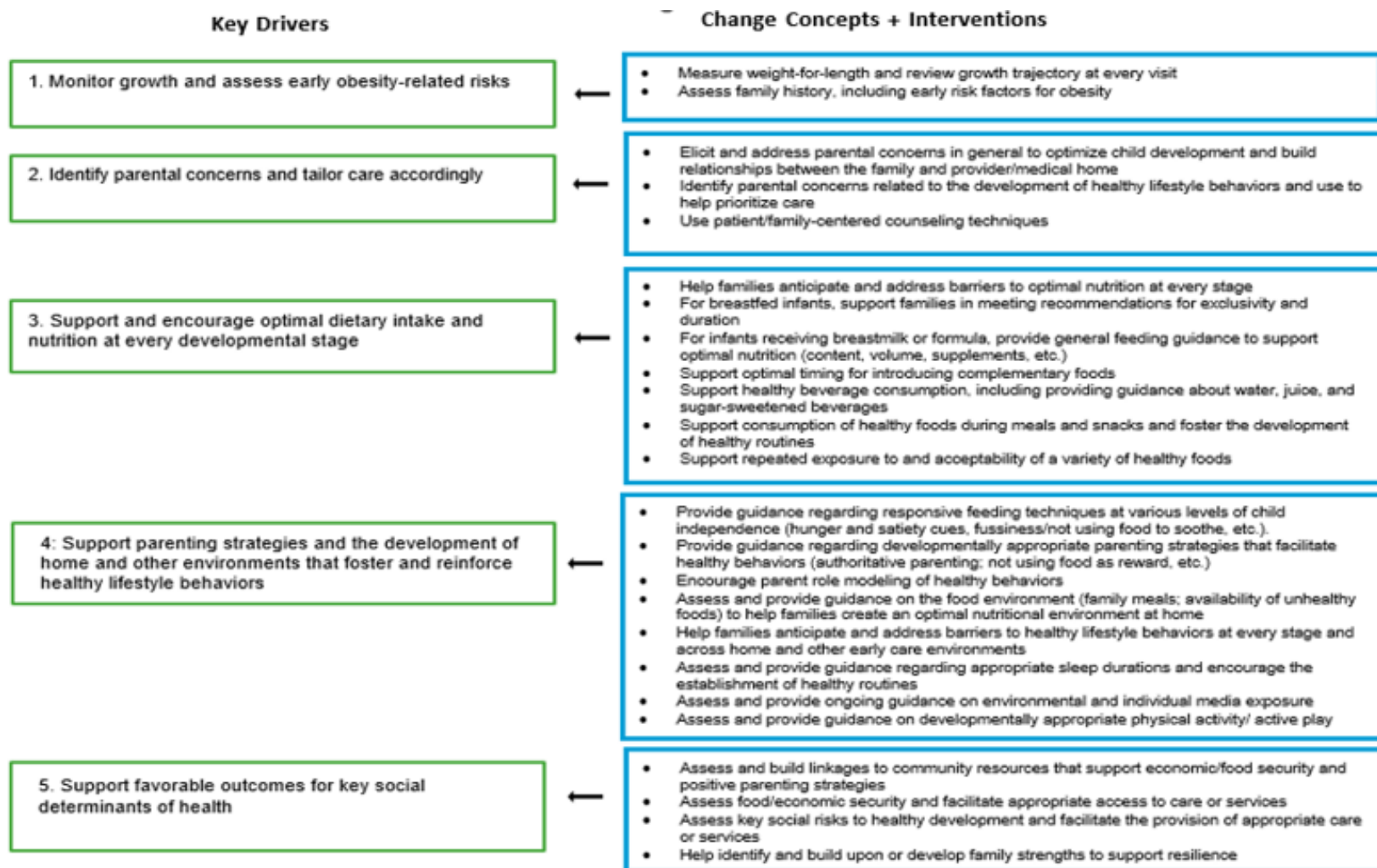


Methods

- **Clinical data submission:**
 - 3 collaborative data cycles (T1–T3) plus 1 “monitoring” cycle 6 months later (T4)
 - 20 randomly selected charts/cycle (well visits, <2 years old)
 - 8 measures; 6 included multiple subtopics to support tailored care
 - **Summed measures:**
 - Total assessments/visit
 - Total counseled topics/visit
- **Provider post-project surveys** (response rates=64–80%): Overall satisfaction with participation
- **Analysis:** Independent samples t-tests of total assessments and total counseled topics
 - T1 (baseline) vs. T3 (end of collaborative)
 - T1 (baseline) vs. T4 (monitoring data cycle)



Change Concepts/Key Driver Diagram



6 Key Components to Remember for Every Visit



Early obesity risk

- Birth weight
- Parental obesity
- Prenatal smoking
- Gestational weight gain and diabetes



Appropriate Growth Assessment

- **Weight-for-length percentile**

Assess & counsel on dietary intake & nutrition

- Breastfeeding
- Formula feeding
- Complementary food introduction
- Healthy and unhealthy food consumption
- Healthy and unhealthy beverage consumption
- Picky eating
- Snacking



Assess and counsel on parenting/home lifestyle environments

- Responsive feeding
- Other parenting strategies (e.g., role modeling, authoritative parenting)
- Home food environment
- Active play/physical activity
- Sleep routines/behaviors
- Media exposure/use



Assess and counsel on key social determinants of health

- Food security
- Economic security
- Family health and wellbeing
- Family strengths and supports

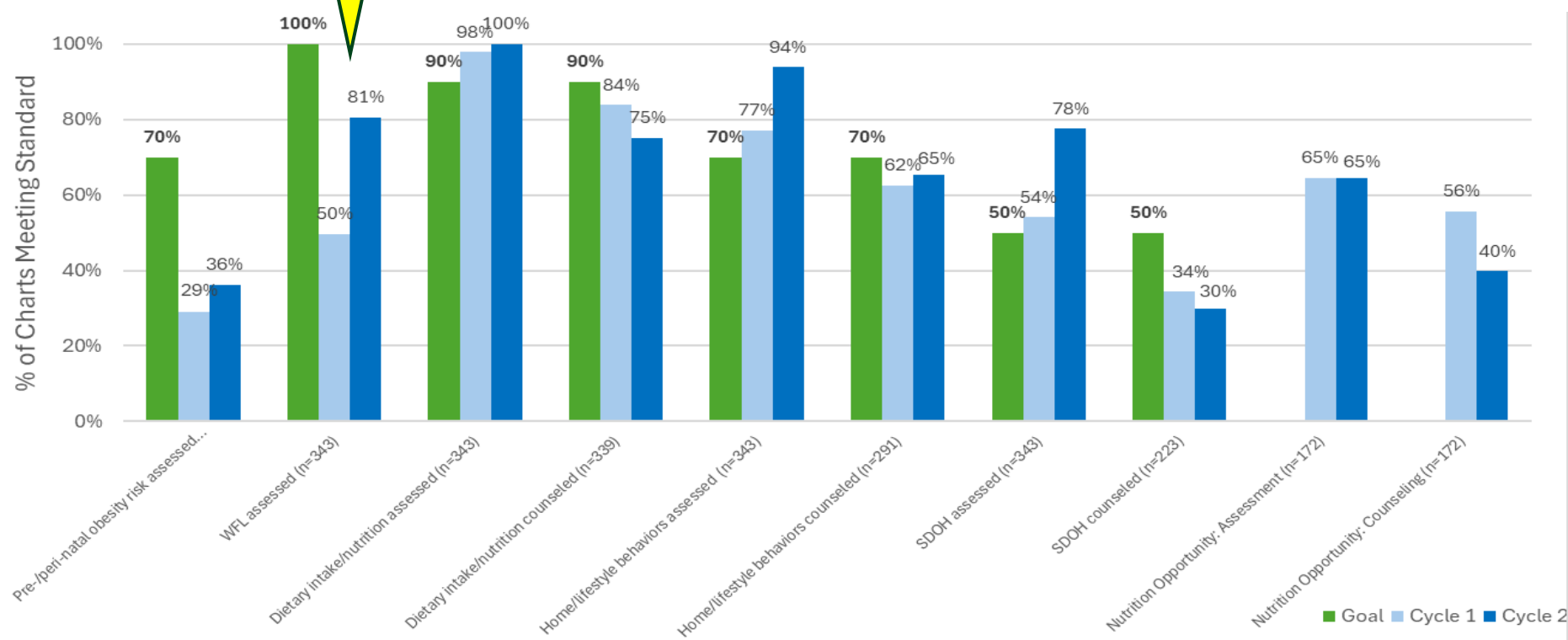
Measures and Subtopics

Measure Topic	Subtopics
Pre-/Perinatal Risk Assessment	(All documented) Parental obesity, Pre-natal smoking, Gestational weight gain, Gestational diabetes, Birth weight
Weight-for-Length Assessment	<u>Weight-for-length</u> Percentile documentation (not just weight and length)
Dietary Intake/Nutrition	(≥1 assessed/counseled) Breastfeeding/formula feeding, Complementary food introduction, Healthy/unhealthy foods or beverages, Picky eating, Snacking
Parenting/Home Lifestyle Environment	(≥1 assessed/counseled) Responsive feeding, Other parenting strategies, Food environment, Sleep routines or duration (other than safe sleep), Active play/physical activity routines, Media exposure/use
Social Determinants of Health (SDOH)	(≥1 assessed/counseled) Food security, Economic security/housing or living conditions, Parent/family health and well-being, Family strengths or supports

Results: Clinical Measures

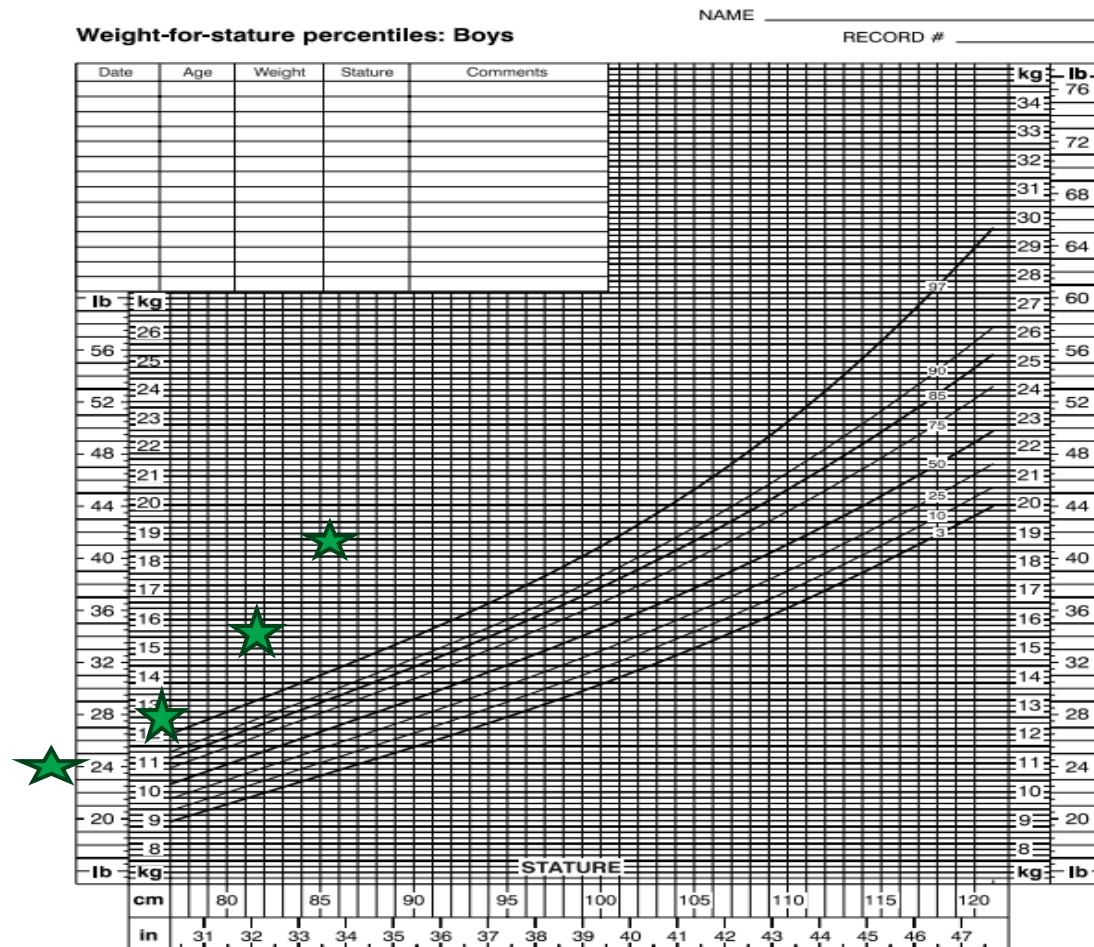
- Improvements in individual clinical measures varied by round.
- During each round >60% clinical measures were either significantly improved or routinely high.
 - Dietary intake/nutrition assessment was typically high (>90%) throughout.
 - Improvements were most consistent for pre/perinatal risk assessments and parenting /home lifestyle environment assessments and counseling.
 - Considerable room for improvement typically remained for pre/perinatal risk assessment & SDOH counseling.
 - Improvements were nearly always sustained between T3 and T4.

Percent of Charts Meeting Standard: Goal vs Cycle 1 vs Cycle 2 (Round 7)



When a child starts to leave the growth chart, ask questions about...

- Nutrition
- Activity
- Feeding practices
- Sleep
- Parenting
- Home environment
- SDoH



General Principles: Weight-related Conversations

- Be sensitive to family culture, beliefs, and circumstances.
- Use a strength-based approach.
- Focus on child growth and health.
- Communicate respect/trust through active listening.
- Ask open questions; be collaborative and solution-focused.
- Start conversations early and have them regularly.
 - Involve all relevant stakeholders.
 - Don't expect to address everything at once.
 - Use person-first language.
 - Acknowledge that both height and weight are the result of the interaction of heredity and the environment.

Adapted from "Fostering Positive Weight Related Conversations," UConn Rudd Center for Food Policy and Health. Available at:
<https://research.hollandbloorview.ca/sites/default/files/2019-10/WeightRelatedConversationsKTCasebook.pdf>

Weighing and Measuring

- **Rounds 1 and 2:** A common problem was identified with procedures for accurately weighing and measuring children <2 years.
 - A checklist was created, based on an HRSA training resource.
- **Round 3:** Completion of the checklist was piloted to increase team awareness and support accurate weighing and measuring.
 - Teams completed the checklist at 3 time points.
- **Round 4:** In addition to improving clinical measures, an extra specific aim was added of ≥ 1 team improvement to support accurate weighing and measuring.
 - Teams continued to complete the checklist x 3.
- Having accurate weighing and measuring as an aim was discontinued prior to Round 5 since it appeared to reduce the focus on clinical measures during this brief QI project.
- Instead, for **Round 5 and subsequent rounds**, a checklist to increase awareness about accurate weighing and measuring was added to be completed once as pre-work.
 - Results thus far support this change and the addition of the checklist to the intervention.

Weighing and Measuring Checklist

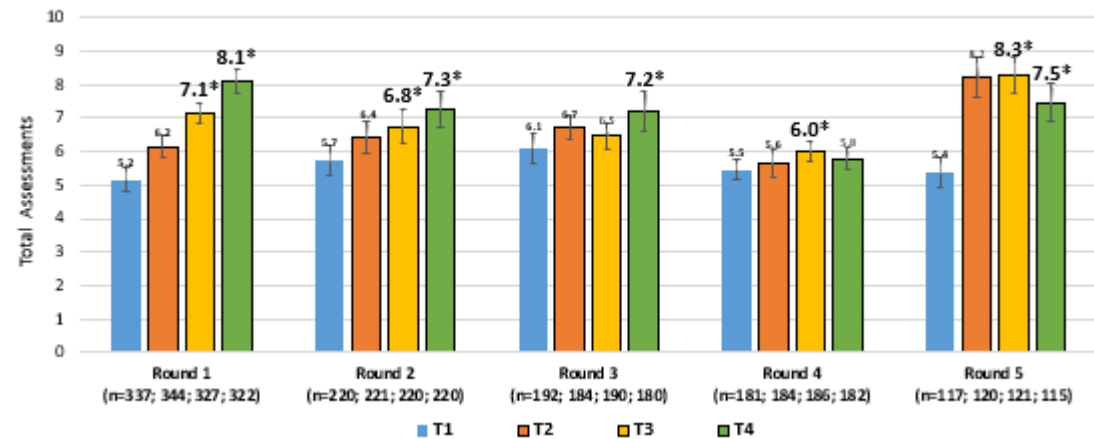
Category	Specific Aspect
Equipment	
Weighing	Quality (durable, safe, accurate) beam balance or electronic scales
	Scales that weigh up to 20 kg or 40lb
	Scales that weigh in 0.01 kg (10 gm) or 1/2 oz increments
	Scales with a tray large enough to support the infant
	Scales that can be easily 'zeroed'
	Scales that can be calibrated
	Scales without any attached length device
Measuring	Length boards specifically designed to measure length of infants/young children (rather than devices attached to scales or rulers or tapes on examination tables, etc.)
	Length boards that are sturdy and easily cleaned
	Length boards with a firm, flat horizontal surface and a measuring tape in 1 mm (0.1 cm) or 1/8-inch increments
	Length boards with an immovable headpiece at a right angle to the tape
	Length boards with a moveable foot piece, perpendicular to the tape
	Length boards specifically designed to measure length of infants/young children (rather than devices attached to scales or rulers or tapes on examination tables, etc.)
	Length boards that are sturdy and easily cleaned
	Length boards with a firm, flat horizontal surface and a measuring tape in 1 mm (0.1 cm) or 1/8-inch increments
Calibration	Scales are checked and 'zeroed' before each daily clinic
	Length boards are checked and zeroed before each daily clinic
	Scales are 'tested' with standard weights on at least a monthly basis.
	If movable, scales are calibrated after each time the scale is moved
	Length boards are checked with standard length rods on at least a monthly basis
	If movable, length boards are checked with standard rods after each time the equipment is moved

Procedures	
Weighing	Child is weighed
	Child is weighed nude or in a clean, dry diaper
	Child is centered on the scale tray
	Child is weighed to nearest 0.01 kg, 10 gm, or 1/2 oz
	Child is repositioned and weighed a second time, and weights are compared
	If weights do not agree within 0.01 kg, 10 gm or 1/2 oz, child is weighed for a third time, and the two weights in closest agreement are averaged
	Weight is recorded in the child's chart
	If infant is too active, the measure is postponed until later in the visit or parent is asked to step on a scale that is tared to zero, while holding infant
Measuring	Child is measured
	Child is measured without shoes and wearing light underclothing or clean diaper
	An assistant measurer holds the child's head so the child is looking upward and the crown of the head is against the headpiece ("Frankfort Plane").
	Measurer aligns the child's trunk and legs, extends both legs, and brings the footboard firmly against the feet
	Child's length is measured to the nearest 0.1 cm or 1/8 in
	Child is repositioned and remeasured a second time, and lengths are compared
	If lengths do not agree to the nearest 1 cm or 1/4 in, a child is measured for a third time and the two lengths in closest agreement are averaged
	Length is recorded in the child's chart
Training	
New staff (onboarding)	Accurately weighting children under two
	Accurately measuring children under two
Existing staff (refreshers)	Accurately weighting children under two

Impact of weight and measurement requirements

- Total assessments increased over time—often significantly improved from baseline at both T3 (end of collaborative) and T4 (monitoring cycle).
- **A notable exception occurred during Round 4: A specific aim was added to make improvement in weight /measuring and completing the Weight and Measuring checklist x3.**
- During Round 4, improvement in total assessments was not sustained, and total assessments were lower than during other rounds.
- During Round 5, after removal of the extra specific aim and change in requirements to complete the WM checklist only once rather than 3 times, robust significant increases in total assessments were again observed at both T3 and T4.

Mean number of total assessments per chart for all 4 data cycles in 5 rounds of the collaborative.



Measurement Equipment Challenges

SCALES

- Quality (durable, safe, accurate); tray large enough to support infant
- Weigh up to 20 kg/40 lb. and in 10 gram or half-ounce increments
- Easily 'zeroed'; can be calibrated
- **No attached length device**

LENGTH BOARDS

- **Designed for measuring infant/child length** (not on scales or rulers/tapes on exam table)
- **Firm, flat horizontal surface with a measuring tape in 1 mm (0.1 cm) or 1/8" increments**
- **Immovable head piece at right angle to tape**
- **Movable foot piece perpendicular to tape**

MAINTENANCE

- **Checked/zeroed daily**
- **Calibrated monthly or if moved**

Note: Bolded items indicate that a sizeable minority or most teams did not item have in place at baseline or unknown.

Weighing

- Child should be nude or in clean diaper.
- Center on scale tray.
- Weigh to the nearest 0.01 kg or ½ oz.
- **Reposition and weigh a second time.**
- **If weights don't agree, weight a 3rd time and average closest two values.**
- **Active child: Postpone to later in visit or ask parent to hold infant and step on scale tared to zero.**
- Train new staff; **hold regular trainings to maintain skills of existing staff** (or periodically assess skills).

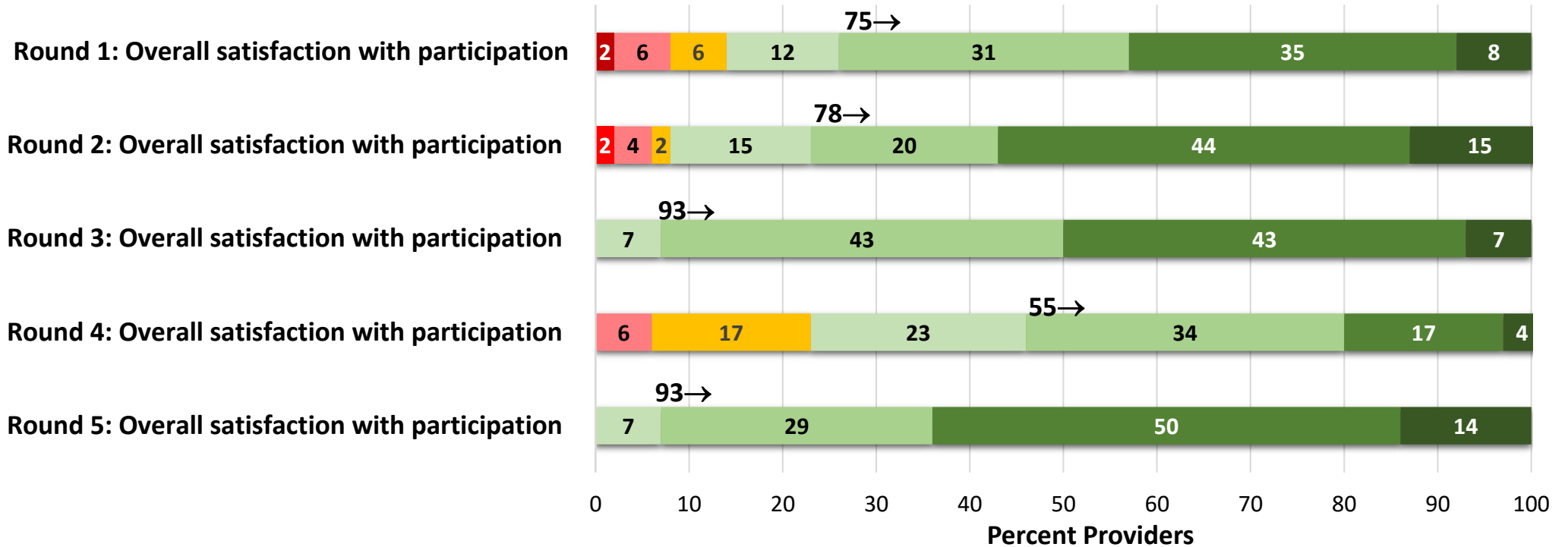
Note: **Bolded items** indicate that a sizeable minority or most teams did not item have in place at baseline or unknown.

Measuring Length

- Child is wearing light underclothing or clean diaper and no shoes.
- **Assistant holds child's head so looking upward and crown is against headpiece (Frankfort plane).**
- Measurer aligns child's trunk and legs, extends legs, brings footboard firmly against feet.
- **Measure to nearest 0.1 cm or 1/8 inch.**
- **Reposition, measure a second time.**
- **If measurements don't agree, measure a third time and average closest two values.**
 - About one-third of teams say they don't always measure to 1/8 inch.
 - About half of teams don't measure a second time; the other half sometimes measures a second time.

Note: Bolded items indicate that a sizeable minority or most teams did not item have in place at baseline or unknown.

Provider satisfaction



Conclusions

- Continued desire of pediatricians and teams to address early infant growth.
- Results support improved comprehensiveness of assessments and counseling provided by teams during well visits with children <2 years after participation in a 19-week QI collaborative to optimize infant and toddler feeding and health.
- Measuring and documenting weight/length and w/l percentile can be significantly improved.
- There are barriers and challenges to obtaining accurate weight and length measurements, which take time and effort to address.
- There is still no definition of infant overweight/obesity to focus interventions.
- A universal approach to improving infant growth was taken, tailored to each patient.
- Participation and provider satisfaction results support the feasibility of participation by providers in diverse primary care settings.

Change Package Resources – Growth

HRSA guidance on weighing and measuring: <https://depts.washington.edu/growth/index.htm>

WHO growth charts by age and sex (CDC website):

https://www.cdc.gov/growthcharts/who_charts.htm#The%20WHO%20Growth%20Charts

CDC WHO growth chart training: <https://www.cdc.gov/growth-chart-training/hcp/training/index.html>

[Conversations About Care Podcast](#): Episode 4 – Weight for Length

Thank you!



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