Web Table 1. Descriptions of BIV Identification Methods

Method	Weight		Height		BMI		Change [a]	Reference
External								
A	−5.0 ≤ Weight for age z-score ≥5.0		−5.0 ≤ Height for age z-score ≥ 3.0		−4.0 ≤ Weight for height or BMI z-score ≥ 5.0		Not applicable	CDC growth charts/WHO (8, 9) YRBS (10)
B	Male:	Female:	Male:	Female:	Male:	Female:	Not applicable	
			≤ 10 yrs:					
	13.62-90.72kg	13.62-90.72kg	0.94-1.68m	0.94-1.73m	11.5-41	11-40		
			11-12 yrs:					
	20.41-136.08kg	15.88-136.08kg	1.02-1.83m	1.02-1.83m	11.5-41	11-40		
			13-14 yrs:					
	27.22-181.44kg	27.22-181.44kg	1.27-1.98m	1.27-1.98m	13-55	13-55		
			≥ 15 years:					
	31.75kg-181.44kg	27.22kg-181.44kg	1.27-2.11m	1.27-1.98m	13-55	13-55		
C					8 > BMI value > 40		Not applicable	Lobstein et al (37)
Internal								
D							Omitted the largest and smallest changes (1%) in BMI values	Sturm et al (34)
E					BMI values > 4 standard deviations above/below the mean for sex and age		Not applicable	Conde et al (16)
F	Flagged values > 99th percentile or < 1st percentile of NHANES III for review; BIV determination made by comparing to other available						Not applicable	NHANES (18)

anthropometric values (e.g., waist circumference, DEXA)

Mixed [b]

G	$-6.0 \leq$ Weight for age z-score ≥ 6.0	$-6.0 \leq$ Height for age z-score ≥ 6.0	$-4.0 \leq$ Weight for height/BMI z-score ≥ 5.0	Annual age and sex specific mean changes of ± 3 SD in BMI Height decrements >1 inch Mean increases in height > 3 SD	Kim et al (3)
H	a) < 1st percentile minus 30% of median body weight b) >99th percentile plus 200% of median body weight	a) height < 30.5 cm b) height <1st percentile minus 30.5 cm c) height >221 cm d) height > 99th percentile plus 61 cm		Not assessed	Smith et al (31)
I	weight <4.5kg (excluded without review)	a) $-5.0 \leq$ Height for age z-score ≥ 3.0 (excluded without review) b) height <61cm (excluded without review)	a) BMI < 10 (excluded without review) b) Flagged: obese children with BMI or height differing by more than 15% or weight by more than 20% per year at a prior or subsequent visit within 2 years who also had any of: (1) BMI percentile > 99th (2) BMI > 120% of 95th percentile, (3) BMI *Z-score* ≥ 2.5 (4) BMI percentile = 95th–98th plus another BMI $\geq$95th percentile	Not assessed	Lo et al (17)

		Excluded: after review from expert pediatric endocrinologist [c]		
J			1) Flagged if either: a) increase or decrease of 50 or more BMI percentile points b) a change of 50% or more of their body weight Deleted if: a) flagged value exceeded value for age- and sex-exhibited in 2 most recent national surveillance data sets (i.e., NHANES III) b) flagged values showed weight change of greater than 50 lb per year or 60 lbs per year for youth who were obese at baseline as per individual review by expert pediatric endocrinologist c) a height change greater than 2 standard deviations above their normative height velocity change [d]	Lawman et al (29)
K		a) BMI values < 12 for pre-adolescents or 12.5 for adolescents b) BMI values > 3 SD above the mean excluded as outliers	Not assessed	Field et al (15)

Notes: Abbreviations: BIV=biologically implausible values; CDC=Centers for Disease Control and Prevention; NHANES=National Health and Nutrition Examination Survey; SD=standard deviation; WHO=World Health Organization; YRBS=Youth Risk Behavior Surveillance Survey. [a] Not applicable was noted for cross-sectional data, Not assessed was noted where longitudinal data were obtained but implausible change over time was not assessed. [b] Percentiles and z-scores refer to national reference data. [c] This criteria utilized longitudinal data in the determination of assessment for individual implausible values but did not assess criteria for implausible change over time. [d] According to Tanner J, Davies P. Clinical longitudinal standards for height and height velocity for North American children. The Journal of Pediatrics. 1985;107(3):317-29.

Web Table 2. Large-scale epidemiological studies and treatment of BIV identification.

	Reference	BIV Identification	Notes
1	Avon Longitudinal Study of Parents and Children(1)	Not mentioned	
2	National Longitudinal Study of Adolescent Health(2)	Not mentioned	
3	Padez et al. (3)	Not mentioned	
4	Sardinha et al (4)	Not mentioned	
5	Rolland-Cachera et al (5)	Not mentioned	
6	Savva et al (6)	Not mentioned	
7	Pediatric Rosetta Body Composition Project (7)	Not mentioned	
8	Kleiser et al (8)	Not mentioned	
9	Kobzová et al (9)	Not mentioned	
10	Health Behaviour in School-Aged Children Study (10)	Not mentioned	"out of range values were coded as missing"
11	Bogalusa Heart Study	Not Mentioned	
12	HEALTHY Study (11)	Not mentioned	
13	SNIPPY Study (12)	Not mentioned	
14	Savva et al (13)	Not mentioned	
15	Moreno et al (14)	Not mentioned	
16	Canadian National Longitudinal Survey of Children and Youth (15)	Not mentioned	
17	Health Survey for England (16)	Not mentioned	
18	Growing Up Today Study (17)	Insufficient information	See Table 1 in main document for criteria. No prevalence reported
19	Growing Up Today Study (18)	Insufficient information	BIV criteria: age-specific weight and height z-score below -6 or above 6 and BMI z-score below -4 or above 5 to identify BIV. No prevalence reported
20	Dennison et al (19)	Insufficient information	Visually examined individual plots of anthropometric data point (height, weight, BMI) by age and by identifying BIV for weight-for-height or BMI-for-age using WHO recommendations (z score < -4 or $>+5$). This examination revealed many cases in which the child's growth (height, weight, and BMI) was tracking linearly at high values that would be considered biologically implausible if only the

			individual measures were assessed. Children with consistently high measures ($N = 25$), although identified as biologically implausible, were retained for analysis
21	National Survey of Children's Health (20)	Insufficient information	"extreme height and weight values were recoded to reasonable height and low values to protect confidentiality and were flagged to indicate data were reported or assigned"
22	Youth Risk Behavior Surveillance (21)	Insufficient information	See Table 1 in main document for criteria. No prevalence reported
23	National Longitudinal Survey of Youth–Child Cohort (22)	Insufficient information	Data documentation reported flags for heights and weights outside of "what is considered normal for a child this age." The documentation reports if flags were verified by the interviewer and the number of flags.
24	National Health and Nutrition Examination Survey (23)	Insufficient information	"The data were edited for values that exceeded the capacity of the measuring equipment. Biologically implausible values were identified by examining age and sex-specific measurements that exceeded the 1st and 99th percentile values of the NHANES III distributions for each measure. A small number of observations that were implausible were set to missing." No prevalence reported.
25	Ohio Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (24)	Insufficient information	The weight-for-height z score (WHZ) was calculated for all available paired height and weight measurements. Because biologically implausible norms are available for WHZ, but not for BMI z scores, data cleaning was performed for the WHZ. Paired measurements were excluded if the height was outside the range used to calculate WHZ in the growth reference (77 to 121.5 cm) or if the WHZ was biologically implausible (WHZ ≤ 4 or >5). No prevalence provided.
26	Gleason et al (25)	Insufficient information	Study team members measured and weighed sample members in their schools, and 2,228 sample members (96% of the main SNDA-III analysis sample) had valid height and weight data. Those without valid data included a small number of

			children for whom height and weight measurements were never completed and a few others that were excluded because they had biologically implausible values. We used standards for biologically implausible values as defined by the World Health Organization
27	Lobstein et al (26)	Insufficient information	See Table 1 for criteria. No prevalence provided.
28	Ohio school surveillance data (27)	Insufficient information	No prevalence provided.
29	Early Childhood Longitudinal Study (28)	Complete	
30	Get Healthy Philly (29)	Complete	
31	Boston school surveillance data (30)	Complete	
32	Lo et al (31)	Complete	
33	Smith et al (32)	Complete	
34	Child Health and Human Development Study of Early Child Care and Youth Development (33)	Complete	
35	Weedn et al (34)	Complete	
36	Pediatric Nutrition Surveillance System (35)	Complete	
37	The Three City Study (36)	Complete	
38	Sekhobo et al (37)	Complete	
39	Novotny et al (38)	Complete	
40	California school surveillance data (39)	Complete	
41	Conde et al (40)	Complete	
42	New York school surveillance data (41)	Complete	

Web Table 3. Descriptions of BIV method development samples.

Method	Origin of Study or Data	Sample Size	Age	Characteristics	BIV related Psychometrics	Data Collection Year & Ref
External						
A	WHO recommendations using 1977 National Center for Health Statistics growth charts	22,917	birth-18 years	FELS infant data and nationally representative youth data	None	1977 (42, 43)
B	Youth Risk Behavior Surveillance	9,079	9-12 graders	nationally representative youth	None	2007 (21)
C	Health Survey for England	2,882	5-18 years	England nationally representative youth	None	1998 (26)
Internal						
D	Early Childhood Longitudinal Study	6,918	K -3rd graders	nationally representative youth	None	1998-2002 (28)
E	Brazilian National Nutrition and Health Survey	26,102	2-19 years	Brazilian nationally representative youth	None	1989 (40)
F	National Health and Nutrition Examination Survey III (2000 growth charts)	~10,000 per 2-year cycle	Birth-80+ years	nationally representative youth and adults	None	1999-2012 (23)
Mixed						
G	Boston school surveillance data	8,643	5-14 years	41% White 34% Black 14% Hispanic	None	1999-2003 (30)
	Longitudinal sample	5,301		11% Asian		
H	Kaiser Permanente Southern California medical records	710,949	2-19 years	Not provided	Proportion of false positives (valid data marked implausible) <5% for each selected BIV	2006-2008 (32)

					rule, except upper weight limit (8%)	
I	Kaiser Permanente Northern California medical records	42,559	3-5 years	26% White 24% Hispanic 22% Asian 6% Black	None	2007-2010 (31)
J	Get Healthy Philly longitudinal sample	13,662	1st-7th graders	64% Black 18% Hispanic 8% Asian 7% White	None	2011-2012 (29)
K	Growing Up Today Study	14,972	9-14 years	>90% White	None	1996-1999 (17)

Web Table 4. BIV prevalence rates in peer-reviewed publications across BIV identification methods.

Method	BIV prevalence in cross-sectional studies	BIV prevalence in longitudinal studies
External		
A	0.03% (36)	
	0.08% (33)	
	0.5% (44)	
	0.7% (34)	
	0.8% (41)	
	1.1% (38)	
	1.1% (39)	
	1.5% (37)	
	1.6% (45)	
	2%-3% (46)	
B	Unknown (47)	
C	Unknown (26)	
Internal		
D	1% (28)	1% (28)
E	1% (40) [a]	
F	Unknown	
Mixed		
G	0.2% - 0.3% (30, 48)	4.1% – 4.5% (30, 48)
H	0.6% (49)	
	2.0% (32)	
I	0.06% (31)	
J		0.3% (29)
K	Unknown (17)	

Notes: [a] Included prevalence of missing data and BIV combined

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