

Supplementary Table 1. Filtering for both the study cohorts

Filtering criteria	BCH		CUIMC	
	Observations	Individuals	Observations	Individuals
Extracted dataset	484 564	32 076	201 332	42 073
Keep subjects ≥ 2 years	376 391	28 210	201 332	42 073
Remove BIV height (Ht - z score < -5 or > 4)	373 526	28 178	201 091	42 056
Remove BIV BMI BMI z-score < -4	373 124	28 170	201 044	42 052
LMM1	367 937	28 148	200 174	42 041
LMM2	367 141	28 148	200 074	42 041
Subjects with ≥ 3 BMI observations	360 105	23 281	176 430	24 947
BMI observations ≥ 6 mths duration	355 579	22 352	174 729	24 444

Abbreviations: BIV = Biologically Implausible Value as defined by CDC

BMI = body mass index, BCH = Boston Children's Hospital, CUIMC = Columbia University Irving Medical Center

Supplementary Table 2. Demographic details of the replication cohort

BMI Class	Total	Normal BMI (BMI < 85)	Overweight (BMI 85-95)	Class 1 (BMI 95-120% BMI95)	Class 2 (BMI 120-140% BMI95)	Class 3 (BMI > 140% of BMI95)	All Obesity (BMI > 95)	Severe Obesity (BMI > 120% BMI95)
n (%)								
Total	24 444	14 669 (60.0)	4 463 (18.3)	3 809 (15.6)	1 146 (4.7)	357 (1.5)	5 312 (21.7)	1 503 (6.1)
Female	12 879 (52.7)	7 811 (48.9)	2 487 (52.0)	1 880 (51.7)	541 (53.1)	160 (53.8)	2 581 (48.6)	701 (46.6)
Race/Ethnicity								
White	2 442 (10.0)	1391 (9.5)	469 (10.5)	403 (10.6)	134 (11.7)	45 (12.6)	582 (9.7)	179 (11.9)
Black	1 832 (7.5)	1157 (7.9)	318 (7.1)	233 (6.1)	81 (7.1)	43 (12.0)	357 (6.7)	124 (8.2)
Latino	14 100 (57.7)	8172 (55.7)	2639 (59.1)	2398 (63.0)	700 (61.1)	191 (53.5)	3289 (61.9)	891 (59.3)
Asian	87 (0.4)	54 (0.4)	16 (0.4)	16(0.4)	0 (0.0)	1 (0.3)	17 (0.3)	1 (0.1)
Early onset obesity, (n=11,401)	2 108 (18.5)	7 (0.4)	116 (7.0)	1506 (94.9)	396 (95.2)	83 (100.0)	1985 (87.9)	479 (98.4)
Median (IQR)								
Min age, yrs	6.93 (10.5)	6.23 (10.7)	7.73 (10.3)	6.90 (9.6)	8.66 (8.7)	11.6 (7.8)	7.63 (9.7)	9.38 (8.9)
Max age, yrs	12.1 (10.0)	11.5 (10.6)	12.8 (9.1)	12.0 (9.3)	13.4 (8.0)	15.1 (6.7)	12.6 (9.0)	13.8 (7.7)
BMI z-score	-	0.11(1.05)	1.34 (0.3)	2.11 (0.3)	2.39 (0.3)	2.67 (0.3)	2.07 (0.5)	2.46 (0.4)
Modified BMI z- score	-	-	-	1.89 (0.6)	3.02 (0.8)	4.21 (1.3)	2.13 (1.1)	3.26 (1.2)

Definitions of BMI class based on CDC criteria

Supplementary Table 3. Details of the 3 clusters of Socio-Economic Status (SES)

Characteristic	Low SES*	Mid SES*	High SES*
Food insecurity	0.28 (0.07)	0.14 (0.07)	0.07 (0.03)
Unemployment rate	0.14 (0.05)	0.07 (0.05)	0.05 (0.02)
Poverty Rate	0.33 (0.12)	0.15 (0.10)	0.04 (0.03)
Median Income	30 819 (16 884)	62 208 (18 572)	100 227 (39 549)
Home Ownership	0.21 (0.27)	0.44 (0.21)	0.80 (0.04)

*Median (IQR)

Supplementary Table 4. Estimates on association of the longitudinal BMI classes with obesity with clusters of socio-economic status (SES)

	Total	Median SES		High SES	
		OR	p-value	OR	p-value
Class 1	2 619	1.06 (0.96-1.17)	.25	0.82 (0.73-0.92)	<.001
Class 2	1 152	0.94 (0.81-1.09)	.42	0.81 (0.69-0.95)	.01
Class 3	628	0.94 (0.78-1.15)	.57	0.67 (0.53-0.83)	<.001

Estimates obtained from multinomial regression models adjusting for sex, race/ethnicity and insurance status
BMI between 5-95th percentile is the reference for obesity class and low SES is the reference for the predictor of SES.

Supplementary Table 5. Probability of longitudinal class of BMI based on early onset obesity (EOO) status in the original cohort

n=12,322	Normal BMI		Overweight		Class 1 obesity		Class 2 obesity		Class 3 obesity	
	probability (95% CI)	p-value	probability (95% CI)	p-value	probability (95% CI)	p-value	probability (95% CI)	p-value	probability (95% CI)	p-value
No EOO	0.91 (0.91-0.92)		0.07 (0.06-0.07)		0.02 (0.02-0.02)		0		0	
Overweight	0.18 (0.16-0.20)		0.64 (0.61-0.66)		0.17 (0.15-0.19)		0.02 (0.0-0.02)		0.00	
Class 1 EOO	0.03 (0.03-0.04)	<.001	0.11 (0.10-0.13)	<.001	0.72 (0.69-0.74)	<.001	0.12 (0.10-0.13)	<.001	0.02 (0.10-0.13)	<.001
Class 2 EOO	0.01 (0-0.03)		0.0 (0-0.02)		0.10 (0.07-0.14)		0.68 (0.62-0.73)		0.21 (0.17-0.27)	
Class 3 EOO	0.01 (0-0.04)		0 (0)		0 (0)		0.06 (0.03-0.11)		0.93 (0.88-0.96)	

Abbreviations: EOO = Early Onset Obesity; BMI = body mass index, Probability based on multinomial model with longitudinal BMI class as the outcome and race sex and insurance status as the covariates.

Supplementary Table 6. Association of the Longitudinal Class of BMI with Cardiometabolic risk in the replication cohort

<i>BMI 5-95th percentile reference</i>	Class 1			Class 2		Class 2	
	n	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value
Total Cholesterol > 170 mg/dL	10 928	1.33 (1.2-1.5)	< .001	1.66 (1.4-1.9)	< .001	1.76 (1.4-2.2)	< .001
TG > 100 (< 9 yrs), > 130 mg/dL (> 9 yrs)	8 490	1.56 (1.4-1.7)	< .001	2.08 (1.8-2.4)	< .001	2.22 (1.7-2.8)	< .001
HDL-C < 40 mg/dL	8 365	1.91 (1.7-2.1)	< .001	2.75 (2.3-3.2)	< .001	3.34 (2.6-4.3)	< .001
LDL-C > 130 mg/dL	8 294	1.16 (0.9-1.4)	.21	1.78 (1.3-2.3)	< .001	2.21 (1.4-3.3)	< .001
non-HDL-C > 145 mg/dL	8 381	1.48 (1.2-1.8)	< .001	2.59 (2.1-3.2)	< .001	3.15 (2.3-4.3)	< .001
HgA1C > 5.7%	6 520	1.06 (0.9-1.3)	.55	1.80 (1.4-2.3)	< .001	2.10 (2.4-2.9)	< .001
ALT > 44 U/L in girls, >50 U/L in boys	9 688	1.67 (1.3-2.1)	<.001	2.12 (1.5-2.9)	< .001	2.54 (2.0-3.9)	< .001
Risk factor ≥ 2	14 126	3.47 (3.1-3.9)	<.001	5.49 (4.7-6.3)	<.001	7.26 (5.8-9.1)	<.001

Multivariable model with covariates: age of test, sex, race and ethnicity.

Abbreviations: ALT: alkaline transferase; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; TG: triglycerides; non-HDL-C: non-high-density lipoprotein cholesterol; Hba1c: Hemoglobin A1c.