

Childhood Cardiovascular and Diabetes Risk Factors Leading to Adult Diabetes and Cardiovascular Events

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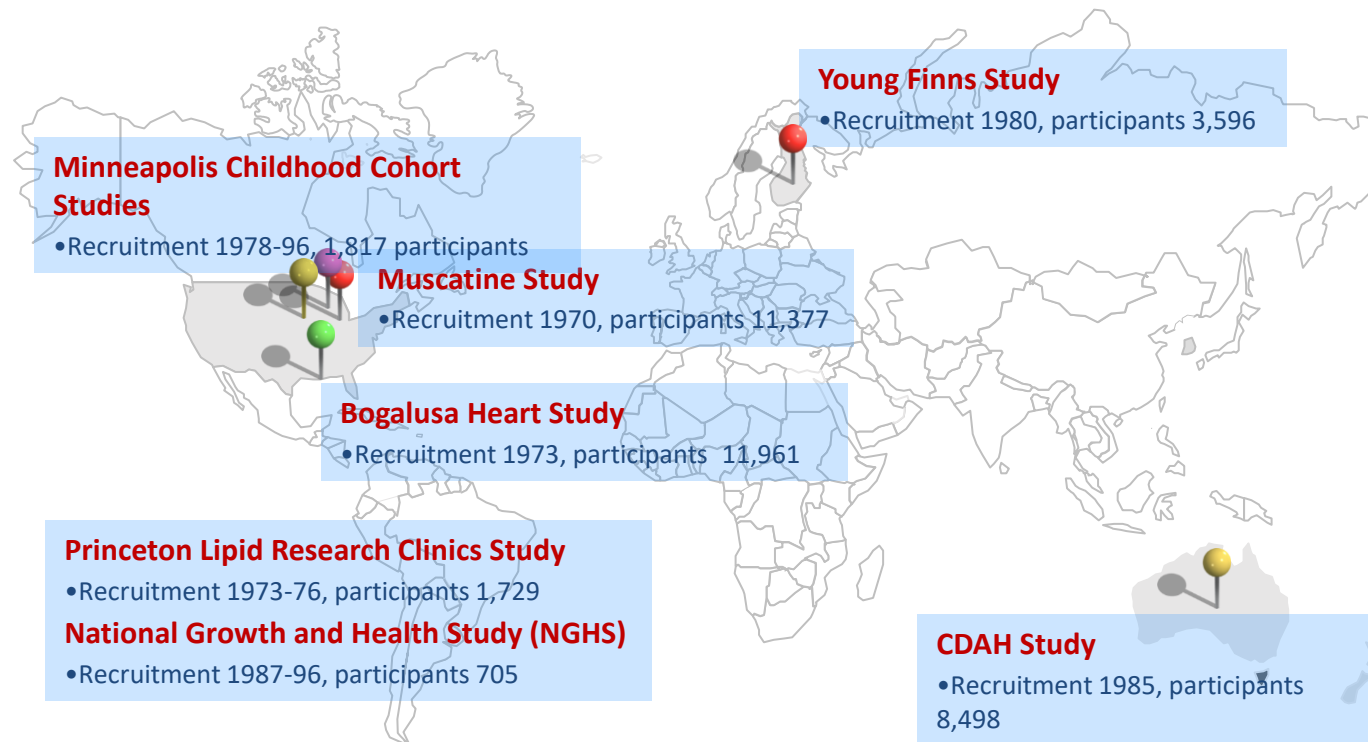
“I think it’s all been decided for us by the time we’re 5 years old - predisposition to diabetes, to high blood pressure, to obesity, to high cholesterol, perhaps even to nervous smoking.”

-Paul Dudley White, M.D.

The roots of cardiovascular disease in adulthood extend back into childhood

The International Childhood Cardiovascular Cohort (I3C)

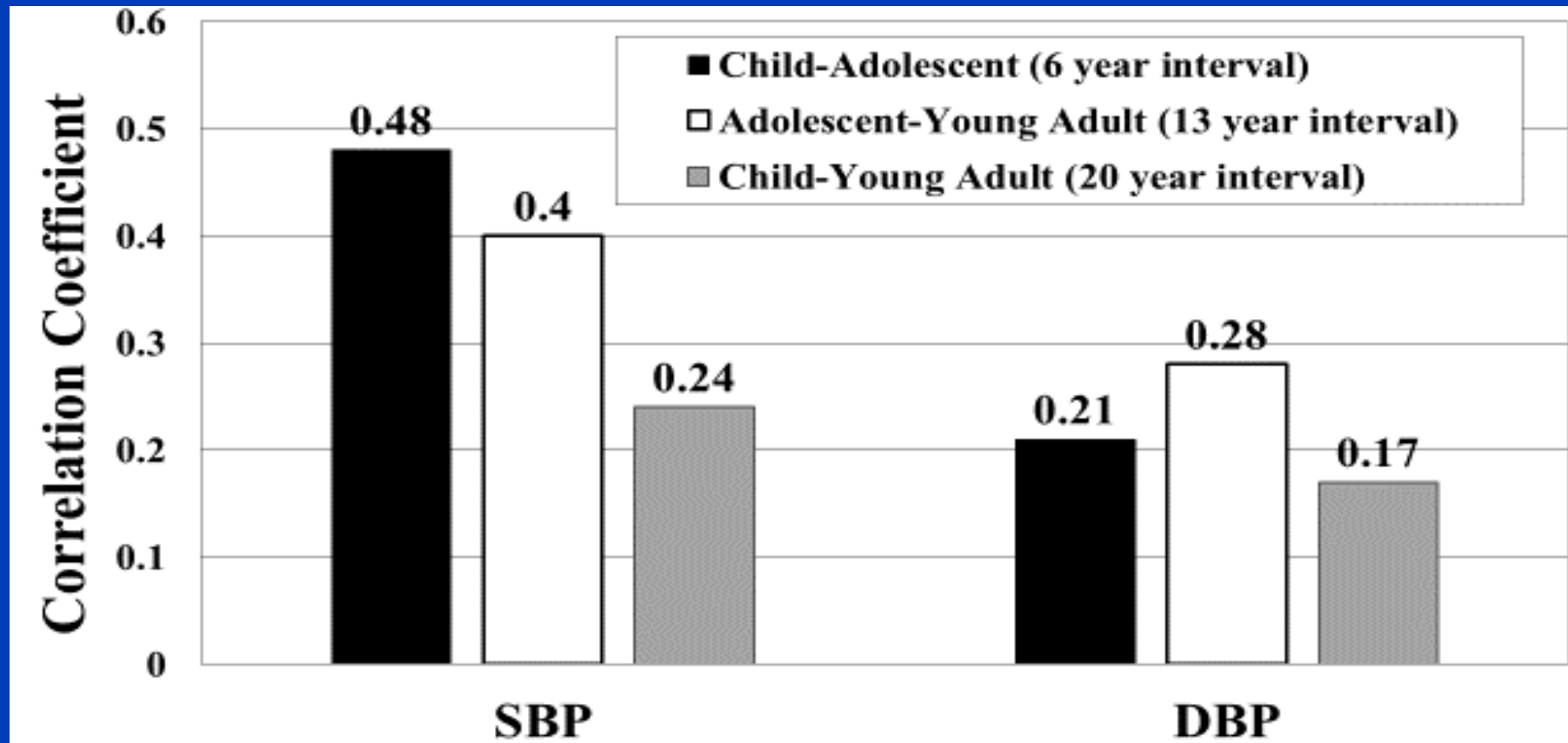
Child cohort studies with measurement of CVD risk factors were initiated in the 1970's



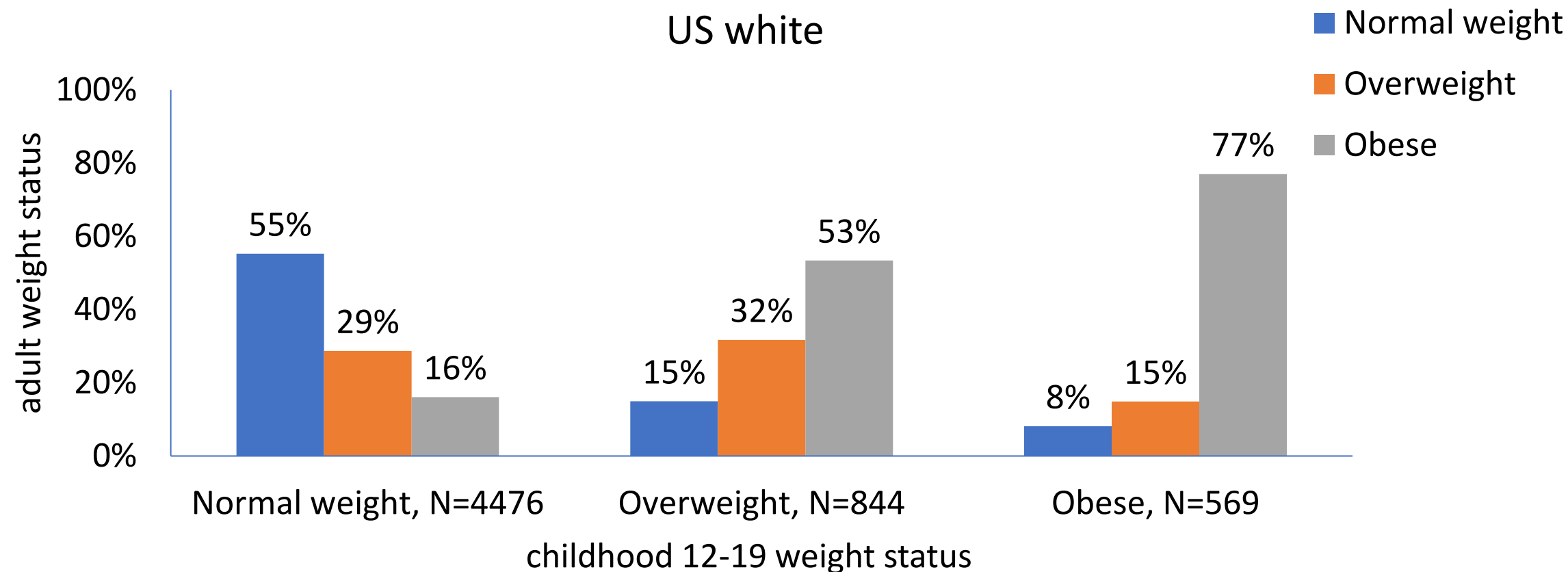
Early studies of cardiovascular (CV) risk factors (obesity, blood pressure, lipids) in childhood

1. Identified a broad range of levels of CV risk factors in childhood (BMI, Blood Pressure, Triglycerides, Total Cholesterol), with the highest levels thought to be abnormally elevated.
2. CV risk factors track through childhood.
3. CV risk factors track into young and mid-adulthood.

Spearman correlation coefficients for BP between age groups (average year intervals). All $p < 0.0001$.

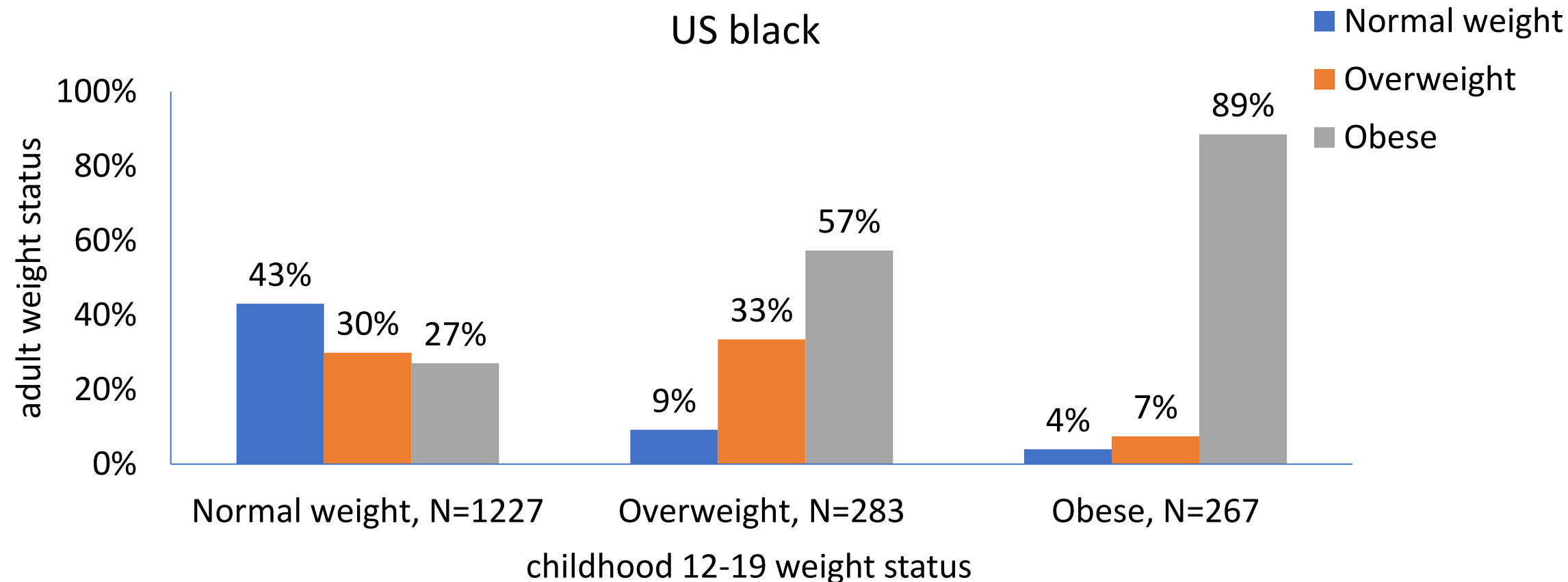


Relation of Adolescent (12-19 years) Weight to Adult Weight Status



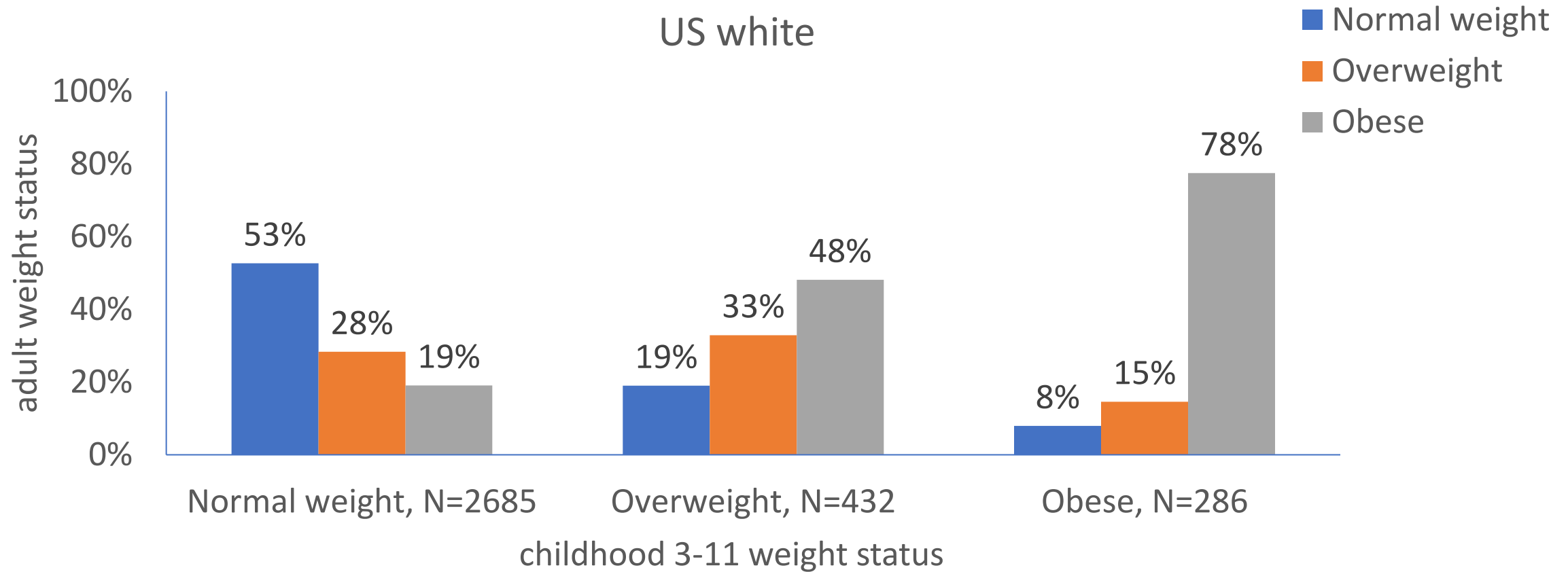
	Teen 12-19			
adult	Normal weight	Overweight	Obese	Total
NW	2447	128	41	2616
	55%	15%	7%	
OW	1289	296	109	1694
	29%	35%	19%	
Obese	740	420	419	1579
	17%	50%	74%	
Total	4476	844	569	5889

Relation of Adolescent (12-19 years) Weight to Adult Weight Status



	Teen 12-19			
adult	Normal weight	Overweight	Obese	Total
NW	549	26	9	584
	45%	9%	3%	
OW	357	90	23	470
	29%	32%	9%	
Obese	321	167	235	723
	26%	59%	88%	
Total	1227	283	267	1777

Relation of Childhood (3-11 years) Weight to Adult Weight Status

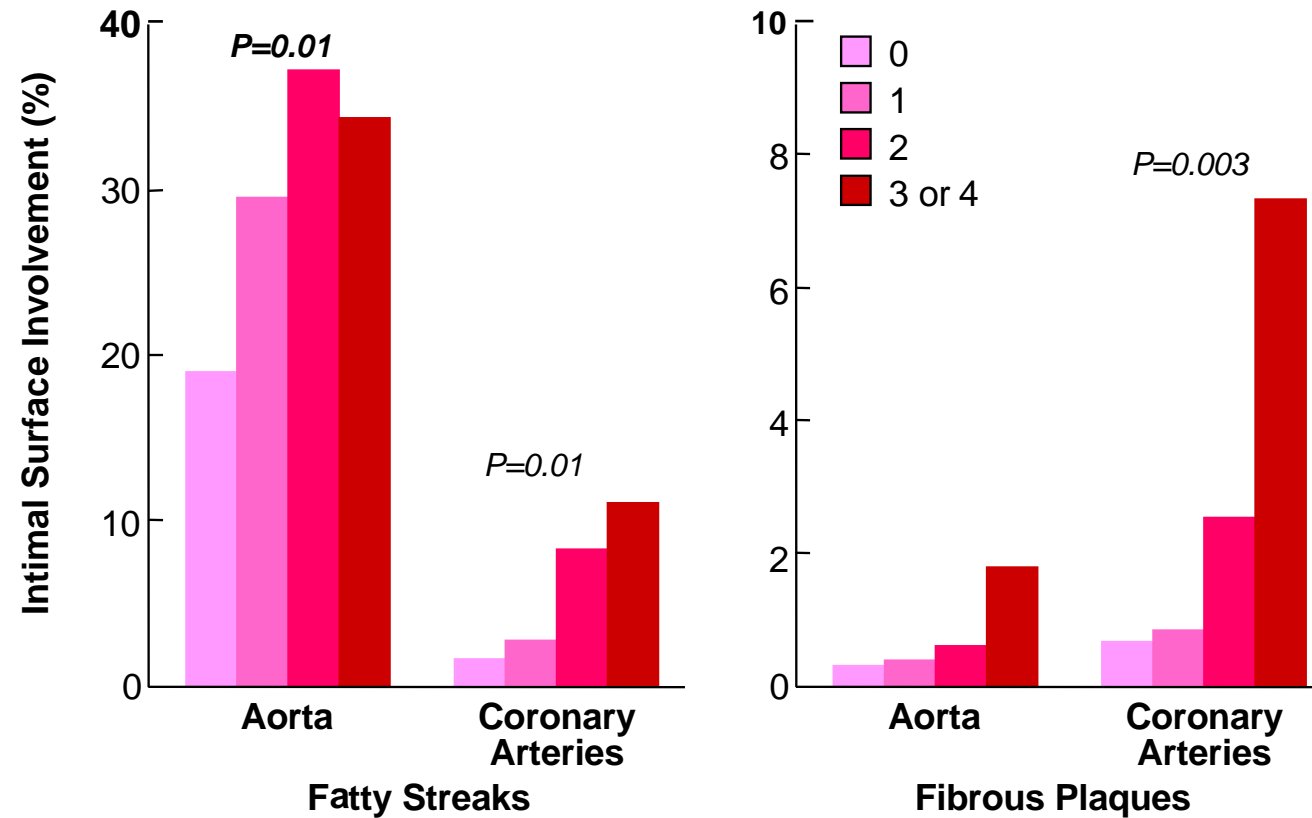


	child 3-11			
adult	Normal weight	Overweight	Obese	Total
NW	1412	81	23	1516
	53%	19%	8%	
OW	750	142	45	937
	28%	33%	16%	
Obese	523	209	218	950
	19%	48%	76%	
Total	2685	432	286	3403

Change in BMI categories from childhood to adolescence

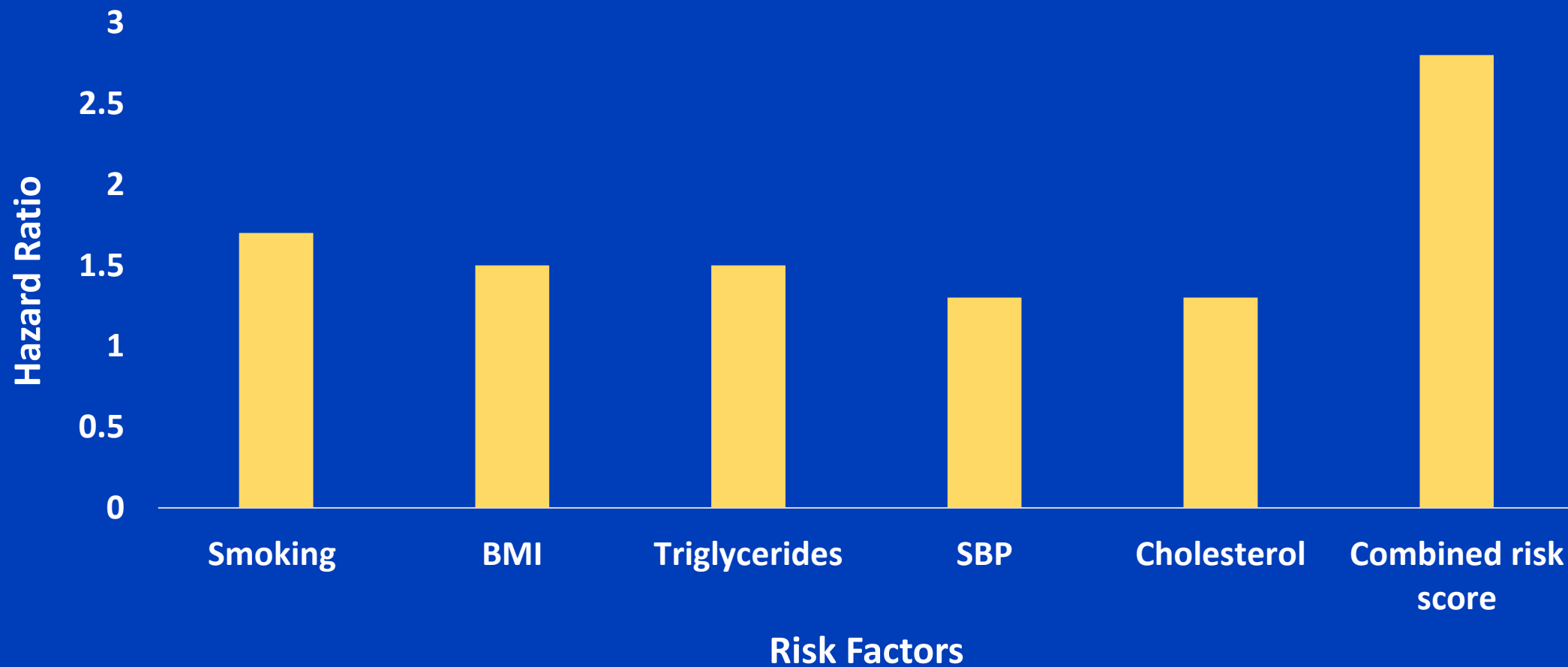
		Adolescent BMI Category			
Childhood BMI Category	N	Low normal (5-49%tile)	High normal (≥50-84%tile)	Overweight (≥85-94%tile)	Obesity (≥95%tile)
Low Normal (5-49%tile)	1975	1361 (69%)	549 (28%)	49 (2%)	16 (1%)
High Normal (≥50-84%tile)	1867	312 (17%)	1202 (64%)	29 (16%)	55 (3%)
Overweight (≥85-94%tile)	624	12 (2%)	182 (29%)	305 (49%)	125 (20%)
Obesity (≥95%tile)	432	5 (1%)	24 (6%)	87 (20%)	316 (73%)

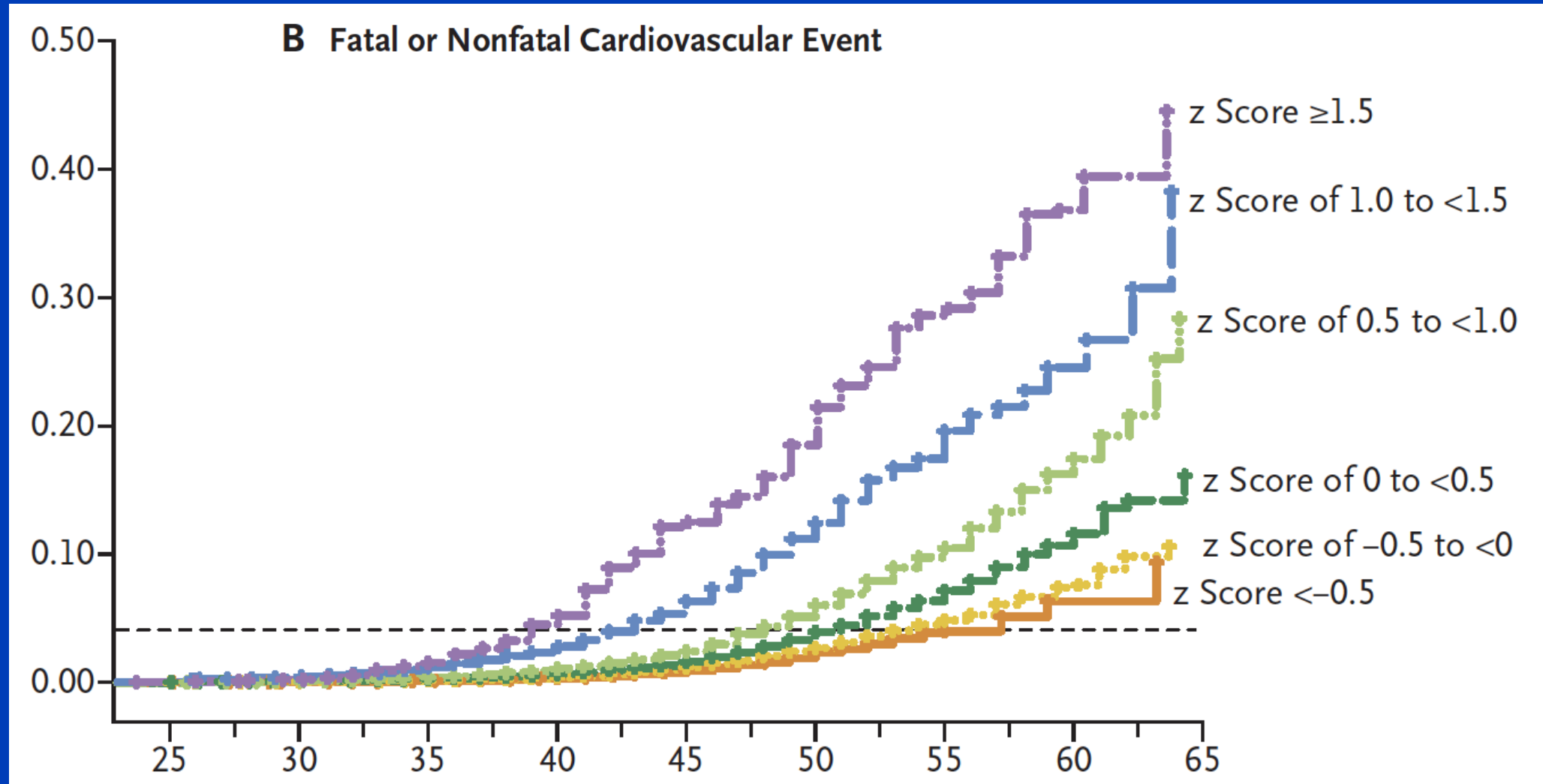
The Effects of Multiple Risk Factors on the Extent of Atherosclerosis in the Aorta and Coronary Arteries in Children and Young Adults



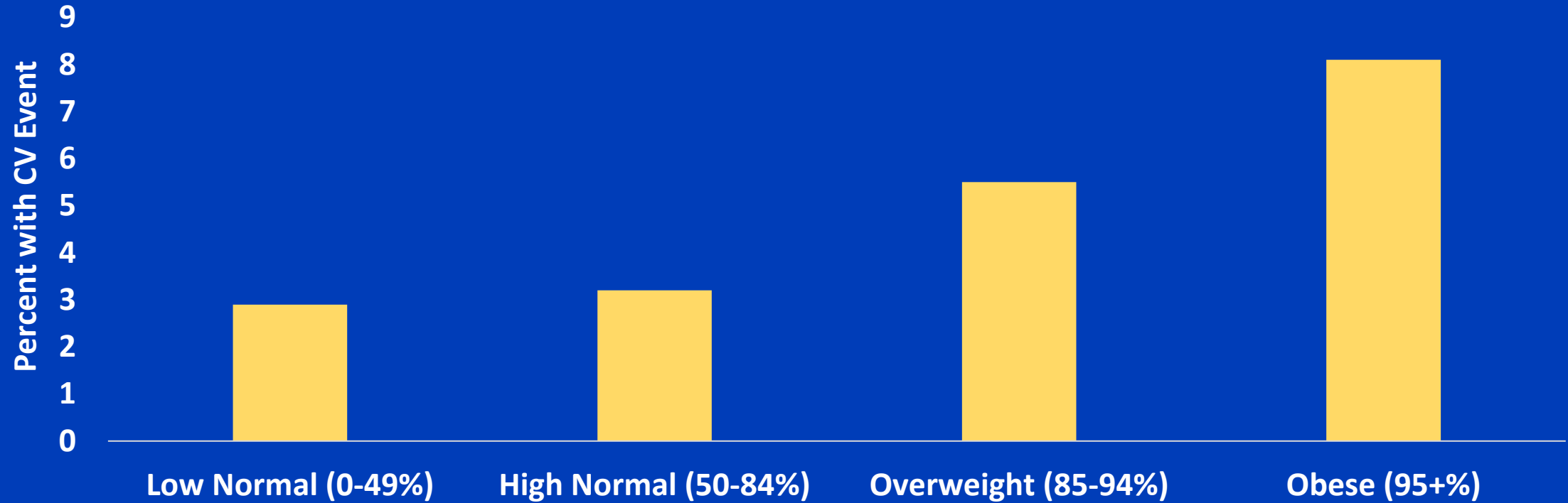
Berenson G, et al., NEJM 1998;338:1650-6

**Relation in i3C (N=38,589)
Between CV Risk Factors and CV Events (N=779)**



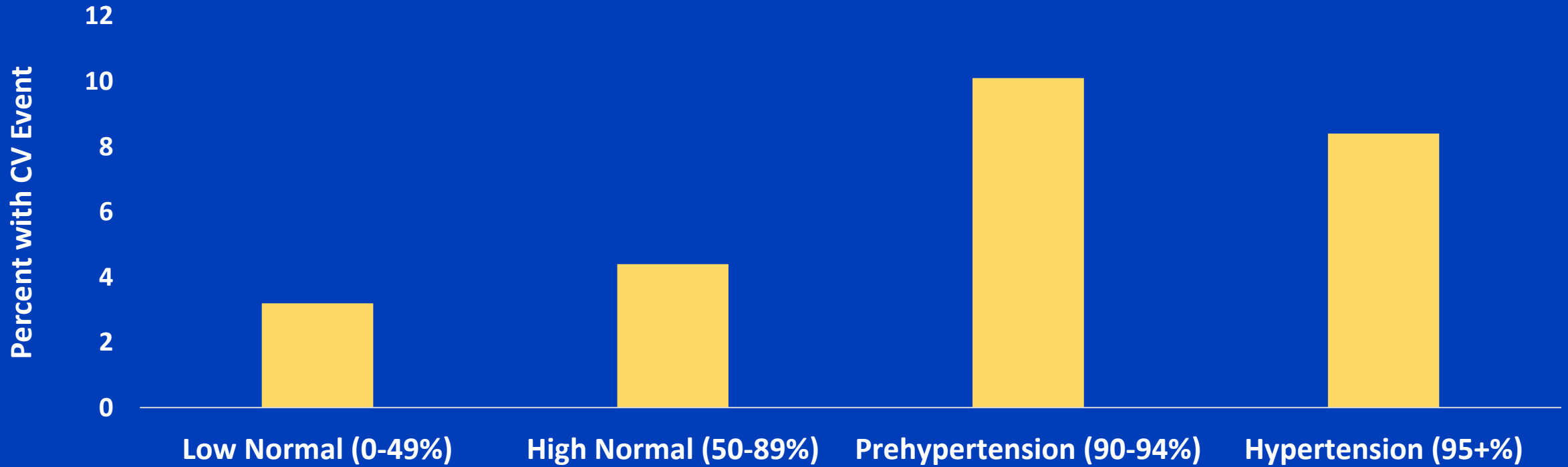


CV Events by BMI Clinical Category



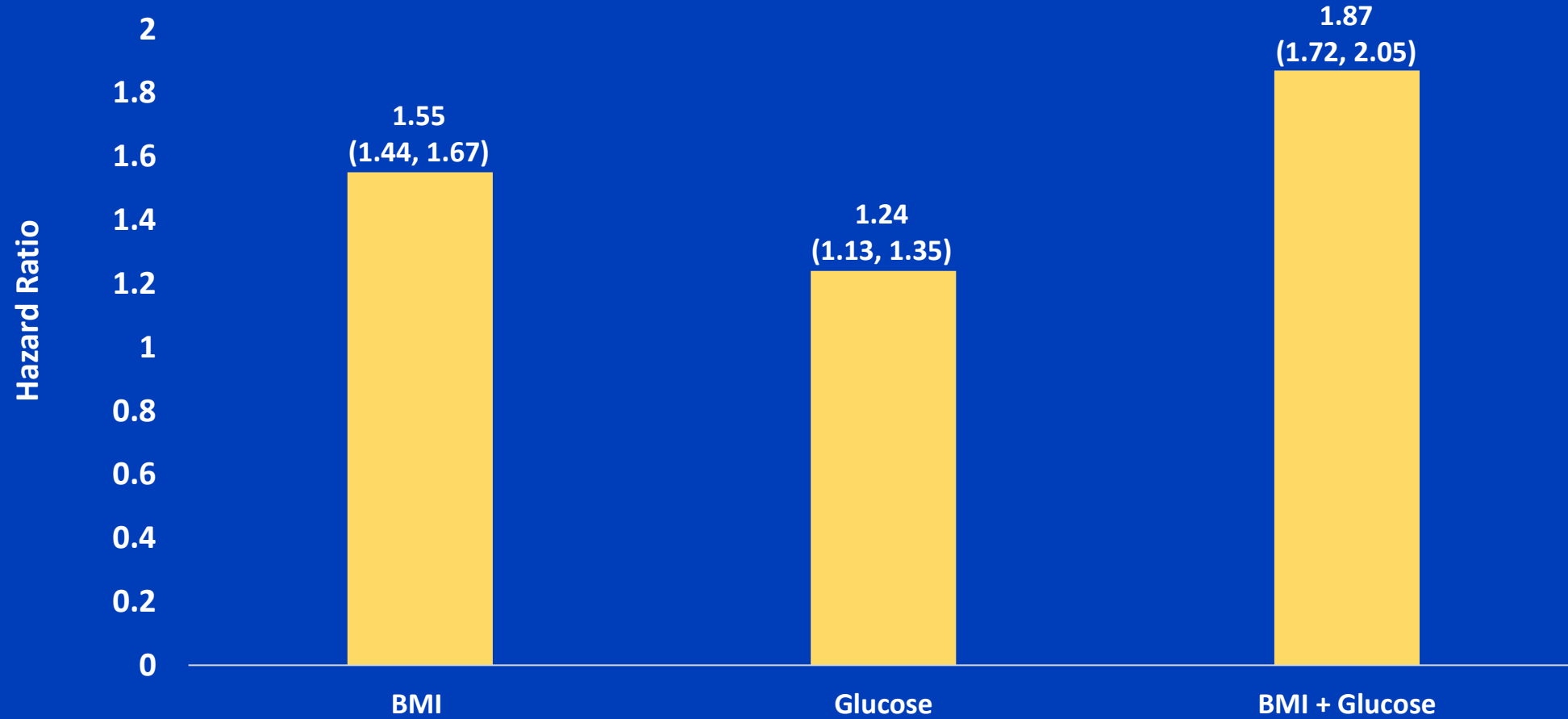
N with CV Event	237	280	134	117
Total N (%) in Category	8,048 (39)	8,688 (42)	2,423 (12)	1,440 (7)
Hazard Ratio Mean (C.I)	Reference	1.19 (1.01-1.4)	1.92 (1.62-2.27)	3.39 (2.73-4.21)

CV Events by Blood Pressure Clinical Category

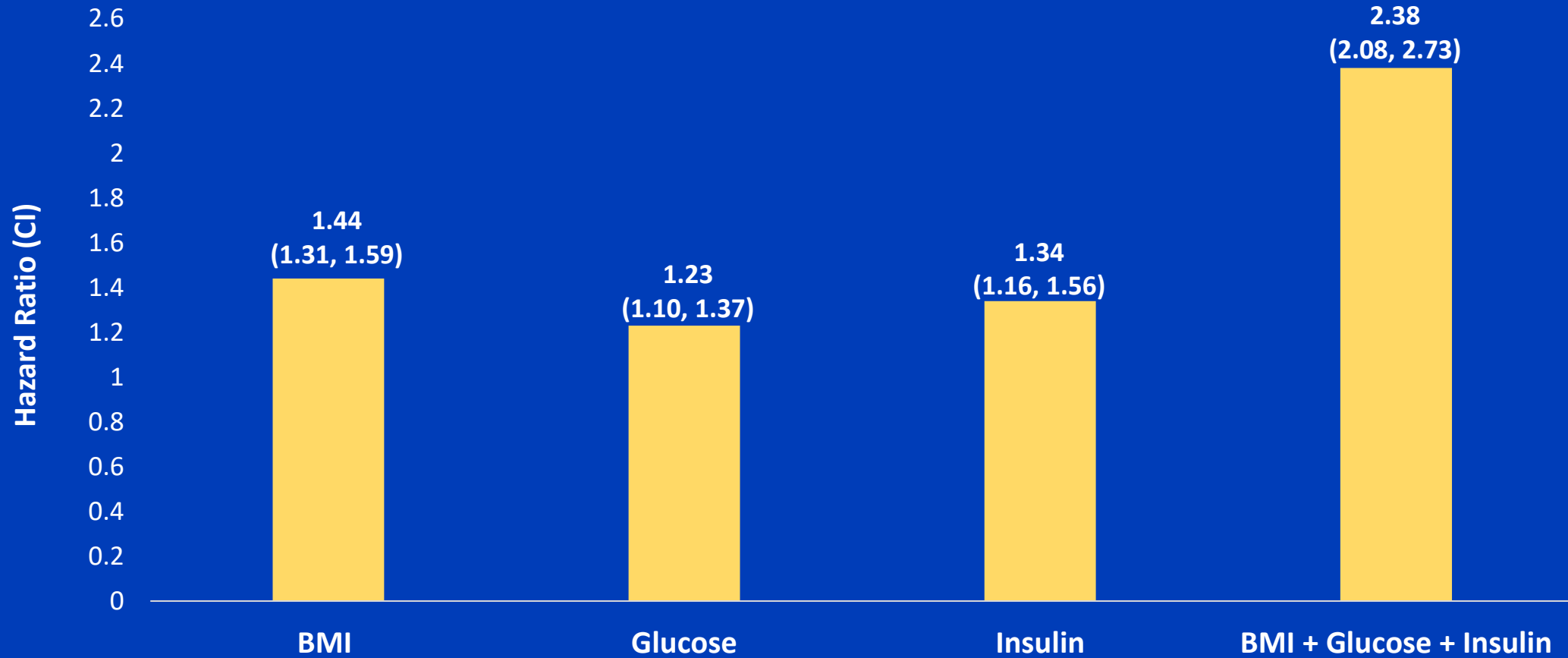


N with CV Event	288	346	67	67
Total N (%) in Category	8,879 (49)	7,942 (43)	666 (4)	801 (4)
Hazard Ratio Mean (C.I.)	Reference	1.46 (1.26-1.69)	1.99 (1.48-2.67)	2.31 (1.74-3.07)

Relation Between Childhood Glucose and BMI Z-Scores and Adult Type 2 Diabetes



Relation Between BMI, Glucose, and Insulin Z-Scores and Adult Type 2 Diabetes



Conclusions

1. We can now confirm a significant relation between CV risk factors in childhood and CV events and between risk factors in childhood and type 2 diabetes.
2. This relationship begins in young (prepubertal) children.
3. Most adults with CV events were children with normal levels of CV risk factors.
4. We believe It is time to develop effective public health strategies to prevent early CV disease, CV events, and type 2 diabetes.

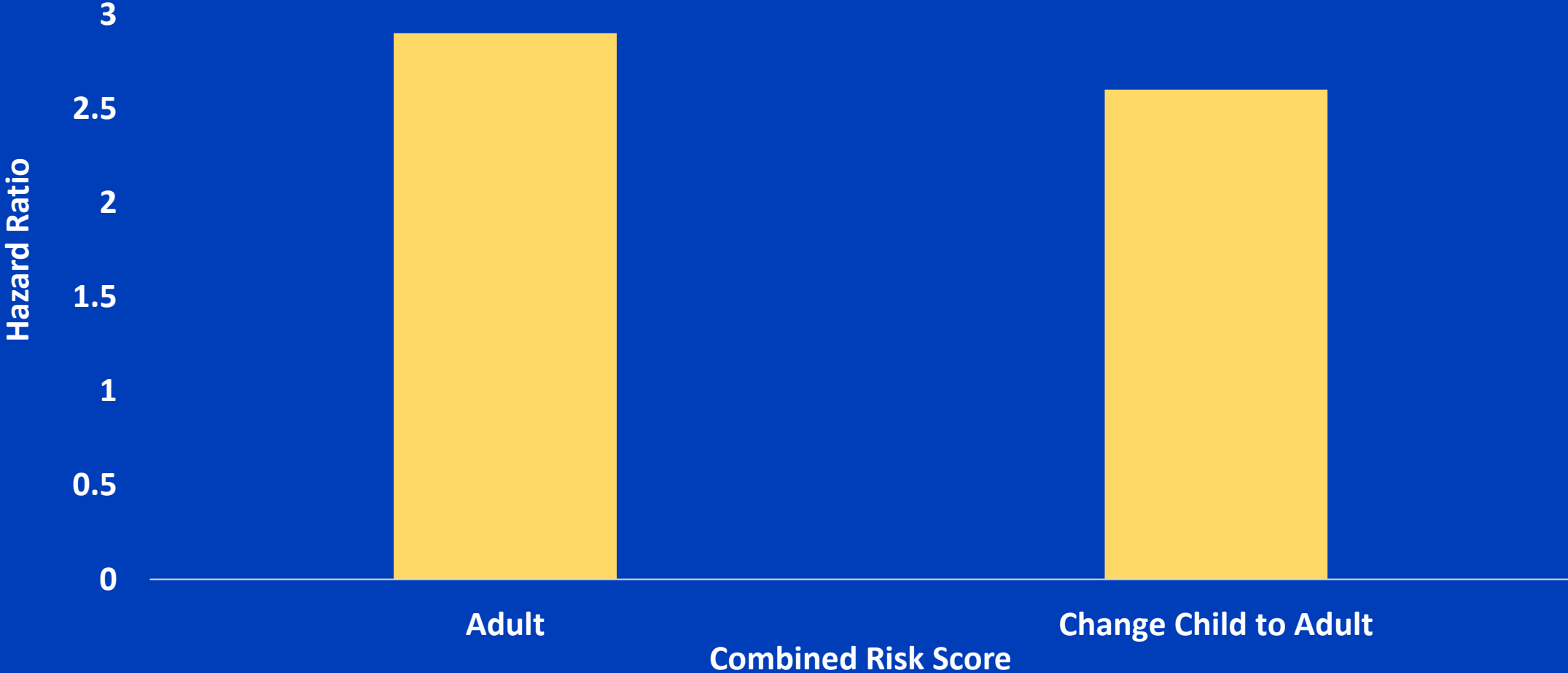
Co-Authors for Study

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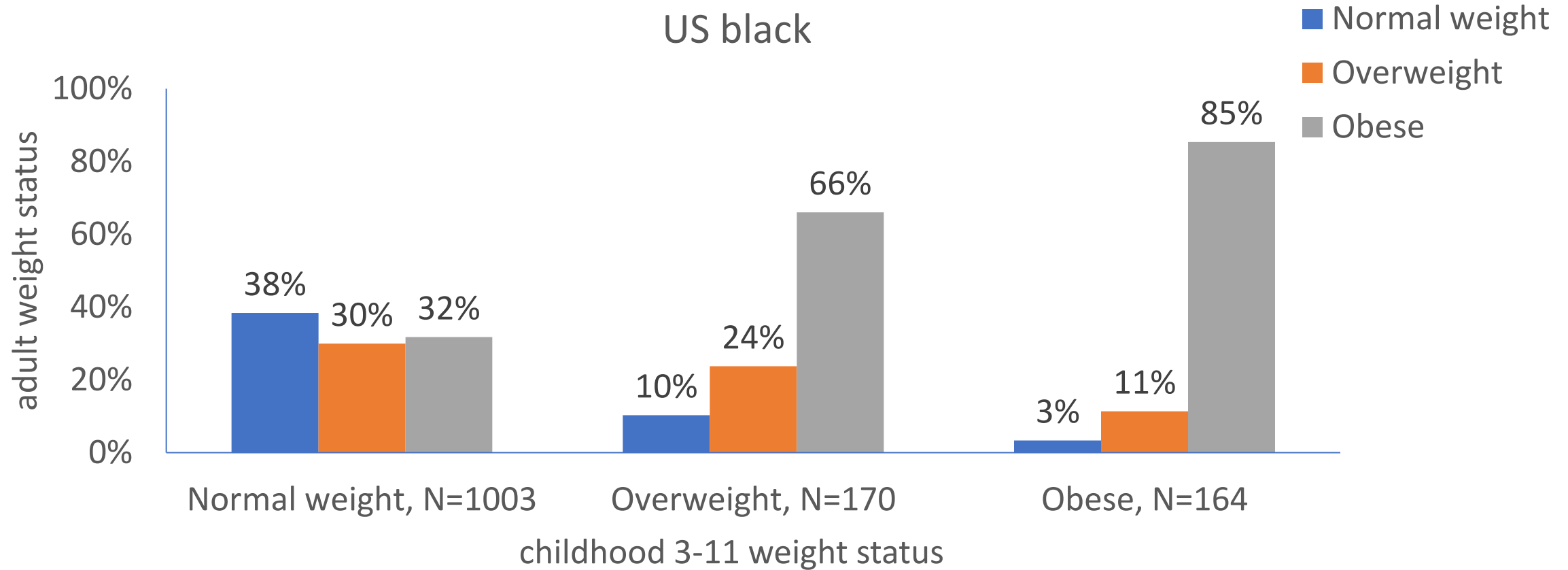
What is known about childhood cardiovascular (CV) risk factors and their relationship to adulthood to support the hypothesis that cardiovascular disease has its origins in childhood?

- 1. There is a broad range of levels of CV risk factors in childhood and the highest levels are thought to be abnormally elevated.**
- 2. CV risk factors track through childhood.**
- 3. CV risk factors track into young and mid-adulthood.**
- 4. CV risk factors predict pre-clinical atherosclerosis (carotid intima-media thickness).**
- 5. Autopsy studies in young individuals show an association between antemortem levels of CV risk factors and histologic atherosclerotic lesions in coronary arteries and aorta.**

Adult Risk Score and Change in Risk Score Child to Adulthood



Relation of Childhood (3-11 years) Weight to Adult Weight Status



	child 3-11			
adult	Normal weight	Overweight	Obese	Total
NW	384	19	6	409
	38%	11%	4%	
OW	300	39	20	359
	30%	23%	12%	
Obese	319	112	138	569
	32%	66%	84%	
Total	1003	170	164	1337

The International Childhood Cardiovascular Cohort (I3C)

Child cohort studies with measurement of CVD risk factors were initiated in the 1970's

