Gains in income during early childhood are associated with decreases in body mass index z-scores among children in the United States

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BACKGROUND

- Children with low family income in the United States (U.S.) are disproportionality burdened by overweight and obesity compared to those with a high family income.

- However, few studies have leveraged longitudinal data to investigate the impact of changes in family income on changes in children's body mass index (BMI) z-score.

OBJECTIVE

- To assess whether gains in family income are associated with changes in BMI z-score.

CONCEPTUAL MODEL

Gains in Family Income

- Changes in the neighborhood environment
- Healthy foods are more affordable
- Increased awareness of health issues
- Emphasis on purchasing foods based on health value

Improved diet quality and increased physical activity

Decreased BMI z-score

METHODS

- We used longitudinal data from the nationally representative Early Childhood Longitudinal Survey Birth Cohort (n≈ 9,300).

- Children were born between 2000-2001. Anthropometrics and family income were assessed at 2-, 4-, 5- and 6-year visits.

- We used gender-stratified, individual fixed-effects linear regression models to compare children to themselves over time.

- Fixed-effects models control for all baseline time-invariant factors (e.g. sex, race/ethnicity) and unmeasured confounding factors. Models additionally controlled for time-varying confounders including number of siblings, household structure, age, and age squared.

RESULTS

Sample Characteristics (n≈9,300)[1]

Characteristic	Means or % (SE)[2]
Mean Age (years)	4.29 (0.01)
Mean BMI z-score	0.63 (0.02)
Sex	
Female	49.0 (0.76)
Male	51.0 (0.76)
Race/Ethnicity	
White	53.7 (1.73)
Hispanic	22.9 (1.26)
Black	17.0 (1.02)
Asian	3.51 (0.21)
AI/AN	2.83 (0.29)
Household Income	
$0 - $10,000	8.08 (0.44)
$10,001 - $25,000	21.1 (0.65)
$25,001 - $35,000	12.4 (0.38)
$35,001 - $50,000	15.3 (0.39)
$50,001 - $75,000	15.5 (0.47)
$75,001 or above	27.6 (1.18)

AI/AN = American Indian/Alaska Native; SE = standard error
[1] Means, percentages and standard errors based on sample weighted data. Sample size is rounded to comply with the data reporting agreement.
[2] Taylor series linearized standard errors.

Average Changes in Family Income and BMI z-score by Gender (n≈ 9,300)[1]

	Change in Family Income (SE)[2]	Change in BMI z-score[3] (SE)[2]
Overall	$7,345 ($501)	0.14 (0.03)
Sex		
Female	$7,100 ($672)	0.19 (0.03)
Male	$7,579 ($586)	0.10 (0.03)

SE = standard error
[1] Means and standard errors based on sample weighted data and sample size is rounded to comply with the data reporting agreement.
[2] Taylor series linearized standard errors.
[3] Age- and sex-specific BMI z-scores use the Centers for Disease Control and Prevention growth charts.

Individual Fixed-Effects Linear Regression for the Relationship Among Gains in Income and BMI z-score by Gender[1,2]

	β [3] (95% Confidence Interval)	
	Females n≈ 4,550[4]	Males n≈ 4,650[4]
Income per $10,000	-0.013 (-0.024, -0.001)*	-0.003 (-0.013, 0.007)
Income per $10,000 x preterm[5]	Not Applicable	-0.038 (-0.069, -0.008)*

[1] Coefficients are based on sample weighted data.
[2] Age- and sex-specific BMI z-scores use the Centers for Disease Control and Prevention growth charts.
[3] Adjusted for number of siblings, household structure, age, age squared, and child fixed effects.
[4] Sample size is rounded to comply with the data reporting agreement.
[5] We tested whether the relationship varied by race, baseline poverty status, preterm status and very-low birthweight and retained only those interactions that were significant at the α = 0.10 level. The association of income with BMI z-score among preterm boys is β income + β incomeXpreterm = -0.042 (95% CI: -0.070, -0.013).
* p-value <0.05

CONCLUSIONS

- Gains in family income are associated with a significant decrease in BMI z-score among girls and *pre-term* boys. Among term boys, changes in family income were not significantly related to BMI z-score.

- By comparing children to themselves over time, we provide stronger evidence that gains in income during early childhood may promote healthy weight outcomes among girls 2 to 6 years old.

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