# The Effect of School Lunch Program on Childhood Obesity

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*World Class. Face to Face.*

## Introduction

• **Childhood obesity problem** raises new social issue in developed countries by changing societal attitudes

• **National School Lunch Program (NSLP)** can be effective policy tool to control childhood obesity

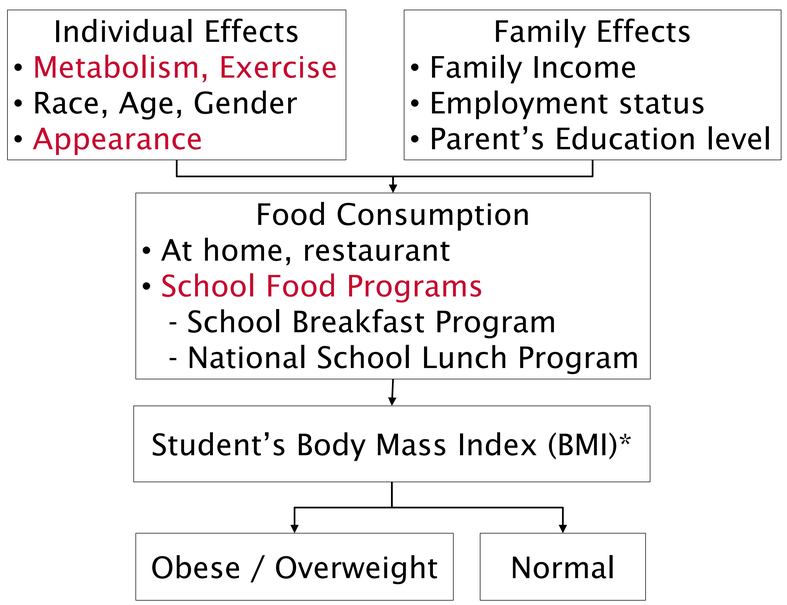
• We Investigate effects of enrollment in NSLP on student's BMI

• We set up a **student's utility maximization problem** to choose food between school lunch or outside restaurants

• We focus on **twin students in ECLS-K data** to control identification problems

- Nationwide longitudinal study from kindergarten to 8th grade, 15000 students in 100 different school

• We analyze empirical relationship between participation in NSLP and student's BMI




• Independent variables

* : Do not consider underweight

## Results

### Theoretical Model: Utility Maximization Problem of Twin

$$\max_{\{q_{\tau i}\}} U = U\left(Z, H, BMI\right)$$

$$\text{s.t. } Z = Z\left(\sum\nolimits_{\tau} q_{\tau i}; c_{\tau}\right), \quad H = \overline{H}$$

$$BMI = \delta\left(Z + H\right) - CO$$

$$i = 1(\text{NSLP}), \; 0(\text{Otherwise})$$

$$\frac{dBMI^{*}}{dq_{\tau 1}^{*}} = \delta\left[\frac{\partial Z}{\partial q_{\tau 1}^{*}} + \frac{\partial Z}{\partial q_{\tau 0}^{*}} \frac{\partial q_{\tau 0}^{*}}{\partial q_{\tau 1}^{*}}\right]$$

### Ordinary Least Square (OLS) Model
### Overall (N=5584) / Obese (N=606)

| | Overall | | Obese | |
|---|---|---|---|---|
| | Coeff. | Std.Err | Coeff. | Std. Err |
| $BMI_{t-1}$ | .930*** | .015 | .402*** | .148 |
| Calorie-in | .020 | .023 | -.118 | .077 |
| Exercise | -.079*** | .023 | -.051 | .134 |
| Loose weight | 1.06*** | .103 | -2.00 | 1.23 |
| Buying frequency in school | .045* | .024 | .429** | .211 |
| SLP | .222** | .104 | -1.05 | .757 |
| Constant | 3.61*** | .362 | 24.7*** | 5.40 |
| $R^2$ | | .58 | | .05 |

### Generalized Estimation Equation (GEE) Model
### Twin students (N=168)

| | Normal | | Binary | |
|---|---|---|---|---|
| | Coeff. | Std.Err | Coeff. | Std. Err |
| Calorie-in | .690*** | .190 | .960* | .540 |
| Exercise | .089 | .238 | -.040 | .097 |
| Loose weight | -.470 | 1.25 | .133 | .521 |
| Buying frequency in school | .282 | .218 | .321*** | .132 |
| SLP | 1.25 | 1.47 | .684 | .676 |
| Constant | -.626 | 1.59 | .063 | .558 |



## Why twins?

• Control environmental, biological unobservable variables

- Family characteristics, innate ability

• Eliminate any absolute ability bias in BMI difference

## Key Findings

• NSLP effect on student's BMI is determined by size of marginal product of NSLP and outside restaurant

• BMI determinants of obese students are **different** to overall students

• **Total amount of calorie**, **buying frequency from vending machine in school** affect to increase twin's BMI difference

### Policy Implication

**• Reduce number of vending machines in school**

**• Provide low calorie foods in both NSLP and vending machine**