Do Mothers' Eating Behaviors Cause Daughters' Dieting?
Drawing Causal Inferences From the Early Dieting in Girls Study.
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Introduction
Dieting is associated with disordered eating (Patton et al., 1997) and weight gain (Field et al., 2003) before adolescence. However, little has been documented about the predictors of the early emergence of dieting (by age 11; Sinton & Birch, 2007). In this study, we examine the influence of various mothers’ eating behaviors on early emergence of daughters’ dieting. Specifically, we assess the impact of mother’s overall weight concerns, restrained eating, disinhibited eating, and overall eating behavior on the emergence of dieting. In other words, the relationship between mothers’ eating behavior and daughters’ emergence of dieting is confounded. In this study, we use propensity score methods under the potential outcomes framework for causal inference to study the effect of mothers’ eating behaviors on daughters’ dieting.

Inverse Propensity Weighted Estimation

Causal inference can be made by using inverse propensity weighted (IPW) estimator. We estimate causal effects using IPW in four steps (Figure 1).

Step 1: Estimate propensity scores
We obtain a list of confounders for mothers’ eating behavior and the emergence of dieting. A propensity score is the probability of observing a certain level of the treatment or exposure given measured confounders.

Step 2: Calculate weights
Weights are the inverse of propensity scores.

Step 3: Check balance
Balance is achieved when individuals in each exposure group with identical propensity scores have identical distribution for all the covariates. To check balance for a binary exposure, we plot the standardized mean difference of each measured confounder before and after weighting. For continuous exposures, correlations between the continuous treatment and each measured confounder before and after weighting can be compared. Based on Cohen’s guidelines for effect sizes, a standardized mean difference (absolute value) smaller than 0.2 indicates a small group difference; a correlation of 0.1 is considered a weak or small association.

Step 4: Outcome analysis
We fit a model to observed data using weights, treating the weights like survey weights. If balance is achieved among confounders in Step 3, and there are no unmeasured confounders, causal inference can be made.

Methods

Participants:
The sample was drawn from a longitudinal observational study of 198 mothers and their daughters, whose eating behaviors were measured biannually. Girls were 5 years old (M = 5.35, SD = 0.29) at the first measurement. All but two of these girls were White. A subsample of 167 girls is considered in the current study; 35% reported any dieting between ages 7 and 11.

Measures:
We consider 6 different measures, adjusted at the first wave:
1. Mother’s overall weight concerns (Killen et., 1994; 0 to 4 Likert scale; M=1.60, SD=0.74)
2. Mother’s restrained eating (range 0-21; M=9.10, SD=5.94)
3. Mother’s disinhibited eating (range 0-16, M=6.60, SD=3.87)
4. Mother currently dieting to maintain weight (Grimo, n=1; yes; M=0.18, SD=0.38)
5. Mother currently dieting to lose weight (Orno, n=1; yes; M=0.24, SD=0.43)
6. Mother’s restriction (Birch et al., 2000; 1 to 5 Likert scale; M=2.93, SD=0.86)

In each follow-up measurement, girls were asked “Have you ever gone on a diet?” A response of “sometimes” or “yes” between ages 7 and 11 is considered early dieting.

Propensity scores and weights estimation:
For each binary exposure, we obtain a logistic regression of the exposure on the measured confounders to estimate the probability of selecting into each exposure condition.

For each continuous exposure, we estimated the generalized propensity score, $\beta$, from the normal probability density function. For example, we can obtain $\beta (\tilde{z}) | X)$ by taking the following steps: (1) fit a linear regression of the exposure on measured confounders; (2) obtain standardized residuals; (3) compute the probability of the standardized residuals under a normal distribution. Finally, (4) compute the weights for a continuous exposure as $Weight = \frac{G(\tilde{z})}{G(\tilde{z} | X)}$.

Outcome analysis:
Given that balance is achieved and no unmeasured confounders exist, we can obtain causal effect estimates from a weighted logistic regression.

Logit[P(early diet = 1) | exposure e] = $\beta_0 + \beta_1 e$
$e^\beta$ is the causal odds ratio associated with an increase in the exposure.

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Discussion
This is an ongoing project. We only presented results of mothers’ restrained eating behavior on girls’ emergence of dieting because we could not obtain balance for the other exposure variables. More advanced methods for propensity score estimation, such as data mining and decision trees, will be considered. We will also explore double-robust estimators, such as augmented IPW. In the future, preventive interventions targeting mothers’ restrained eating behaviors may be developed when we more fully understand their impact on daughters’ dieting behavior.

Results
Balance for each exposure is presented in Figures 2-7. The outcome analysis is conducted by using a logistic regression weighted by the inverse of the propensity scores. The results indicate that an increase in mothers’ restrained eating behavior resulted in a 1.08 (p = .004) times increase in the odds of girls’ dieting behavior.

[Figures 2-7 are not included in the text but would be referenced in the conclusion and discussion sections for visual representation of the results.]