

# EDS241: Assignment 3

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## 1 Question 1: Application of estimators based on treatment ignorability

This exercise asks you to implement some of the techniques presented in Lectures 6-7. The goal is to estimate the causal effect of maternal smoking during pregnancy on infant birth weight using the treatment ignorability assumptions. The data are taken from the National Natality Detail Files, and the extract “SMOKING\_EDS241.csv” is a random sample of all births in Pennsylvania during 1989-1991. Each observation is a mother-infant pair. The key variables are:

### **The outcome and treatment variables:**

- birthwgt=birth weight of infant in grams
- tobacco=indicator for maternal smoking

### **The control variables:**

- mage (mother’s age)
- meduc (mother’s education)
- mblack (=1 if mother black)
- alcohol (=1 if consumed alcohol during pregnancy)
- first (=1 if first child)
- diabete (=1 if mother diabetic)
- anemia (=1 if mother anemic)

- 1.1 (a) What is the unadjusted mean difference in birth weight of infants with smoking and non-smoking mothers? Under what hypothesis does this correspond to the average treatment effect of maternal smoking during pregnancy on infant birth weight? Provide some simple empirical evidence for or against this hypothesis.
- 1.2 (b) Assume that maternal smoking is randomly assigned conditional on the observable covariates listed above. Estimate the effect of maternal smoking on birth weight using a linear regression. Report the estimated coefficient on tobacco and its standard error.
- 1.3 (c) Use the exact matching estimator to estimate the effect of maternal smoking on birth weight. For simplicity, consider the following covariates in your matching estimator: create a 0-1 indicator for mother's age ( $=1$  if  $\text{mage} \geq 34$ ), and a 0-1 indicator for mother's education ( $=1$  if  $\text{meduc} \geq 16$ ), mother's race ( $\text{mblack}$ ), and alcohol consumption indicator ( $\text{alcohol}$ ). These 4 covariates will create  $2 \times 2 \times 2 \times 2 = 16$  cells. Report the estimated average treatment effect of smoking on birthweight using the exact matching estimator and its linear regression analogue (Lecture 6, slides 12-14).
- 1.4 (d) Estimate the propensity score for maternal smoking using a logit estimator and based on the following specification: mother's age, mother's age squared, mother's education, and indicators for mother's race, and alcohol consumption.
- 1.5 (e) Use the propensity score weighted regression (WLS) to estimate the effect of maternal smoking on birth weight (Lecture 7, slide 12).