Lab 5: Interaction Terms and Effect Modification

February 2021

Objective

Today, we will be looking at 2 different multiple linear regression models, with 2 possible parameterizations for each. We will look at how to conduct tests on specific hypotheses for each model, and study the different interactions and their meanings.

Quick Discussion: Modeling Vs. Estimation

$E[Y|X = x] = \beta_0 + \beta_1 x$ = Mean Model

β_1 vs. $\hat{\beta}_1$

OLS = Estimation

Primary Analysis

We are going to be looking at the following two codings:

Coding 1

Y: A1c at 6 months
X_1: Indicator of ANY REACH
X_2: Indicator of REACH + FAMS
X_3: Baseline A1c

Coding 2

Y: A1c at 6 months
X_1: Indicator of ONLY REACH
X_2: Indicator of REACH + FAMS
X_3: Baseline A1c

Note: X_1 + X_2 under Coding 2 = X_1 from Coding 1

We are going to be looking at the following two models:

Model A (No effect modification by baseline A1c)

$$E[Y|X_1 = x_1, X_2 = x_2, X_3 = x_3] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$$

Model B (Effect modification allowed)

$$E[Y|X_1 = x_1, X_2 = x_2, X_3 = x_3] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_1 x_3 + \beta_5 x_2 x_3$$

Questions

For each of these models, we can ask the following general scientific questions:

(1) Is receiving ONLY REACH effective relative to control?
(2) Is (REACH + FAMS) effective relative to control?
(3) Is receiving (REACH + FAMS) effective relative to ONLY REACH?
(4) Is receiving ANY REACH effective relative to control?

For each model and for each coding, how would you answer these questions? Which parameter or combination(s) of parameters correspond to each? Write out each hypothesis test (Hint: Writing out expressions for each of these questions, i.e. E$[Y|X_1 =?, X_2 =?, X_3 =?]$ is incredibly helpful). Answer each question for all four combinations of model/coding.