BIOST 536 Homework 5

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Question 1

a.) The model which considers an additive effect of the genetic variant on the risk of the disease is shown below:

$$logit(p) = \beta_0 + \beta_1 * E$$

where

- p is the probability of the disease
- E is the number of copies of the genetic variant, which can take values 0,1, or 2

b.) The model which considers a dominant effect of the genetic variant on the risk of the disease is shown below:

$$logit(p) = \beta_0 + \beta_1 * I_{1-2copies}$$

where

- p is the probability of the disease
- $I_{1-2copies}$ is an indicator variable that equals 1 if the number of genetic variant copies is one or two and equals 0 otherwise

c.) The model which considers a recessive effect of the genetic variant on the risk of the disease is shown below:

$$logit(p) = \beta_0 + \beta_1 * I_{2copies}$$

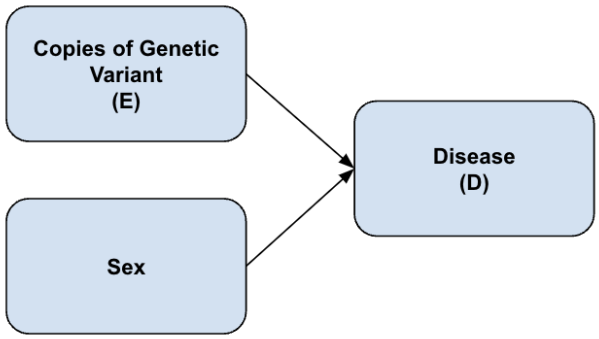
where

- p is the probability of the disease
- $I_{2copies}$ is an indicator variable that equals 1 if the patient has two copies of the genetic variant and equals 0 otherwise

d.) The models are assessed in a pairwise manner below:

- Model A and Model B: Not nested, as they have the same number of parameters and it is not possible to constrain the parameters of one model to obtain the other
- Model A and Model C: Not nested, as they have the same number of parameters and it is not possible to constrain the parameters of one model to obtain the other
- Model B and Model C: Not nested, as they have the same number of parameters and it is not possible to constrain the parameters of one model to obtain the other

e.) The DAG for this situation is shown below:



f.) If the goal is to detect an association between the variant and the disease, the additive model (model A) would be recommended because a significance test could capture the significance of a linear trend with the number of copies.

g.) The results of these regressions show that the higher odds ratio is from the sex-adjusted model. This is made evident by the regression OR being equal to the sex-specific OR for both males and females. The adjustment for sex removes the attenuation that would be expected when pooling two strata of equal odds ratios.

Question 2

Background

Firm mattresses are commonly used as solutions to low back pain. This study seeks to identify the impact of changing mattresses on perceived low back pain among those who have reported the condition and participated in previous studies.

Methods

In a randomized trial, 313 adults who had chronic, non-specific low-back pain while lying in bed and on rising were evaluated. These adults were also previous participants in population-wide studies on the prevalence and risk factors for low-back pain. The European Committee for Standardization mattress firmness ratings were used to categorize mattresses. This scale ranges from firmest at H_s 1.0 to softest at H_s 10.0. Patients were randomized into treatment groups of firm (H_s 2.3), medium-firm (H_s 5.6) and control, in which patients were given a mattress of comparable firmness to their existing mattress. Primary metrics of interest were improvements in pain while lying in bed, improvements in pain on rising, and pain-related disability. Assessments using the visual analog scale, rating pain from 0 (lowest) to 10 (highest) were done at baseline and after 90 days. The outcome was binary improvement in pain scores on these three endpoints. The previous mattress used by each patient was also measured and categorized into one of two groups: soft (H_s 7.0-10.0) and not soft soft (H_s 1.0-7.0).

Findings

Using a multiple logistic regression to estimate the improvement in pain across the three endpoints, we found a X.XX odds-ratio for pain improvement while lying in bed (95% robust CI X.XX-X.XX) for medium-firm mattress use compared to control when adjusting for previous mattress firmness. Similarly, we estimate a X.XX odds-ratio for pain improvement while lying in bed (95% robust CI X.XX-X.XX) for firm mattress use compared to control when adjusting for previous mattress firmness. The metrics of pain on rising and pain-related disability also showed improvements.

Interpretation

The results of this analysis show that switching to a medium-firm or firm mattress can help alleviate lower back pain for patients. Even when adjusting for previous mattress firmness, both groups demonstrated improvements in pain over control. The impact of the placebo effect was mitigated by designating a control group which was given a mattress of equal firmness to their previous mattress. This should also reduce the effect of overall mattress quality and allow for the isolation of the effect of firmness.