Test5_YM

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Question (a)

Let:

$$y_i = P[resp_i = 1] \Rightarrow 1 - y_i = 1 - P[resp_i = 1] = P[resp_i = 0]$$

$$\Rightarrow \frac{P[resp_i = 1]}{\partial age_i} + \frac{\partial P[resp_i = 0]}{\partial age_i} = \frac{\partial y_i}{\partial age_i} + \frac{\partial (1 - y_i)}{\partial age_i} = 0$$

Question(b)

$$\because resp_i^{new} = \begin{cases} 1, & \text{if } resp_i = 0 \\ 0, & \text{if } resp_i = 1 \end{cases}$$

$$\therefore P[resp_i^{new} = 0] = \frac{\exp\left(\beta_0 + \beta_1 male_i + \beta_2 active_i + \beta_3 age_i + \beta_4 (age_i/10)^2\right)}{1 + \exp\left(\beta_0 + \beta_1 male_i + \beta_2 active_i + \beta_3 age_i + \beta_4 (age_i/10)^2\right)}$$

The new odds ratio can be written as :

$$\frac{resp_i^{new} = 1}{resp_i^{new} = 0} = \frac{1}{\exp\left(\beta_0 + \beta_1 male_i + \beta_2 active_i + \beta_3 age_i + \beta_4 (age_i/10)^2\right)}$$

$$= \exp\left(-\beta_0 + -\beta_1 male_i + -\beta_2 active_i + -\beta_3 age_i + -\beta_4 (age_i/10)^2\right)$$

Therefore, the parameters would have opposite sign as opposed to original case.

Question(c)

One possible treatment is to add an interaction term between age and male, e.g, $age * male$ such that its derivative over age still accounts for male.