

Exercise 1a: Understanding Odds Calculation

The **odds** of an event happening is defined as:

$$\text{Odds} = \frac{\text{Probability of the event happening}}{\text{Probability of the event NOT happening}}$$

Given the following probabilities of developing high blood pressure:

- **Group A (Active individuals):** $P=0.3$
- **Group B (Inactive individuals):** $P=0.45$

Questions

1. Calculate the odds of high blood pressure for active individuals.
2. Calculate the odds of high blood pressure for inactive individuals.
3. Compute the **odds ratio** (OR) comparing inactive to active individuals.

Exercise 1b

Suppose a simple logistic regression is estimated to relate the likelihood of a person developing high blood pressure (1 = yes, 0 = no) to their physical activity level (x : 1 = inactive, 0 = active) in a random sample of adults aged 18-25. The resulting estimated logistic equation is:

$$\ln(\text{odds of high blood pressure}) = -1.9 + 0.31x$$

Based on this same logistic regression model, what is the **probability** of having high blood pressure among inactive individuals in the sample?

Solution:

Exercise 1a: Understanding Odds and Odds Ratio

1. Odds of high blood pressure for active individuals

$$\text{Odds} = \frac{0.3}{1 - 0.3} = \frac{0.3}{0.7} \approx 0.43$$

2. Odds of high blood pressure for inactive individuals

$$\text{Odds} = \frac{0.45}{1 - 0.45} = \frac{0.45}{0.55} \approx 0.82$$

3. Odds Ratio (OR)

$$OR = \frac{\text{Odds of inactive individuals}}{\text{Odds of active individuals}} = \frac{0.82}{0.43} \approx 1.91$$

Exercise 1b:

The probability (P) can be calculated using the logistic function:

$$P = \frac{e^{\log-odds}}{1 + e^{\log-odds}}$$

For inactive individuals ($x = 1$), the log-odds equation is:

$$\log - odds = -1.9 + 0.31(1) = -1.9 + 0.31 = -1.59$$

The probability is:

$$P = \frac{e^{-1.59}}{1 + e^{-1.59}} = \frac{0.204}{1.204} \approx 0.17$$

Interpretation: The probability of high blood pressure among inactive individuals is approximately **17%**.