Module 5B: A Non-Parametric Test

Odds Ratio, RR, GWAS

<u>Agenda:</u>

- Odds ratio
- **Relative Risk**
- Genome-Wide Association Studies

Relative Risk

- Another commonly used measure of association between two categorical variables (when both have two categories)

- **RR is valid for any event if you can measure the true risk (cohort, RCT)**
  - Especially appropriate for comparing risk of rare and undesirable outcome whose probability can be directly inferred
  - Cohort studies (retrospective): SID syndrome in children who sleep facing upward and those who sleep on their stomach (if babies are randomly sampled)
  - RCT
  - Common outcomes (>=10%) because RR is interpretable and does not exaggerate effect size (OR can do that)

- Like odds ratio but perhaps more intuitive

- OR should give same answer as RR for rare events

$$\boxed{\widehat{RR} = \frac{\hat{p}_1}{\hat{p}_2} = \frac{treatment}{Control} = \frac{P(Outcome|Exposed)}{P(Outcome|\mathbf{UN}exposed)}}$$

- If 20% of smokers in an entire population develop lung cancer versus 10% of nonsmokers

$$\boldsymbol{RR} \mathbf{= 0.20/0.10 = 2.0}$$

Relative Risk

$$\widehat{RR} = \frac{\hat{p}_1}{\hat{p}_2} = \frac{treatment}{Control} = \frac{P(Outcome|Exposed)}{P(Outcome|\mathbf{UN}exposed)}$$

- OR should give same answer as RR for rare events

$$\widehat{OR} = \frac{\frac{\widehat{p_1}}{1-\widehat{p_1}}}{\frac{\widehat{p_2}}{1-\widehat{p_2}}}$$

- If 20% of smokers in an entire population develop lung cancer versus 10% of nonsmokers

RR = 0.20/0.10 = 2.0 ← RR is not inflated for common events

$$\text{OR} = \frac{Odds_{smokers}}{Odds_{non-smokers}} = \frac{0.2/0.8}{0.1/0.9} = \frac{0.25}{0.111} = 2.25$$ ← OR will be a bit inflated for common events

Relative Risk

Example:

Given, event B = diagnosis of breast cancer w/i 2 years

event A = positive mammogram at present

event A^C = negative mammogram at present

P(diagnosis of breast cancer w/i 2 years|negative mammogram) = 20/100,000

P(diagnosis of breast cancer w/i 2 years|positive mammogram)=1/10

$$RR = \frac{P(Outcome|Exposed)}{P(Outcome|\boldsymbol{UN}exposed)} = \frac{\mathrm{P(B|A)}}{\mathrm{P(B|}A^c)} = \frac{1/10}{2/10{,}000} = 500$$

Individuals with a positive mammogram at present have a **relative risk** of developing breast cancer within two years that is **500** times those of individuals with a negative mammogram.