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Agresti: Ch. 8 (1, 2, 27)

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# Homework 5

8.1

| (i) MI Controls | (j) MI Cases Diabetes | No Diabetes | $\Sigma$ |
|---|---|---|---|
| Diabetes | 9 | 16 | 25 |
| No Diabetes | 37 | 82 | 119 |
| $\Sigma$ | 46 | 98 | 144 |

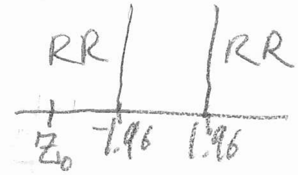
$n_* = 144 > 10$ ✓

$H_0$: $\pi_{1+} = \pi_{+1}$

$H_a$: $\pi_{1+} \neq \pi_{+1}$

$$TS: \quad Z_0 = \frac{d}{\hat{\sigma}_0} = \frac{n_{12} - n_{21}}{\sqrt{n_{12} + n_{21}}} = \frac{16 - 37}{\sqrt{16 + 37}} = \frac{-21}{7.280} = -2.885$$

$RR$: $|Z| > |Z_{.025}| \Rightarrow |Z| > 1.96$




$p = P(|Z| > |-2.885|) = .003914$

Concl.: Reject $H_0$.

At the $\alpha = .05$ significance level, there is sufficient evidence to indicate that MI cases are more likely than MI controls to have diabetes.

8.2

| (i) Believe in Heaven | (j) Believe in Hell: Yes | No | $\Sigma$ |
|---|---|---|---|
| Yes | 833 | 125 | 958 |
| No | 2 | 160 | 162 |
| $\Sigma$ | 835 | 285 | 1120 |

a. $n_{*} = 1120 > 10$ ✓

$\underline{H_0}$: $\pi_{1+} = \pi_{+1}$
$\underline{H_a}$: $\pi_{1+} \neq \pi_{+1}$

$\underline{TS}$: $Z_0 = \frac{d}{\hat{\sigma}_0} = \frac{n_{12} - n_{21}}{\sqrt{n_{12} + n_{21}}}$

$= \frac{125 - 2}{\sqrt{125 + 2}}$

$= 10.944$

$\underline{RR}$: $|Z| > 1.96$


$p = p(|Z| > 10.944) < .0001$

$\underline{Concl}$: ~~Reject $H_0$.~~
At the $\alpha = .05$ significance level, there is sufficient evidence to indicate that more people believe in heaven than in hell.

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# Agresti: Ch. 8 (1, 2, 27)

# Homework 5

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8.2 b. $\hat{\pi}_{1+} = \frac{958}{1120} = .855$

$\hat{\pi}_{+1} = \frac{835}{1120} = .746$

$$\delta_{.90} = d \pm Z_{.05} \hat{\sigma}_d$$
$$= (\hat{\pi}_{1+} - \hat{\pi}_{+1}) \pm Z_{.05} \frac{\sqrt{(n_{12}+n_{21}) + \frac{(n_{12}-n_{21})^2}{n}}}{n}$$
$$= (.855 - .746) \pm (1.645)(0.00951)$$
$$= .109 \pm 0.0156 = [.093, .125]$$

We are 90% confident that the difference in proportions between those who believe in heaven and those who believe in hell is between 9.3% and 12.5%.

8.27 $\ln(\mu_{ij}) = \lambda + \lambda_i^X + \lambda_j^Y + \lambda_{ij}^{XY}$
where $\lambda_{ij} = \lambda_{ji} \ \forall \ i, j$.

a. $\ln(\mu_{ji}) = \lambda + \lambda_j^X + \lambda_i^Y + \lambda_{ji}^{XY}$

$$\therefore \ln\left(\frac{\mu_{ij}}{\mu_{ji}}\right) = \ln(\mu_{ij}) - \ln(\mu_{ji})$$
$$= (\lambda_i^X - \lambda_i^Y) - (\lambda_j^Y - \lambda_j^X) - \cancel{(\lambda_{ij}^{XY} - \lambda_{ji}^{XY})}$$
$$= \beta_i - \beta_j$$

b. $\lambda_i^X = \lambda_i^Y$ and $\lambda_j^Y = \lambda_j^X$

$$\therefore \ln\left(\frac{\mu_{ij}}{\mu_{ji}}\right) = \cancel{(\lambda_i^X - \lambda_i^Y)} - \cancel{(\lambda_j^Y - \lambda_j^X)} = 0$$
$$\therefore \mu_{ij} = \mu_{ji} \implies \text{Symmetry Model}$$