Exercise 6C.1

The Evans county heart disease study assessed the association between endogenous catecholamine level (CAT) and the subsequent seven-year incidence of coronary heart disease (CHD) in a cohort of 609 white males.

	CHD	No CHD
High CAT	27	95
Low CAT	44	443

(a) Estimate the risk difference for CHD for people with high CAT compared to people with low CAT.

Let p_1 = risk for people with high CAT, p_2 = risk for people with low CAT

$$\widehat{RD} = \hat{p}_1 - \hat{p}_2 = \frac{27}{27+95} - \frac{44}{44+443} = 0.2213 - 0.0903 = 0.131$$

(b) Compute a 95% confidence interval for the true risk difference.

CI for risk difference: $(\hat{p}_1 - \hat{p}_2) \pm z^* \times \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$z^* = 1.96, n_1 = 27+95 = 122, n_2 = 44+443 = 487$

$$0.131 \pm 1.96 \times \sqrt{\frac{0.2213(1-0.2213)}{122} + \frac{0.0903(1-0.0903)}{487}}$$

$$0.131 \pm 1.96 \times \sqrt{0.001581}$$

$$0.131 \pm 1.96 \times 0.03976$$

$$(0.053, 0.209)$$

Exercise 6C.2

The Evans county heart disease study assessed the association between endogenous catecholamine level (CAT) and the subsequent seven-year incidence of coronary heart disease (CHD) in a cohort of 609 white males.

	CHD	No CHD
High CAT	27	95
Low CAT	44	443

(a) Estimate the relative risk of CHD for people with high CAT compared to people with low CAT, and interpret this quantity.

$\widehat{RR} = \frac{\textit{estimated risk of CHD for people with high CAT}}{\textit{estimated risk of CHD for people with low CAT}} = \frac{27/(27+95)}{44/(44+443)} = \frac{27/122}{44/487} = \frac{0.2213}{0.0903} = 2.45$

The estimated risk of CHD for people with high CAT is 2.45 times the risk for people with low CAT.

(b) Compute a 95% confidence interval for the true relative risk.

$\widehat{RR} = 2.45$ *calculated in (a)*
Table is in the correct format to use the SE formula with a=27, b=95, c=44, d=443
CI for log-relative risk: $\ln(\widehat{RR}) \pm z^* \times \sqrt{\frac{b}{a(a+b)} + \frac{d}{c(c+d)}}$
$z^* = 1.96$
$\ln(2.45) \pm 1.96 \times \sqrt{\frac{95}{27(27+95)} + \frac{443}{44(44+443)}}$
$0.896 \pm 1.96 \times \sqrt{0.0495}$
$0.896 \pm 1.96 \times 0.2225$
$(0.460, 1.33)$ ****CI for the log-relative risk****
Exponentiate to get CI for relative risk: $(e^{0.460}, e^{1.33}) = (1.58, 3.78)$

Exercise 6C.3

The Evans county heart disease study assessed the association between endogenous catecholamine level (CAT) and the subsequent seven-year incidence of coronary heart disease (CHD) in a cohort of 609 white males.

	CHD	No CHD
High CAT	27	95
Low CAT	44	443

(a) Estimate the odds ratio for CHD for people with high CAT compared to people with low CAT, and interpret this quantity.

$\widehat{OR} = \frac{\textit{estimated odds of CHD for people with high CAT}}{\textit{estimated odds of CHD for people with low CAT}} = \frac{27/95}{44/443} = \frac{0.2842}{0.0993} = 2.86$

The estimated odds of CHD for people with high CAT is 2.86 times the odds for people with low CAT.

(b) Compute a 95% confidence interval for the true odds ratio.

$\widehat{OR} = 2.86$ *calculated in (a)*
Table is in the correct format to use the SE formula with a=27, b=95, c=44, d=443
CI for log-odds ratio: $\ln(\widehat{OR}) \pm z^* \times \sqrt{\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}}$
$z^* = 1.96$
$\ln(2.86) \pm 1.96 \times \sqrt{\frac{1}{27} + \frac{1}{95} + \frac{1}{44} + \frac{1}{443}}$
$1.051 \pm 1.96 \times \sqrt{0.07255}$
$1.051 \pm 1.96 \times 0.269$
$(0.524, 1.58)$ ****CI for the log-odds ratio****
Exponentiate to get CI for odds ratio: $(e^{0.524}, e^{1.58}) = (1.69, 4.85)$

Exercise 6C.4

A study evaluated the use of ecinacea for upper respiratory infections (URIs) in children. Each child with a URI was randomized to receive either echinacea or placebo. One outcome recorded was the presence or absence of adverse events. The data are below.

	Placebo	Echinacea
Adverse Event	146	152
No Adverse Event	224	185

(a) Estimate and interpret each of the three measures of association between presence of side effects and receiving treatment with echinacea (compared to placebo).

p_1 = probability of adverse event given echinacea, p_2 = probability of adverse event given placebo

$\hat{p}_1 = \frac{152}{152+185} = \frac{152}{337} = 0.451$ *and* $\hat{p}_2 = \frac{146}{146+224} = \frac{146}{370} = 0.395$

Estimated Risk Difference $= \hat{p}_1 - \hat{p}_2 = 0.451 - 0.395 = 0.056$

The risk of an adverse event is 5.6 percentage points higher for people on echinacea compared to placebo.

Estimated Relative Risk $= \frac{\hat{p}_1}{\hat{p}_2} = \frac{0.451}{0.395} = 1.14$

The risk of an adverse event when taking echinacea is 1.14 times the risk when taking placebo.

Estimated Odds Ratio $= \frac{\hat{p}_1/(1-\hat{p}_1)}{\hat{p}_2/(1-\hat{p}_2)} = \frac{0.451/(1-0.451)}{0.395/(1-0.395)} = \frac{0.821}{0.653} = 1.26$

The odds of an adverse event when taking echinacea are 1.26 times the odds when taking placebo.

(b) What type of hypothesis test would you do to test whether there is a significant association between taking echinacea and having adverse events?

Chi-square test (or Two-sample Z-test)