Jacob Miller STAT 784 - HW4 due 5/23/2021

①

equipment	fatal	nonfatal	
None	1601	162,527	(164128)
Seat Belt	510	412,368	~~(574895)~~ (412878)
	(2111)	(574,895)	~~(139535)~~ (577006)

a) $OR = \frac{\hat{\pi}_1/(1-\hat{\pi}_1)}{\hat{\pi}_2/(1-\hat{\pi}_2)} = \frac{1601 \cdot 412{,}368}{510 \cdot 162{,}527} = 7.96$

⇒ the odds are 8x for a fatality occurring when no seat belt is worn

b) $\ln\hat{\theta} \pm z_{\alpha/2} \cdot SE$, $SE = \sqrt{1/n_{11} + 1/n_{12} + 1/n_{21} + 1/n_{22}}$

$SE = \sqrt{1/1601 + 1/162527 + 1/510 + 1/412{,}368} = 0.0509$

$\ln(7.96) = 2.074$

$2.074 - 1.96(0.0509) = 1.974$, $2.074 + 1.96(0.0509) = 2.174$

$e^{1.974} = 7.2$ $e^{2.174} = 8.8$

⇒ we can be 95% confident that the odds of a fatality occurring from not wearing a seat belt is between 7.2 & 8.8.

c) $\hat{\mu}_{ij} = \frac{n_{i+} \cdot n_{+j}}{n}$ $\hat{\mu}_{11} = 600.5$ $\hat{\mu}_{12} = 163527.5$

$\hat{\mu}_{21} = 1510.5$ $\hat{\mu}_{22} = 411367.5$

d) $\chi^2 = \sum \frac{(n_{ij} - \mu_{ij})^2}{\mu_{ij}} = \frac{(1601-600.5)^2}{600.5} + \frac{(162{,}527-163527.5)^2}{163527.5} + \frac{(510-1510.5)^2}{1510.5} + \frac{(412{,}368-411367.5)^2}{411367.5}$

$\chi^2 = 2338.2$

$G^2 = 2\sum n_{ij} \ln(n_{ij}/\mu_{ij}) = 2\left[1601 \cdot \ln \frac{1601}{600.5} + 162{,}527 \cdot \ln \frac{162527}{163527.5} + 510 \cdot \ln \frac{510}{1510.5} + 412{,}368 \cdot \ln \frac{412368}{411367.5}\right] = \underline{2041.0}$

∴ reject null hypothesis