Solution

2.4
a.
(i) $p = 1085/(1085 + 55623) = 0.019$
(ii) $p = 703/(703 + 441239) = 0.0016$
b.
(i) $p = 703/(703 + 1085) = 0.39$
(ii) $p = 441239/(441239 + 55623) = 0.89$
c.
Difference of proportions = 1085/(1085+55623) - 703/(703+441239) = 0.018.
Relative risk = $\frac{1085/(1085+55623)}{703/(703+441239)} = 12.03$.
Odds ratio = $\frac{1085*441239}{703*55623} = 12.24$.
The relative risk and odds ratio are approximately equal because $p_1 = 0.019$ and $p_2 = 0.0016$ are both close to zero.

2.10
a.
11.4 is the odds ratio but not the relative risk, so the quoted interpretation is wrong. The correct interpreatation should be that the odds of survival for females was 11.4 times that for males. The quoted interpretation would be approximately right when the probability of survival is close to zero for both females and males.
b.
$\pi_f = \frac{2.9}{1+2.9} = 0.74$.
$\pi_m = \frac{2.9/11.4}{1+2.9/11.4} = 0.20$.

2.20
$\hat{\theta}_{XY(1)} = \frac{19*52}{11*132} = 0.68$.
$\hat{\theta}_{XY(2)} = \frac{0*97}{6*9} = 0$.
Marginal odds ratio $\hat{\theta}_{XY} = \frac{(19+0)*(52+97)}{(11+6)*(132+9)} = 1.18$.
When victims' race is white, the sample odds of the death penalty for white defendants were 68% of that for black defendants. When victims' race is black, the sample odds of the death penalty for white defendants were 0% of that for black defendants. However, marginally, the sample odds of death penalty were 18% higher for white defendants than for black defendants. This reversal in the association illustrates Simpson's paradox.