Homework Set #5 Solutions

| | | Disease | No Disease | Total |
|---|---|---|---|---|
| (1.) prospective study: | Placebo | 28 | 656 | 684 |
| | Trtmnt | 18 | 658 | 676 |

(a) $\hat{\sigma}^2(\log \hat{RR}) = \left(\dfrac{1-\pi_1}{\pi_1}\right)\dfrac{1}{n_{1+}} + \left(\dfrac{1-\pi_2}{\pi_2}\right)\dfrac{1}{n_{2+}}$

(b) $\hat{\sigma}(\log \hat{RR}) = \left(\dfrac{1}{n_{11}} - \dfrac{1}{n_{1+}} + \dfrac{1}{n_{21}} - \dfrac{1}{n_{2+}}\right)^{\frac{1}{2}}$

(c) $\log \hat{RR} = \log\left(\dfrac{28/684}{18/676}\right) = \log(1.537) = 0.430$

$\left(\hat{\pi}_1 = .041, \ \hat{\pi}_2 = .027\right), \quad \left(\hat{RR} = 1.537\right)$

$\hat{\sigma}(\log \hat{RR}) = \left(\dfrac{1}{28} - \dfrac{1}{684} + \dfrac{1}{18} - \dfrac{1}{676}\right)^{\frac{1}{2}} = 0.297$

CI for $\log RR = 0.430 \pm 1.96(0.297)$

$= 0.430 \pm 0.582 = [-0.152, 1.012]$

(d) CI for $RR = \left[e^{-0.152}, e^{1.012}\right]$

$= [0.859, 2.750]$

② (sensitivity) $Y_\delta = 103$, $n_\delta = 122$ , (specificity) $Y_\partial = 399$, $n_\partial = 401$

(a) interval estimate for $\delta = [.77, .90]$

(b) interval estimate for $\partial = [.982, .998]$

③ $n_I = 196$, $Y_c = 185$, $Y_v = 11$

interval estimate for $VE = [.891, .967]$

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> y=103
> n=122
> a=y+1
> b=n-y+1
> lower = qbeta(.025,a,b)
> median = qbeta(.5,a,b)
> upper = qbeta(.975,a,b)
> print(c(lower,median,upper))
[1] 0.7693298 0.8405335 0.8977577


> y=399
> n=401
> a=y+1
> b=n-y+1
> lower = qbeta(.025,a,b)
> median = qbeta(.5,a,b)
> upper = qbeta(.975,a,b)
> print(c(lower,median,upper))
[1] 0.9821445 0.9933537 0.9984584


> v = 11
> c = 185
> a = v+1
> b = c+1
> p= rbeta(100000,a,b)
> efficacy = 1 - p/(1-p)
> quantile(efficacy,c(.025,.25,.5,.75,.975))
      2.5%        25%        50%        75%      97.5%
 0.8919293  0.9233633  0.9371700  0.9490042  0.9670680
```