BS852 HOMEWORK 3

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A

Do you find significant evidence of increasing odds of MI with an increase in coffee consumption? Provide evidence for your conclusion.

I use the Mantel Extension Chi-square Test. Let the standard scores be an ordinal score for coffee consumption, so the standard scores are,
1 for coffee consumption 0, <1;
2 for coffee consumption 1, 2;
3 for coffee consumption 3, 4;
4 for coffee consumption 5+;

H0 : There is no linear association between coffee consumption and odds of MI in women;
H1 : There is a linear association between coffee consumption and odds of MI in women.
I use the function in R as followings,

```
prop.trend.test( x=c(26,57,36,41), n=c(44,85,50,51), score=c(1,2,3,4))
```

```
##
##  Chi-squared Test for Trend in Proportions
##
## data:  c(26, 57, 36, 41) out of c(44, 85, 50, 51) ,
##  using scores: 1 2 3 4
## X-squared = 5.4356, df = 1, p-value = 0.01973
```

From the above results, I get the X-squared 5.4356, with 1 df, and the p-value is 0.01973. The p-value is less than 0.05, so with 95% confidence interval, we reject the H0, and conclude that there is linear association between coffee consumption and odds of MI in women. Since from the given chart the odds of MI are increasing with the increase in coffee consumption, there is significant evidence of ORs increading from 1.0 for 0, <1 coffee consumption, to 1.4 for 1,2 coffee consumption, to 1.8 for 3,4 coffee consumption, to 2.8 for 5+ coffee consumption.

B

1. Is there evidence of a linear increase of odds for mortality with increasing stage at diagnosis?

Hand-writing on the paper.

2. Is there evidence of interaction between stage at diagnosis and receptor level?

```
library(epiR)
```

```
## Loading required package: survival
## Package epiR 0.9-69 is loaded
## Type help(epi.about) for summary information
```

```r
data <- c(2,10,5,50,9,13,17,57,12,2,9,6)
dim(data) <- c(2,2,3)
dimnames(data)[[1]] <- c("Dead", "Alive")
dimnames(data)[[2]] <- c("Receptor low", "Receptor high")
dimnames(data)[[3]] <- c("Stage 1", "Stage 2", "Stage 3")
data
```

```
## , , Stage 1
##
##       Receptor low Receptor high
## Dead             2             5
## Alive           10            50
##
## , , Stage 2
##
##       Receptor low Receptor high
## Dead             9            17
## Alive           13            57
##
## , , Stage 3
##
##       Receptor low Receptor high
## Dead            12             9
## Alive            2             6
```

```r
# Testing interaction, Breslow Day test
res.BD <- epi.2by2(dat=data, method="case.control", homogeneity="breslow.day", conf.level=0.95)
summary(res.BD)
```

```
## $OR.strata.wald
##        est     lower     upper
## 1 2.000000 0.3390269 11.798472
## 2 2.321267 0.8473002  6.359352
## 3 4.000000 0.6489009 24.657077
##
## $OR.strata.cfield
##        est     lower    upper
## 1 2.000000 0.2368906 11.63738
## 2 2.321267 0.8142182  6.39044
## 3 4.000000 0.6383014 33.02644
##
## $OR.strata.score
##         est      lower     upper
## 1  2.000000  0.6705882 0.1333333
## 2  6.923077  2.3212670 0.4615385
## 3 60.000000 20.1176471 4.0000000
##
## $OR.strata.mle
##        est     lower     upper
## 1 1.975753 0.1660439 14.387494
## 2 2.298753 0.7334621  7.053917
## 3 3.811928 0.5181857 47.338072
##
```

```
## $OR.crude.wald
##        est    lower    upper
## 1 3.353548 1.679029 6.698088
##
## $OR.crude.cfield
##        est    lower    upper
## 1 3.353548 1.660099 6.710124
##
## $OR.crude.score
##   est    lower     upper
## 1 9.2 3.084706 0.6133333
##
## $OR.crude.mle
##        est    lower    upper
## 1 3.329255 1.577218 7.072612
##
## $OR.mh
##        est       se    lower    upper
## 1 2.539913 0.398357 1.163421 5.544991
##
## $ARe.strata.wald
##        est      lower    upper
## 1 11.90476 -22.864211 46.67374
## 2 16.04396  -4.386168 36.47408
## 3 32.14286  -4.576694 68.86241
##
## $ARe.strata.score
##        est      lower    upper
## 1 11.90476 -11.908581 48.71953
## 2 16.04396  -2.604463 37.00534
## 3 32.14286  -8.423210 60.59290
##
## $ARe.crude.wald
##        est     lower    upper
## 1 11.90476 -22.86421 46.67374
##
## $ARe.crude.score
##        est     lower    upper
## 1 11.90476 -11.90858 48.71953
##
## $AR.mh
##        est       se     lower    upper
## 1 18.21401 16.48284 -14.09176 50.51979
##
## $ARp.strata.wald
##         est      lower    upper
## 1  1.243781 -11.917539 14.40510
## 2  4.345238  -8.051355 16.74183
## 3 23.275862 -11.811292 58.36302
##
## $ARp.strata.piri
##         est     lower    upper
## 1  1.243781 -2.491978  4.97954
## 2  4.345238 -1.368777 10.05925
```

```
## 3 23.275862 -3.823363 50.37509
##
## $ARp.crude.wald
##        est     lower    upper
## 1 6.884058 -1.993292 15.76141
##
## $ARp.crude.piri
##        est   lower    upper
## 1 6.884058 2.47401 11.29411
##
## $AFest.strata
##         est      lower     upper
## 1 0.4938638 -5.0225030 0.9304952
## 2 0.5649815 -0.3633970 0.8582348
## 3 0.7376656 -0.9298102 0.9788754
##
## $AFpest.strata
##          est      lower     upper
## 1 0.08333333 -0.1965751 0.2977643
## 2 0.23285486 -0.1098228 0.4697247
## 3 0.64285714 -0.4848765 0.9140999
##
## $chisq.strata
##   test.statistic df    p.value
## 1      0.6042569  1 0.43695844
## 2      2.7625564  1 0.09649393
## 3      2.3969388  1 0.12157294
##
## $chisq.crude
##   test.statistic df      p.value
## 1        12.4015  1 0.0004289884
##
## $chisq.mh
##   test.statistic df    p.value
## 1       4.558653  1 0.03275282
##
## $OR.homog
##   test.statistic df  p.value
## 1      0.3421486  2 0.842759
```

Breslow Day test:
H0: OR1 and OR2 is equal; H1: OR1 and OR2 is not equal.
From the $OR.homog results, we can get the test statistic chi-square is 0.34, with df=2, and the p-value is 0.84. The p-value is larger than 0.05, so with 95% confidence, we can not reject the null hypothesis. Hence, OR1 and OR2 is similar, and there is no interaction between stage at diagnosis and receptor level.

3. Is there a significant association between receptor level and 5 years mortality?

```
mantelhaen.test(data)
```

```
##
##  Mantel-Haenszel chi-squared test with continuity correction
```

```
##
## data:  data
## Mantel-Haenszel X-squared = 4.5587, df = 1, p-value = 0.03275
## alternative hypothesis: true common odds ratio is not equal to 1
## 95 percent confidence interval:
##  1.163421 5.544991
## sample estimates:
## common odds ratio
##          2.539913
```

Mantel-Haenszel chi-square test:
H0: there is no association between receptor level and 5 years mortality; H1: there is an association between receptor level and 5 years mortality.
From the above output, we can see that the Mantel-Haenszel X-squared is 4.5587 with 1 df, and the p-value is 0.0328, less than 0.001, so we can reject the null hypothesis. Hence, there is an significant association between receptor level and 5 years mortality.

From the above output, the 95% confidence interval for the age-adjusted association is (1.1634, 5.5450). With 95% confidence, we estimate that the true adjusted OR for dead lies between 1.1634 and 5.5450. This confidence interval excludes 1. There is statistically significant evidence to reject H0 and suggest an increased odds of dead among those who have low estrogen receptor after adjusting for stage of cancer at diagnosis.

Based on the adjusted analysis, the odds ratio is 2.54, so after adjusting for stage of cancer at diagnosis, those who have low estrogen receptor are at 2.54 times the odds of dead compared to those who have high estrogen receptor.

C

Hand-writing on the paper.