665hw3

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Problem 1

part a

```
a=ctab(22,13,33,19)
b=ctab(27,7,18,15)
rnames=c("good","poor")
cnames=c("test","placebo")
rownames(a)=rnames
colnames(a)=cnames
rownames(b)=rnames
colnames(b)=cnames
```

```
oddsratio.wald(a)
```

```
## $data
##       test placebo Total
## good    22      13    35
## poor    33      19    52
## Total   55      32    87
##
## $measure
##                            NA
## odds ratio with 95% C.I. estimate     lower    upper
##                     good 1.000000        NA       NA
##                     poor 0.974359 0.4008923 2.368156
##
## $p.value
##          NA
## two-sided midp.exact fisher.exact chi.square
##      good         NA           NA         NA
##      poor  0.9525674            1  0.9542846
##
## $correction
## [1] FALSE
##
## attr(,"method")
## [1] "Unconditional MLE & normal approximation (Wald) CI"
```

```
oddsratio.wald(b)
```

```
## $data
##       test placebo Total
## good    27       7    34
## poor    18      15    33
## Total   45      22    67
##
## $measure
##                            NA
## odds ratio with 95% C.I. estimate    lower    upper
```

```
##                       good 1.000000       NA       NA
##                       poor 3.214286 1.094512 9.439487
##
## $p.value
##          NA
## two-sided midp.exact fisher.exact chi.square
##      good         NA           NA         NA
##      poor 0.03492711   0.03916203 0.03024678
##
## $correction
## [1] FALSE
##
## attr(,"method")
## [1] "Unconditional MLE & normal approximation (Wald) CI"
```

The odds ratio between test treatment and placebo for good versus poor response for center A is .974 At center A the odds of a good response for the test group are .974 times the odds of a good response for the placebo group. These methods are justified because each cell count is at least 10.

The 95% CI is $(.401, 2.368)$ The interval includes the null value 1, so the results are not significant.

The odds ratio between test treatment and placebo for good versus poor response for center B is 3.214. At center B the odds of a good response for the test group are 3.124 times the odds of a good response for the placebo group.

The 95% CI is $(1.095, 9.439)$ The interval does not contain the null value 1, so the results are significant. These methods are justified because each cell count is at least 5.

part b

For Center A, provide and interpret the results of a statistical test for the association between treatment and response using the two-sided 0.05 significance level. Repeat separately for Center B

```r
chisq.test(a,correct=F)
```

```
##
##  Pearson's Chi-squared test
##
## data:  a
## X-squared = 0.0032864, df = 1, p-value = 0.9543
```

```r
chisq.test(b,correct=F)
```

```
##
##  Pearson's Chi-squared test
##
## data:  b
## X-squared = 4.6952, df = 1, p-value = 0.03025
```

Conducting a chi-square test for the association between treatment and response for center A.

H_0 : There is no association between treatment and response

$\chi^2 = .003$ p-value$= .954 > .05$ Thus fail to reject the null hypothesis

Not enough evidence to suggest an association between treatment and response at center A

Conducting a chi-square test for the association between treatment and response for center B.

H_0 : There is no association between treatment and response

$\chi^2 = 4.695$ p-value$= .03 < .05$ Thus reject the null hypothesis

There is evidence to suggest an association between treatment and response at center B

part c

```r
gi=tibble(center=rep(c("a","a","b","b"),times=2),
treat=rep(c("test",'placebo'),times=4),response=c(rep(1,4),rep(0,4)),
count=c(22,33,27,18,13,19,7,15))
```

Under minimal assumptions, assess the association between treatment and response, controlling for center, with a statistical test at the two-sided 0.05 level. Briefly justify your methods and interpret the results

The Mantel-Fleiss criterion requires that the across-strata sum of expected values for a particular cell has a difference of at least 5 from both the minimum possible sum and the maximum possible sum of the observed values in order for the chi-square approximation to be appropriate for the distribution of the Mantel-Haenszel statistic for 2 strata.

```r
include_graphics("1c.png")
```

Summary Statistics for treat by response
Controlling for center

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	1.8804	0.1703
2	Row Mean Scores Differ	1	1.8804	0.1703
3	General Association	1	1.8804	0.1703

Mantel-Fleiss Criterion	24.0377

Common Odds Ratio and Relative Risks				
Statistic	Method	Value	95% Confidence Limits	
Odds Ratio	Mantel-Haenszel	1.5928	0.8135	3.1185
	Logit	1.5793	0.7959	3.1337
Relative Risk (Column 1)	Mantel-Haenszel	1.1802	0.9285	1.5000
	Logit	1.1823	0.9292	1.5043
Relative Risk (Column 2)	Mantel-Haenszel	0.7353	0.4716	1.1465
	Logit	0.7641	0.4869	1.1993

The Mantel-Fleiss crierion is 24.038 which is greater than 5. Thus the chi-square approximation is appropriate for the Mantel-Haenszel statistic.

Estimate for common odds ratio is 1.593 comparing test treatment to placebo for good versus poor response. On average, those with treatment had 1.593 times the odds of having a good response than those with placebo

Conducting a Mantel-Haenszel test

H_0 : Ttreatment is not associated with response, controlling for center

Mantel_Hanszel χ^2=1.88 with 1 df p-value=.17>.05 Thus fail to reject the null hypothesis

Not enough evidence to suggest an association between treatment and response, adjusting for center.

```r
tab=array(c(a,b),dim=c(2,2,2))
mantelhaen.test(tab,correct = F)
```

```
##
##  Mantel-Haenszel chi-squared test without continuity correction
##
## data:  tab
```

```
## Mantel-Haenszel X-squared = 1.8804, df = 1, p-value = 0.1703
## alternative hypothesis: true common odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.8134943 3.1185488
## sample estimates:
## common odds ratio
##          1.592772
```

part d

Assess the homogeneity of the odds ratio across the two centers

```r
BreslowDayTest(tab)
```

```
##
##  Breslow-Day test on Homogeneity of Odds Ratios
##
## data:  tab
## X-squared = 2.8407, df = 1, p-value = 0.09191
```

Conducting a Breslow-Day test for homogeneity of odds ratios across the centers

H_0 : The odds ratios are homogeneous across the centers

$\chi^2 = 2.841$ with 1 df p-value= .092 > .05 Thus fail to reject the null hypothesis

There is not enough evidence to reject the null hypothesis that the odds ratios comparing test vs placebo are homogeneous across centers. We can conclude that the odds ratios for the two centers can reasonably be considered homogeneous.

part e

Provide a corresponding 95% confidence interval for the quantity in part d

For the results of part c, the common odds ratio estimate 1.593 with 95% CI: $(.813, 3.119)$ On average, those with treatment had 1.593 times the odds of having a good response than those with placebo

Since the interval contains the null value 1, the results are not significant, which supports the conclusion that the odds ratio do not differ signicantly.

Problem 2

part a

```r
rashdat=tibble(treat=c("p","p","l","l","h","h"),sex=rep(c("M","F"),times=3),none=c(6,7,9,10,19,21),mild
```

Under minimal assumptions (not involving a formal statistical model), conduct a statistical test to assess the association of pooled test treatments (high or low) vs. placebo with presence of rash after 2 weeks of treatment, controlling for gender.

```r
pooled=rashdat%>%mutate(treat=as.numeric((treat!="p")),rash=total-none)%>%select(treat,sex,rash,none)%>%
rnames=c("test","placebo")
cnames=c("rash","norash")
tnames=c("male","female")
m=ctab(93,28,42,6)
f=ctab(77,31,51,7)
rownames(m)=rnames
colnames(m)=cnames
```

```r
rownames(f)=rnames
colnames(f)=cnames
ptab=array(c(m,f),dim=c(2,2,2),dimnames = list(rnames,cnames,tnames))
ptab
```

```
## , , male
##
##         rash norash
## test      93     28
## placebo   42      6
##
## , , female
##
##         rash norash
## test      77     31
## placebo   51      7
```

```r
mantelhaen.test(ptab,correct = F)
```

```
##
##  Mantel-Haenszel chi-squared test without continuity correction
##
## data:  ptab
## Mantel-Haenszel X-squared = 8.0511, df = 1, p-value = 0.004548
## alternative hypothesis: true common odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.2070140 0.7625413
## sample estimates:
## common odds ratio
##         0.3973119
```

Running a Mantel-Haenszel test to assess the association of the pooled test treatments vs placebo with presence of rash, controlling for sex. Common odds ratio estimate= .397 (comparing presence of rash in treatment groups vs placebo, controlling for sex). On average, those with treatment had .397 times the odds of occurence of rash than those with placebo

The 95% CI is $(.207, .763)$. Since the interval does not contain the null value 1, the results are significant.

H_0 Pooled test treatment is not associated with presence of rash, controlling for sex

$\chi^2 = 8.051$ with 1 df p-value=.005<.05 Thus reject H_0

There is evidence to suggest an association between pooled treatment and presence of rash, controlling for sex.

part b

Provide an odds ratio and 95% confidence interval that describe the effect of pooled (high or low dose) treatment vs. placebo on presence of rash after 2 weeks for each of the following:

i. Females only.

```r
oddsratio.wald(f)
```

```
## $data
##         rash norash Total
## test      77     31   108
## placebo   51      7    58
```

```
## Total    128     38   166
##
## $measure
##                          NA
## odds ratio with 95% C.I.  estimate     lower     upper
##                  test    1.0000000        NA        NA
##                  placebo 0.3409235 0.1395468 0.8329019
##
## $p.value
##          NA
## two-sided midp.exact fisher.exact chi.square
##   test            NA           NA         NA
##   placebo 0.01387925   0.01936474 0.01500746
##
## $correction
## [1] FALSE
##
## attr(,"method")
## [1] "Unconditional MLE & normal approximation (Wald) CI"
```

The odds ratio comparing test to placebo for females is .341 with a 95% CI $(.140, .833)$ The interval,does not contain the null value 1, thus the results are significant

ii. Males only.

```r
oddsratio.wald(m)
```

```
## $data
##         rash norash Total
## test      93     28   121
## placebo   42      6    48
## Total    135     34   169
##
## $measure
##                          NA
## odds ratio with 95% C.I.  estimate     lower    upper
##                  test    1.0000000        NA       NA
##                  placebo 0.4744898 0.1827634 1.231869
##
## $p.value
##          NA
## two-sided midp.exact fisher.exact chi.square
##   test            NA           NA         NA
##   placebo  0.1207834    0.1400785  0.1197059
##
## $correction
## [1] FALSE
##
## attr(,"method")
## [1] "Unconditional MLE & normal approximation (Wald) CI"
```

The odds ratio comparing test to placebo for males is .474 with a 95% CI $(.183, 1.232)$ The interval contains the null value 1, thus the results are not sigificant.

iii. Controlling for gender. You should address the assumption that the effect of pooled (high or low dose) treatment vs. placebo on presence of rash after 2 weeks treatment is similar in both males and females.

Common odds ratio estimate= .397 (comparing presence of rash in treatment groups vs placebo, controlling for sex). On average, those with treatment had .397 times the odds of occurence of rash than those with placebo. The 95% CI is $(.207, .763)$. Since the interval does not contain the null value 1, the results are significant. Since the interval does not contain the null value 1, the results are significant. This suggests a statistically significant association between the effect of pooled treatment on presence of rash.

```
BreslowDayTest(ptab)
```

```
##
##  Breslow-Day test on Homogeneity of Odds Ratios
##
## data:  ptab
## X-squared = 0.24622, df = 1, p-value = 0.6197
```

Conducting a Breslow-Day test for homogeneity of odds ratios

H_0 : Odds ratios are homogeneous across sex

$\chi^2 = .246$ with 1 df p-value= $.62 > .05$ Thus fail to reject H_0

There is not enough evidence to reject the null hypothesis that the odds ratios comparing test vs treatment occurence of rash for males and females are homogeneous. We can conclude that the odds ratios for males and females can reasonably be considered homogeneous.

part c

Fit logistic regression models for the presence of rash after 2 weeks with exaplantory variables for pooled (high or low dose) treatment vs. placebo and for female vs. male, using placebo and male as reference groups for the following:

```
pooled1=pooled%>%mutate(sex=as.numeric(sex=="F"))
pooledat=tibble(treat=rep(pooled1$treat,2),sex=rep(pooled1$sex,2),rash=c(rep(1,4),rep(0,4)),count=c(pool
```

main effects

main effects model: provide gender-specific odds ratios and their corresponding 95% confidence intervals.

```
pmod1=glm(rash~treat+sex,weights = count,family = "binomial",data = pooledat)
summary(pmod1)
```

```
##
## Call:
## glm(formula = rash ~ treat + sex, family = "binomial", data = pooledat,
##     weights = count)
##
## Deviance Residuals:
##      1       2       3       4       5       6       7       8
##  3.821   3.123   7.116   7.102  -5.311  -5.150  -8.881  -8.973
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)   2.0943     0.3363   6.227 4.75e-10 ***
## treat        -0.9279     0.3336  -2.782  0.00541 **
## sex          -0.2231     0.2703  -0.825  0.40932
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
```

```
##
##     Null deviance: 348.67  on 7  degrees of freedom
## Residual deviance: 339.54  on 5  degrees of freedom
## AIC: 345.54
##
## Number of Fisher Scoring iterations: 5
```

Explanatory Variables

Treat indicator of pooled treatment

Sex indicator of female sex

Rash indicator of rash occurrence (rash=1)

θ_{hi} is the probability that person from hth treatment group with ith sex level has rash occurrence

$logit(\theta_{ij}) = 2.094 + -.928Treat + -.223Sex$

The odds ratio of rash occurence of females to males is $\exp(-.223) = .8$ The odds of rash occurence for females is .8 times the odds of rash occurrence in males. The 95% CI is $(.471, 1.359)$

main effects plus interaction

main effects plus two-way interaction model: provide gender-specific odds ratios and their corresponding 95% confidence intervals

```
pmod2=glm(rash~treat+sex+treat*sex,weights = count,family = "binomial",data = pooledat)
summary(pmod2)
```

```
##
## Call:
## glm(formula = rash ~ treat + sex + treat * sex, family = "binomial",
##     data = pooledat, weights = count)
##
## Deviance Residuals:
##      1       2       3       4       5       6       7       8
##  3.622   3.349   7.218   6.997  -5.441  -4.995  -8.797  -9.053
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  1.94591    0.43643   4.459 8.25e-06 ***
## treat       -0.74552    0.48677  -1.532    0.126
## sex          0.04001    0.59409   0.067    0.946
## treat:sex   -0.33058    0.66682  -0.496    0.620
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 348.67  on 7  degrees of freedom
## Residual deviance: 339.29  on 4  degrees of freedom
## AIC: 347.29
##
## Number of Fisher Scoring iterations: 5
```

___Treat*Sex___ Two-way interaction term between treatment and sex

$logit(\theta_{ij}) = 1.946 + -.746Treat + .04Sex + -.331Treat * Sex$

```
include_graphics("or2.png")
```

Odds Ratio Estimates and Wald Confidence Intervals			
Odds Ratio	**Estimate**	**95% Confidence Limits**	
sex 1 vs 0 at treat=0	1.041	0.325	3.335
sex 1 vs 0 at treat=1	0.748	0.413	1.354

Odds ratio for females to males in placebo group:

$\exp(.04) = 1.041$ The odds of rash occurence for females in the placebo group is 1.041 times the odds of rash occurrence in males in the placebo group. The 95% Confidence interval is $(.325, 3.335)$

Odds ratio for females to males in pooled treatment group:

$\exp(.04 + -.33058) = .748$ The odds of rash occurence for females in the pooled treatment group is .748 times the odds of rash occurrence in males in the pooled treatment group. The 95% CI is $(.413, 1.354)$

part d

Do parts a through c agree? Briefly comment on your findings in 1-2 short sentences

The results from part a suggest that pooled treatment and presence of presence of rash are accociated when controlling for sex. From part b, the odds ratio controlling for gender, comparing presence of rash in the pooled treatment group to the placebo group was .397, which suggests that the treatment is associated with rash reduction. This is in agreement with part a. The odds ratio for females only was .341 and the odds ratio for males only was .474 (although the confidence interval included the null value). Thus parts a and b are in agreeement. From part c the odds ratio of rash occurence from the main effects model of females to males was .8 but the 95% CI included the null value so the results were not siginifcant. In both the main effects model and the interaction model, sex was not significant, the main effects model had a p-value for sex of .41 and the interaction model had a p-value for sex of .95. Also the interaction term between treatment and sex was non-significant with a p-value of .62

```
include_graphics("me.png")
```

Analysis of Maximum Likelihood Estimates					
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	2.0943	0.3363	38.7775	<.0001
treat	1	-0.9279	0.3336	7.7374	0.0054
sex	1	-0.2231	0.2703	0.6808	0.4093

```
include_graphics("inter.png")
```

Analysis of Maximum Likelihood Estimates							
Parameter			**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept			1	1.9459	0.4364	19.8794	<.0001
treat	1		1	-0.7455	0.4868	2.3456	0.1256
sex	1		1	0.0400	0.5941	0.0045	0.9463
treat*sex	1	1	1	-0.3306	0.6668	0.2458	0.6201

Problem 3

part a

```
teeth=tibble(toothex=c("none","none","one","one","2+","2+"),jaw=rep(c("upper","lower"),times=3),low=c(2
```

Under minimal assumptions, conduct a statistical test to determine whether there is a location shift across degree of insurance coverage when comparing between no tooth extraction and one or more teeth extraction, while controlling for type of jaw.

```
teeth1=teeth%>%mutate(toothex=as.numeric(toothex!="none"))%>%group_by(toothex,jaw)%>%summarize(low=sum(
u=teeth1%>%filter(jaw=="upper")%>%select(jaw,toothex,low,med,high)
l=teeth1%>%filter(jaw=="lower")%>%select(jaw,toothex,low,med,high)
```

```
include_graphics("3a.png")
```

Summary Statistics for toothex by insurance
Controlling for jaw

Cochran-Mantel-Haenszel Statistics (Modified Ridit Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	0.0504	0.8224
2	Row Mean Scores Differ	1	0.0511	0.8211
3	General Association	2	0.0482	0.9762

Running an extension Mantel-Haenszel test to test the null hypothesis that there is no location shift across degree of insurance coverage when comparing between no tooth extraction and one or more teeth extraction, while controlling for type of jaw. Since we can't say that the response levels for degree of insurance coverage are equally spaced, using the modified ridit score in the computation of Q_{SMH}

Q_{SMH} = .0511 with df=1 p-value=.821>.05

Fail to reject the null hypothesis, conclude there is no location shift across degree of insurance coverage when comparing between no tooth extraction and one or more teeth extraction, while controlling for type of jaw.

part b

Please specify which tooth extraction tends to demonstrate a higher degree of insurance coverage if the result in part a) is shown to be statistically significant.

The results from part a were non-significant

part c

Under minimal assumptions, conduct a statistical test to determine whether there is a trend in the proportion of degree of high insurance (versus not) across the ordered levels of number of extracted teeth ignoring any effect of jaw.

```
teeth2=teeth%>%mutate(not_high=low+med,toothex=case_when(toothex=="none"~0,toothex=="one"~1,TRUE~2))%>%
teeth2
```

```
## # A tibble: 3 x 4
##   toothex not_high  high prophigh
##     <dbl>    <dbl> <dbl>    <dbl>
## 1       0      704   510    0.420
## 2       1      163   156    0.489
## 3       2      111    43    0.279
```

```
include_graphics("high.png")
```

Summary Statistics for high by toothex

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	2.7039	0.1001
2	Row Mean Scores Differ	1	2.7039	0.1001
3	General Association	2	18.7539	<.0001

Conducting a Mantel-Haenszel test to determine whether there is a trend in the proportion of high insurance across the ordered levels of number of extracted teeth ignoring jaw type.

H_0 There is no trend in proportion of high insurance across tooth extraction level.

$Q_S = 2.704$ with 1 df p-value= $.1001 > .05$ Thus fail to reject the null hypothesis, conclude there is not a trend in proportion of high insurance across tooth extraction level, ignoring jaw type.

part d

Under minimal assumptions, conduct a statistical test to determine whether there is a trend in the proportion of high insurance (versus not) across the ordered levels of number of extracted teeth, controlling for jaw

```
teeth3=teeth%>%mutate(not_high=low+med,toothex=case_when(toothex=="none"~0,toothex=="one"~1,TRUE~2))%>%
teeth3
```

```
## # A tibble: 6 x 4
##   jaw   toothex not_high  high
##   <chr>   <dbl>    <dbl> <dbl>
## 1 lower       0      232   137
## 2 lower       1       73    75
## 3 lower       2       33    19
## 4 upper       0      472   373
## 5 upper       1       90    81
## 6 upper       2       78    24
```

```
include_graphics("3d.png")
```

Summary Statistics for high by toothex
Controlling for jaw

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)				
Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	2.5042	0.1135
2	Row Mean Scores Differ	1	2.5042	0.1135
3	General Association	2	19.3605	<.0001

Running an extension Mantel-Haenszel test to test the null hypothesis that there is trend in proportion of high insurance across ordered tooth extraction level, controlling for jaw type.

$Q_{SMH} = 2.504$ with 1 df p-value= $.1135 > .05$ Thus fail to reject the null hypothesis, conclude there is not trend in proportion of high insurance across ordered tooth extraction level, controlling for jaw type.

Problem 4

part a

```
drugs=tibble(druga=c(rep("f",times=4),rep("u",times=4)),drugb=rep(c("f","f","u","u"),times=2),drugc=rep
```

Fit a conditional logistic regression model describing the relationship of favorable response to the treatments, conditioning on patient. Use drug A as the reference category. Report a table of all parameter estimates and their standard errors

```
include_graphics("conditional.png")
```

Analysis of Conditional Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
drug	B	1	1.75E-15	0.4472	0.0000	1.0000
drug	C	1	-1.0986	0.4511	5.9307	0.0149

Running a conditional logistic regression model in SAS using drug A as the reference category and conditioning on patient.

Drug B Estimate $< .001$ Standard error .447

Drug C Estimate -1.099 Standard Error .451

part b

Provide appropriate measures of association and 99% confidence intervals for the effects of treatments relative to one another for favorable response, while conditioning on the patient effect

```
include_graphics("condor.png")
```

Odds Ratio Estimates and Wald Confidence Intervals			
Odds Ratio	Estimate	99% Confidence Limits	
drug B vs A	1.000	0.316	3.164
drug C vs A	0.333	0.104	1.065
drug B vs C	3.000	0.939	9.589

The Odds Ratio of the effects of each drug relative to each other for favorable response and corresponding 99% CI:

Drug B to A OR=1 99% CI: $(.316, 3.164)$

Drug C to A OR=.333 99% CI: $(.104, 1.065)$

Drug B to C OR= 3 99% CI: $(.939, 9.589)$

part c

Using this model with drug A as reference, perform a hypothesis test to compare drug B to drug C at the 0.05 significance level. Justify your choice of methods and interpret the results

Using contrast to preform a Wald test comparing the effect on favorable response of drug B vs drug C

$H_0:B-C=0 $ There is no difference in favorable response between drug B and drug C

```
include_graphics("contrast.png")
```

Contrast Test Results			
Contrast	DF	Wald Chi-Square	Pr > ChiSq
b vs c	1	5.9307	0.0149

$\chi^2 = 5.931$ with 1 df $p - value = .015 < .05$

Thus reject H_0 and conclude there is a difference in favorable response between drug B and drug C. Given these results and the that the odds ratio of favorable response comparing Drug B to drug C, conditioning on patient effect is 3, this suggests that drug B is more effective than drug C.