Birth Weight

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Contents

Problem – Infant Birth Weight Data

Read data from SAS input file

```
# this data came from SASHELP.BWEIGHT
bw = read.csv('bwgt.csv', header = TRUE, fileEncoding = 'UTF-8-BOM')
bw = data.frame(bw)[!(bw$Smoking == ""),]
#summary(bw)
bw = transform(bw, AgeGroup.f = as.factor(AgeGroup))
bw = transform(bw, Race.f = as.factor(Race))
bw = transform(bw, Drinking.f = as.factor(Drinking))
bw = transform(bw, Death.f = as.factor(Death))
bw = transform(bw, Smoking.f = as.factor(Smoking))
bw = transform(bw, SomeCollege.f = as.factor(SomeCollege))
bw = transform(bw, LowBirthWgt.f = as.factor(LowBirthWgt))
```

```
tally(~ AgeGroup + Race.f, data=bw)
```

```
##         Race.f
## AgeGroup Asian Black Hispanic Native White
##        1     8    89       79      5   160
##        2    91   358      467     20  1230
##        3    31    49       66      3   236
```

```
tally(~ Race.f | AgeGroup.f, data=bw)
```

```
##           AgeGroup.f
## Race.f        1    2    3
##   Asian       8   91   31
##   Black      89  358   49
##   Hispanic   79  467   66
##   Native      5   20    3
##   White     160 1230  236
```

```
mytab = tally(~ Race.f | AgeGroup.f, data=bw)
addmargins(mytab)
```

```
##           AgeGroup.f
## Race.f        1    2    3  Sum
##   Asian       8   91   31  130
##   Black      89  358   49  496
##   Hispanic   79  467   66  612
##   Native      5   20    3   28
##   White     160 1230  236 1626
##   Sum       341 2166  385 2892
```

```
prop.table(mytab, 1)
```

```
##           AgeGroup.f
## Race.f               1          2          3
##   Asian    0.06153846 0.70000000 0.23846154
##   Black    0.17943548 0.72177419 0.09879032
##   Hispanic 0.12908497 0.76307190 0.10784314
##   Native   0.17857143 0.71428571 0.10714286
##   White    0.09840098 0.75645756 0.14514145
```

```
attach(bw)
mytab = tally(~ LowBirthWgt.f | Death.f, data=bw)
addmargins(mytab)
```

```
##              Death.f
## LowBirthWgt.f   No  Yes  Sum
##           No  2135  182 2317
##           Yes  192  383  575
##           Sum 2327  565 2892
```

```
prop.table(mytab, 1)
```

```
##              Death.f
## LowBirthWgt.f         No        Yes
##           No  0.92145015 0.07854985
##           Yes 0.33391304 0.66608696
```

```
riskratio(x=Smoking.f, y=Death.f)
```

```
## $data
##          Outcome
## Predictor   No Yes Total
##     No    1786 405  2191
##     Yes    541 160   701
##     Total 2327 565  2892
```

```
##
## $measure
##          risk ratio with 95% C.I.
## Predictor estimate    lower    upper
##       No  1.000000       NA       NA
##       Yes 1.234779 1.050052 1.452004
##
## $p.value
##          two-sided
## Predictor midp.exact fisher.exact chi.square
##       No          NA           NA         NA
##       Yes  0.0127352   0.01371876 0.01165276
##
## $correction
## [1] FALSE
##
## attr(,"method")
## [1] "Unconditional MLE & normal approximation (Wald) CI"
```

Code 1

Summary Statistics

```
summary(bw)
```

```
##  LowBirthWgt          Married             AgeGroup         Race
##  Length:2892        Length:2892        Min.   :1.000   Length:2892
##  Class :character   Class :character   1st Qu.:2.000   Class :character
##  Mode  :character   Mode  :character   Median :2.000   Mode  :character
##                                        Mean   :2.015
##                                        3rd Qu.:2.000
##                                        Max.   :3.000
##    Drinking            Death              Smoking          SomeCollege
##  Length:2892        Length:2892        Length:2892        Length:2892
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##  AgeGroup.f      Race.f     Drinking.f Death.f    Smoking.f  SomeCollege.f
##  1: 341     Asian   : 130   No :2493   No :2327   No :2191      :  48
##  2:2166     Black   : 496   Yes: 399   Yes: 565   Yes: 701   No :1526
##  3: 385     Hispanic: 612                                    Yes:1318
##             Native  :  28
##             White   :1626
##
##  LowBirthWgt.f
##  No :2317
##  Yes: 575
##
##
##
```

```
##
```

```
head(bw)
```

```
##   LowBirthWgt Married AgeGroup   Race Drinking Death Smoking SomeCollege
## 1         Yes     Yes        2 Native       No   Yes      No          No
## 2         Yes     Yes        1  White       No   Yes     Yes          No
## 3          No     Yes        2  White       No   Yes     Yes          No
## 4         Yes      No        2  Black       No   Yes     Yes          No
## 5          No     Yes        1  White       No   Yes     Yes          No
## 6         Yes     Yes        2  Black       No   Yes      No          No
##   AgeGroup.f Race.f Drinking.f Death.f Smoking.f SomeCollege.f LowBirthWgt.f
## 1          2 Native         No     Yes        No            No           Yes
## 2          1  White         No     Yes       Yes            No           Yes
## 3          2  White         No     Yes       Yes            No            No
## 4          2  Black         No     Yes       Yes            No           Yes
## 5          1  White         No     Yes       Yes            No            No
## 6          2  Black         No     Yes        No            No           Yes
```

Code 2

Test for Association Between Low Birth Weight and Smoking

```
bw_smoking_table = tally(~ LowBirthWgt.f | Smoking.f, data=bw)
addmargins(bw_smoking_table)
```

```
##              Smoking.f
## LowBirthWgt.f   No  Yes  Sum
##           No  1771  546 2317
##           Yes  420  155  575
##           Sum 2191  701 2892
```

```
prop.table(bw_smoking_table, 1)
```

```
##              Smoking.f
## LowBirthWgt.f        No       Yes
##           No  0.7643505 0.2356495
##           Yes 0.7304348 0.2695652
```

```
fisher.test(bw_smoking_table)
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  bw_smoking_table
## p-value = 0.09208
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.9655756 1.4791492
## sample estimates:
## odds ratio
##    1.19693
```

```
chisq.test(bw_smoking_table)
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  bw_smoking_table
## X-squared = 2.7038, df = 1, p-value = 0.1001
```

Both p-values are greater than 0.05.

```
ratio <- table(bw$Smoking.f,bw$LowBirthWgt.f)
epi.2by2(ratio, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 1771 420 2191 80.8 4.22
## Exposed - 546 155 701 77.9 3.52
## Total 2317 575 2892 80.1 4.03
##
## Point estimates and 95% CIs:
## -------------------------------------------------------------------
## Inc risk ratio 1.04 (0.99, 1.08)
## Odds ratio 1.20 (0.97, 1.47)
## Attrib risk in the exposed * 2.94 (-0.54, 6.43)
## Attrib fraction in the exposed (%) 3.64 (-0.74, 7.82)
## Attrib risk in the population * 2.23 (-1.17, 5.63)
## Attrib fraction in the population (%) 2.78 (-0.57, 6.03)
## -------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 2.886 Pr>chi2 = 0.089
## Fisher exact test that OR = 1: Pr>chi2 = 0.092
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 1.04 (95% CI 0.99 to 1.08) times greater
than the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 1.2 (95% CI 0.97 to 1.47) times greater
than the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by 2.94 (95% CI -0.54 to 6.43) per
100 population units. 3.6% of outcomes in the exposed were attributable to exposure
(95% CI -0.7% to 7.8%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to benefit (NNTB) is 34 (NNTH 184 to
infinity to NNTB 16).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by 2.23 (95% CI -1.17 to 5.63)
per 100 population units. 2.8% of outcomes in the population were attributable to
exposure (95% CI -0.6% to 6%).
```

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and smoking.

Test for Association Between Low Birth Weight and Drinking

```
bw_drinking_table = tally(~ LowBirthWgt.f | Drinking.f, data=bw)
addmargins(bw_drinking_table)
```

```
##              Drinking.f
## LowBirthWgt.f   No  Yes  Sum
##           No  1992  325 2317
##           Yes  501   74  575
##           Sum 2493  399 2892
```

```
prop.table(bw_drinking_table, 1)
```

```
##              Drinking.f
## LowBirthWgt.f        No       Yes
##           No  0.8597324 0.1402676
##           Yes 0.8713043 0.1286957
```

```
fisher.test(bw_drinking_table)
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  bw_drinking_table
## p-value = 0.4998
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.6807265 1.1925401
## sample estimates:
## odds ratio
##  0.9053474
```

```
chisq.test(bw_drinking_table)
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  bw_drinking_table
## X-squared = 0.42596, df = 1, p-value = 0.514
```

Both p-values are greater than 0.05.

```
ratio <- table(bw$Drinking.f,bw$LowBirthWgt.f)
epi.2by2(ratio, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 1992 501 2493 79.9 3.98
## Exposed - 325 74 399 81.5 4.39
## Total 2317 575 2892 80.1 4.03
##
## Point estimates and 95% CIs:
## -------------------------------------------------------------------
## Inc risk ratio 0.98 (0.93, 1.03)
## Odds ratio 0.91 (0.69, 1.19)
## Attrib risk in the exposed * -1.55 (-5.68, 2.58)
## Attrib fraction in the exposed (%) -1.94 (-7.25, 3.11)
## Attrib risk in the population * -1.34 (-5.42, 2.75)
```

```
## Attrib fraction in the population (%) -1.67 (-6.21, 2.68)
## ---------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 0.519 Pr>chi2 = 0.471
## Fisher exact test that OR = 1: Pr>chi2 = 0.500
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 0.98 (95% CI 0.93 to 1.03) times less than
the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 0.91 (95% CI 0.69 to 1.19) times less than
the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by -1.55 (95% CI -5.68 to 2.58) per
100 population units. -1.9% of outcomes in the exposed were attributable to exposure
(95% CI -7.3% to 3.1%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to be harmed (NNTH) is 65 (NNTH 18 to
infinity to NNTB 39).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by -1.34 (95% CI -5.42 to 2.75)
per 100 population units. -1.7% of outcomes in the population were attributable to
exposure (95% CI -6.2% to 2.7%).
```

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and drinking.

Code 3

Test for Association between Low Birth Weight and Smoking, Controlling for Death

Death = "Yes"

```
deathdaty <- bw |> filter(Death.f == "Yes")
smokingtaby <- tally(~ Smoking.f | LowBirthWgt.f, data = deathdaty)
epi.2by2(smokingtaby, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 124 281 405 30.6 0.441
## Exposed - 58 102 160 36.2 0.569
## Total 182 383 565 32.2 0.475
##
## Point estimates and 95% CIs:
## ---------------------------------------------------------------------
## Inc risk ratio 0.84 (0.66, 1.09)
```

```
## Odds ratio 0.78 (0.53, 1.14)
## Attrib risk in the exposed * -5.63 (-14.33, 3.06)
## Attrib fraction in the exposed (%) -18.40 (-52.39, 8.02)
## Attrib risk in the population * -4.04 (-12.42, 4.35)
## Attrib fraction in the population (%) -12.53 (-33.67, 5.26)
## ---------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 1.666 Pr>chi2 = 0.197
## Fisher exact test that OR = 1: Pr>chi2 = 0.230
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 0.84 (95% CI 0.66 to 1.09) times less than
the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 0.78 (95% CI 0.53 to 1.14) times less than
the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by -5.63 (95% CI -14.33 to 3.06) per
100 population units. -18.4% of outcomes in the exposed were attributable to
exposure (95% CI -52.4% to 8%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to be harmed (NNTH) is 18 (NNTH 7 to
infinity to NNTB 33).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by -4.04 (95% CI -12.42 to 4.35)
per 100 population units. -12.5% of outcomes in the population were attributable to
exposure (95% CI -33.7% to 5.3%).
```

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and smoking when Death = "Yes".

Death = "No"

```
deathdatn <- bw |> filter(Death.f == "No")
smokingtabn <- tally(~ Smoking.f | LowBirthWgt.f, data = deathdatn)
epi.2by2(smokingtabn, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 1647 139 1786 92.2 11.85
## Exposed - 488 53 541 90.2 9.21
## Total 2135 192 2327 91.7 11.12
##
## Point estimates and 95% CIs:
## ---------------------------------------------------------------------
## Inc risk ratio 1.02 (0.99, 1.05)
## Odds ratio 1.29 (0.92, 1.79)
## Attrib risk in the exposed * 2.01 (-0.78, 4.81)
```

```
## Attrib fraction in the exposed (%) 2.18 (-0.88, 5.16)
## Attrib risk in the population * 1.55 (-1.20, 4.29)
## Attrib fraction in the population (%) 1.68 (-0.68, 4.00)
## ---------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 2.225 Pr>chi2 = 0.136
## Fisher exact test that OR = 1: Pr>chi2 = 0.153
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 1.02 (95% CI 0.99 to 1.05) times greater
than the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 1.29 (95% CI 0.92 to 1.79) times greater
than the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by 2.01 (95% CI -0.78 to 4.81) per
100 population units. 2.2% of outcomes in the exposed were attributable to exposure
(95% CI -0.9% to 5.2%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to benefit (NNTB) is 50 (NNTH 128 to
infinity to NNTB 21).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by 1.55 (95% CI -1.2 to 4.29) per
100 population units. 1.7% of outcomes in the population were attributable to
exposure (95% CI -0.7% to 4%).
```

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and smoking when Death = "No".

General

```
mysarray <- array(c(smokingtaby, smokingtabn),dim = c(2,2,2))
mantelhaen.test(mysarray)
```

```
##
##  Mantel-Haenszel chi-squared test with continuity correction
##
## data:  mysarray
## Mantel-Haenszel X-squared = 0.034773, df = 1, p-value = 0.8521
## alternative hypothesis: true common odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.8003662 1.3327269
## sample estimates:
## common odds ratio
##          1.032797
```

```
DescTools::BreslowDayTest(mysarray)
```

```
##
##  Breslow-Day test on Homogeneity of Odds Ratios
##
## data:  mysarray
## X-squared = 3.8091, df = 1, p-value = 0.05098
```

Both p-values are greater than 0.05, so we fail to reject that the common odds ratio is 1 and fail to reject that the odds ratios are homogeneous.

Test for Association between Low Birth Weight and Drinking, Controlling for Death

Death = "Yes"

```
drinkingtaby <- tally(~ Drinking.f | LowBirthWgt.f, data = deathdaty)
epi.2by2(drinkingtaby, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 157 338 495 31.7 0.464
## Exposed - 25 45 70 35.7 0.556
## Total 182 383 565 32.2 0.475
##
## Point estimates and 95% CIs:
## -------------------------------------------------------------------
## Inc risk ratio 0.89 (0.63, 1.25)
## Odds ratio 0.84 (0.49, 1.41)
## Attrib risk in the exposed * -4.00 (-15.95, 7.95)
## Attrib fraction in the exposed (%) -12.60 (-58.17, 19.84)
## Attrib risk in the population * -3.50 (-15.37, 8.37)
## Attrib fraction in the population (%) -10.87 (-48.64, 17.30)
## -------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 0.449 Pr>chi2 = 0.503
## Fisher exact test that OR = 1: Pr>chi2 = 0.498
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 0.89 (95% CI 0.63 to 1.25) times less than
the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 0.84 (95% CI 0.49 to 1.41) times less than
the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by -4 (95% CI -15.95 to 7.95) per
100 population units. -12.6% of outcomes in the exposed were attributable to
exposure (95% CI -58.2% to 19.8%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to be harmed (NNTH) is 25 (NNTH 6 to
infinity to NNTB 13).
##
```

```
## Measures of effect in the population:
## Exposure changed outcome risk in the population by -3.5 (95% CI -15.37 to 8.37)
per 100 population units. -10.9% of outcomes in the population were attributable to
exposure (95% CI -48.6% to 17.3%).
```

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and drinking when Death = "Yes".

Death = "No"

```
drinkingtabn <- tally(~ Drinking.f | LowBirthWgt.f, data = deathdatn)
epi.2by2(drinkingtabn, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 1835 163 1998 91.8 11.3
## Exposed - 300 29 329 91.2 10.3
## Total 2135 192 2327 91.7 11.1
##
## Point estimates and 95% CIs:
## -------------------------------------------------------------------
## Inc risk ratio 1.01 (0.97, 1.04)
## Odds ratio 1.09 (0.72, 1.65)
## Attrib risk in the exposed * 0.66 (-2.63, 3.95)
## Attrib fraction in the exposed (%) 0.71 (-2.93, 4.23)
## Attrib risk in the population * 0.56 (-2.70, 3.82)
## Attrib fraction in the population (%) 0.61 (-2.51, 3.65)
## -------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 0.161 Pr>chi2 = 0.688
## Fisher exact test that OR = 1: Pr>chi2 = 0.666
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 1.01 (95% CI 0.97 to 1.04) times greater
than the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 1.09 (95% CI 0.72 to 1.65) times greater
than the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by 0.66 (95% CI -2.63 to 3.95) per
100 population units. 0.7% of outcomes in the exposed were attributable to exposure
(95% CI -2.9% to 4.2%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to benefit (NNTB) is 152 (NNTH 38 to
infinity to NNTB 25).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by 0.56 (95% CI -2.7 to 3.82) per
100 population units. 0.6% of outcomes in the population were attributable to
```

exposure (95% CI -2.5% to 3.6%).

Because 1 is in the odds ratio confidence interval and the p-values for the Fisher's exact test and Chi-Square test are above 0.05, we fail to reject that there is a significant association between low birth weight and drinking when Death = "No".

General

```
mydarray <- array(c(drinkingtaby, drinkingtabn), dim = c(2,2,2))
mantelhaen.test(mydarray)
```

```
##
##  Mantel-Haenszel chi-squared test with continuity correction
##
## data:  mydarray
## Mantel-Haenszel X-squared = 0.00027035, df = 1, p-value = 0.9869
## alternative hypothesis: true common odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.7080307 1.3658739
## sample estimates:
## common odds ratio
##         0.9834026
```

```
DescTools::BreslowDayTest(mydarray)
```

```
##
##  Breslow-Day test on Homogeneity of Odds Ratios
##
## data:  mydarray
## X-squared = 0.59941, df = 1, p-value = 0.4388
```

Both p-values are greater than 0.05, so we fail to reject that the common odds ratio is 1 and fail to reject that the odds ratios are homogeneous.

Code 4

Test for Association between Low Birth Weight and Death

```
mytab = tally(~ LowBirthWgt.f | Death.f, data=bw)
addmargins(mytab)
```

```
##              Death.f
## LowBirthWgt.f   No  Yes  Sum
##           No  2135  182 2317
##           Yes  192  383  575
##           Sum 2327  565 2892
```

```
prop.table(mytab, 1)
```

```
##              Death.f
## LowBirthWgt.f         No        Yes
##           No  0.92145015 0.07854985
##           Yes 0.33391304 0.66608696
```

```
fisher.test(mytab)
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  mytab
## p-value < 2.2e-16
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##  18.45830 29.66376
## sample estimates:
## odds ratio
##   23.35087
```

```
chisq.test(mytab)
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  mytab
## X-squared = 1007.9, df = 1, p-value < 2.2e-16
```

```
ratio <- table(bw$Death.f,bw$LowBirthWgt.f)
epi.2by2(ratio, method = "cohort.count", interpret = TRUE)
```

```
## Outcome + Outcome - Total Inc risk * Odds
## Exposed + 2135 192 2327 91.7 11.120
## Exposed - 182 383 565 32.2 0.475
## Total 2317 575 2892 80.1 4.030
##
## Point estimates and 95% CIs:
## -------------------------------------------------------------------
## Inc risk ratio 2.85 (2.53, 3.21)
## Odds ratio 23.40 (18.59, 29.45)
## Attrib risk in the exposed * 59.54 (55.52, 63.55)
## Attrib fraction in the exposed (%) 64.89 (60.41, 68.87)
## Attrib risk in the population * 47.91 (43.79, 52.02)
## Attrib fraction in the population (%) 59.79 (55.06, 64.03)
## -------------------------------------------------------------------
## Uncorrected chi2 test that OR = 1: chi2(1) = 1011.621 Pr>chi2 = <0.001
## Fisher exact test that OR = 1: Pr>chi2 = <0.001
## Wald confidence limits
## CI: confidence interval
## * Outcomes per 100 population units
##
## Measures of association strength:
## The outcome risk among the exposed was 2.85 (95% CI 2.53 to 3.21) times greater
than the outcome risk among the unexposed.
##
## The outcome odds among the exposed was 23.4 (95% CI 18.59 to 29.45) times greater
than the outcome odds among the unexposed.
##
## Measures of effect in the exposed:
## Exposure changed outcome risk in the exposed by 59.54 (95% CI 55.52 to 63.55) per
100 population units. 64.9% of outcomes in the exposed were attributable to exposure
```

```
(95% CI 60.4% to 68.9%).
##
## Number needed to treat for benefit (NNTB) and harm (NNTH):
## The number needed to treat for one subject to benefit (NNTB) is 2 (95% CI 2 to
2).
##
## Measures of effect in the population:
## Exposure changed outcome risk in the population by 47.91 (95% CI 43.79 to 52.02)
per 100 population units. 59.8% of outcomes in the population were attributable to
exposure (95% CI 55.1% to 64%).
```

From the frequency table of Death by Low birth weight, we know that low birth weight is more likely to lead to death. The Chi-square test and the Fisher's test shows that there are enough statistical evidence to conclude that the odds ratio is more than one of death by low birth weight, that is, death and low birth weight are positively correlated. The Chi-square test provides the 95% CI of Death by Low birth weight is (18.3410, 28.5869), which is far away from 1 and does not contain "0".