Agresti Coronary Data

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Needed Packages

```
if(!require(FSA)){install.packages("FSA")}
if(!require(ggplot2)){install.packages("ggplot2")}
if(!require(car)){install.packages("car")}
if(!require(multcompView)){install.packages("multcompView")}
if(!require(lsmeans)){install.packages("lsmeans")}
if(!require(grid)){install.packages("grid")}
if(!require(nlme)){install.packages("nlme")}
if(!require(lme4)){install.packages("lme4")}
if(!require(Rmisc)){install.packages("Rmisc")}
if(!require(FSA)){install.packages("FSA")}
#if(!require(lmerTest)){install.packages("lmerTest")}
#if(!require(rcompanion)){install.packages("rcompanion")}
```

Example 1

Read data from SAS input file

```
Input = ("
sex ecg ca total
0 0 4 15
0 1 8 18
1 0 9 18
1 1 21 27
")
coronary1 = read.table(textConnection(Input),header=TRUE)
coronary1 = data.frame(coronary1)

sex = coronary1$sex
ecg = coronary1$ecg
ca = coronary1$ca
total = coronary1$total
per.ca = ca/total
```

Fit Logistic Model with Identity Link

```
mod1 = glm( per.ca ~ sex + ecg,
            family = "gaussian"(link="identity"),
            data=coronary1)
mod1
```

```
##
```

```
## Call:  glm(formula = per.ca ~ sex + ecg, family = gaussian(link = "identity"),
##     data = coronary1)
##
## Coefficients:
## (Intercept)          sex          ecg
##      0.2417       0.2833       0.2278
##
## Degrees of Freedom: 3 Total (i.e. Null);  1 Residual
## Null Deviance:       0.1347
## Residual Deviance: 0.0025    AIC: -10.16
```

Fit Logistic Model with LOGIT link

```
mod2 = glm( ca/total ~ sex + ecg,
            family = "binomial"(link="logit"),
            data=coronary1)
```

```
## Warning in eval(family$initialize): non-integer #successes in a binomial glm!
```

```
mod2
```

```
##
## Call:  glm(formula = ca/total ~ sex + ecg, family = binomial(link = "logit"),
##     data = coronary1)
##
## Coefficients:
## (Intercept)          sex          ecg
##      -1.141        1.240        1.017
##
## Degrees of Freedom: 3 Total (i.e. Null);  1 Residual
## Null Deviance:       0.5656
## Residual Deviance: 0.01141   AIC: 9.874
```

```
#plot(mod1)
```

Fit Logistic Model with Cloglog link

```
mod3 = glm( ca/total ~ sex + ecg,
            family = "binomial"(link="cloglog"),
            data=coronary1)
```

```
## Warning in eval(family$initialize): non-integer #successes in a binomial glm!
```

```
mod3
```

```
##
## Call:  glm(formula = ca/total ~ sex + ecg, family = binomial(link = "cloglog"),
##     data = coronary1)
##
## Coefficients:
## (Intercept)          sex          ecg
##     -1.2244       0.8864       0.7247
##
## Degrees of Freedom: 3 Total (i.e. Null);  1 Residual
## Null Deviance:       0.5656
## Residual Deviance: 0.001879  AIC: 9.749
```

```
#plot(mod2)
```

Fit Results

```
p_linear = 0.76 - 0.28*sex - 0.23*ecg
p_logit = exp(1.14-1.24*sex-1.02*ecg)/(1 + exp(1.14-1.24*sex-1.02*ecg))
p_cll = 1 - exp( -exp(0.36 - 0.84*sex - 0.68*ecg))
p_linear = 1 - p_linear
p_logit = 1 - p_logit
p_cll = 1 - p_cll
## Probability for CA event
cbind(sex,ecg,per.ca,p_linear,p_logit,p_cll)
```

```
##      sex ecg    per.ca p_linear   p_logit     p_cll
## [1,]   0   0 0.2666667     0.24 0.2423204 0.2385135
## [2,]   0   1 0.4444444     0.47 0.4700359 0.4837684
## [3,]   1   0 0.5000000     0.52 0.5249792 0.5385993
## [4,]   1   1 0.7777778     0.75 0.7539887 0.7308945
```

Odds For Sex and ECG

```
odds_sex = exp(1.24)
odds_sex                    #male vs female for CA event
```

```
## [1] 3.455613
```

```
odds_ecg = exp(1.02)
odds_ecg                    #high vs low (ECG) for CA event
```

```
## [1] 2.773195
```

Example 2

Read data from SAS input file

```
Input = ("
sex ecg age ca
0 0 28 0
1 0 42 1
0 1 46 0
1 1 45 0
0 0 34 0
1 0 44 1
0 1 48 1
1 1 45 1
0 0 38 0
1 0 45 0
0 1 49 0
1 1 45 1
0 0 41 1
1 0 46 0
0 1 49 0
1 1 46 1
0 0 44 0
1 0 48 0
0 1 52 0
1 1 48 1
0 0 45 1
```

```
1 0 50 0
0 1 53 1
1 1 57 1
0 0 46 0
1 0 52 1
0 1 54 1
1 1 57 1
0 0 47 0
1 0 52 1
0 1 55 0
1 1 59 1
0 0 50 0
1 0 54 0
0 1 57 1
1 1 60 1
0 0 51 0
1 0 55 0
0 2 46 1
1 1 63 1
0 0 51 0
1 0 59 1
0 2 48 0
1 2 35 0
0 0 53 0
1 0 59 1
0 2 57 1
1 2 37 1
0 0 55 1
1 1 32 0
0 2 60 1
1 2 43 1
0 0 59 0
1 1 37 0
1 0 30 0
1 2 47 1
0 0 60 1
1 1 38 1
1 0 34 0
1 2 48 1
0 1 32 1
1 1 38 1
1 0 36 1
1 2 49 0
0 1 33 0
1 1 42 1
1 0 38 1
1 2 58 1
0 1 35 0
1 1 43 0
1 0 39 0
1 2 59 1
0 1 39 0
1 1 43 1
```

```
1 0 42 0
1 2 60 1
0 1 40 0
1 1 44 1
")
coronary2 = read.table(textConnection(Input),header=TRUE)
coronary2 = data.frame(coronary2)

sex = coronary2$sex
ecg = coronary2$ecg
ca = coronary2$ca
age = coronary2$age
ca[ca==2] = 1
```

Fit Logistic Model with LOGIT link

```
mod2 = glm( ca ~ sex + ecg + age,
            family = "binomial"(link="logit"),
            data=coronary2)
mod2
```

```
##
## Call:  glm(formula = ca ~ sex + ecg + age, family = binomial(link = "logit"),
##     data = coronary2)
##
## Coefficients:
## (Intercept)          sex          ecg          age
##    -5.64176      1.35643      0.87320      0.09285
##
## Degrees of Freedom: 77 Total (i.e. Null);  74 Residual
## Null Deviance:       107.9
## Residual Deviance: 86.81     AIC: 94.81
```

```
#plot(mod1)
```

Odds for CA

```
odds_sex = exp(1.36)
odds_sex                    #male vs female for CA event
```

```
## [1] 3.896193
```

```
odds_ecg = exp(0.87)
odds_ecg                    #high vs low (ECG) for CA event
```

```
## [1] 2.386911
```

```
odds_age = exp(0.09)
odds_age                    #for each year of age for CA event
```

```
## [1] 1.094174
```

Fit Logistic Model with Cloglog link

```
mod3 = glm( ca ~ sex + ecg + age,
            family = "binomial"(link="cloglog"),
            data=coronary2)
mod3
```

```
##
## Call:  glm(formula = ca ~ sex + ecg + age, family = binomial(link = "cloglog"),
##     data = coronary2)
##
## Coefficients:
## (Intercept)          sex          ecg          age
##    -4.48090      0.92131      0.56107      0.06809
##
## Degrees of Freedom: 77 Total (i.e. Null);  74 Residual
## Null Deviance:       107.9
## Residual Deviance: 86    AIC: 94
```

```
#plot(mod2)
```

Fit Results

```
p_logit = exp(-5.64+1.36*sex+0.87*ecg+0.09*age)/(1 + exp(-5.64+1.36*sex+0.87*ecg+0.09*age))
p_cll = 1 - exp( -exp(-4.48+0.92*sex+0.56*ecg+0.07*age))
cbind(sex,ecg,age,p_logit,p_cll)
```

```
##       sex ecg age    p_logit      p_cll
##  [1,]   0   0  28 0.04228977 0.07730783
##  [2,]   1   0  42 0.37754067 0.41605264
##  [3,]   0   1  46 0.34751054 0.39139468
##  [4,]   1   1  45 0.65475346 0.68708830
##  [5,]   0   0  34 0.07043673 0.11525555
##  [6,]   1   0  44 0.42067575 0.46140070
##  [7,]   0   1  48 0.38936077 0.43515790
##  [8,]   1   1  45 0.65475346 0.68708830
##  [9,]   0   0  38 0.09796880 0.14958069
## [10,]   1   0  45 0.44275215 0.48503186
## [11,]   0   1  49 0.41095957 0.45807431
## [12,]   1   1  45 0.65475346 0.68708830
## [13,]   0   0  41 0.12455336 0.18117723
## [14,]   1   0  46 0.46505705 0.50922540
## [15,]   0   1  49 0.41095957 0.45807431
## [16,]   1   1  46 0.67480527 0.71236896
## [17,]   0   0  44 0.15709547 0.21854442
## [18,]   1   0  48 0.50999867 0.55900897
## [19,]   0   1  52 0.47751518 0.53035761
## [20,]   1   1  48 0.71300016 0.76148651
## [21,]   0   0  45 0.16938390 0.23239290
## [22,]   1   0  50 0.55477924 0.61006083
## [23,]   0   1  53 0.50000000 0.55540176
## [24,]   1   1  57 0.84812884 0.93220281
## [25,]   0   0  46 0.18242552 0.24697287
## [26,]   1   0  52 0.59868766 0.66151892
## [27,]   0   1  54 0.52248482 0.58077950
## [28,]   1   1  57 0.84812884 0.93220281
## [29,]   0   0  47 0.19623406 0.26230238
## [30,]   1   0  52 0.59868766 0.66151892
## [31,]   0   1  55 0.54487889 0.60638965
## [32,]   1   1  59 0.86989153 0.95475470
## [33,]   0   0  50 0.24232036 0.31292450
## [34,]   1   0  54 0.64106741 0.71236896
```

```
## [35,]   0   1  57 0.58904043 0.65785073
## [36,]   1   1  60 0.87974314 0.96385140
## [37,]   0   0  51 0.25922510 0.33136986
## [38,]   1   0  55 0.66150316 0.73721721
## [39,]   0   2  46 0.55971365 0.58077950
## [40,]   1   1  63 0.90550963 0.98336016
## [41,]   0   0  51 0.25922510 0.33136986
## [42,]   1   0  59 0.73691590 0.82937158
## [43,]   0   2  48 0.60348325 0.63212056
## [44,]   1   2  35 0.64794080 0.63579929
## [45,]   0   0  53 0.29525430 0.37061559
## [46,]   1   0  59 0.73691590 0.82937158
## [47,]   0   2  57 0.77381857 0.84704486
## [48,]   1   2  37 0.68783133 0.68708830
## [49,]   0   0  55 0.33403307 0.41291860
## [50,]   1   1  32 0.37051689 0.37353754
## [51,]   0   2  60 0.81757448 0.90136873
## [52,]   1   2  43 0.79084063 0.82937158
## [53,]   0   0  59 0.41824062 0.50573728
## [54,]   1   1  37 0.48001066 0.48503186
## [55,]   1   0  30 0.17079548 0.20724121
## [56,]   1   2  47 0.84422416 0.90363834
## [57,]   0   0  60 0.44028635 0.53035761
## [58,]   1   1  38 0.50249998 0.50922540
## [59,]   1   0  34 0.22793645 0.26455442
## [60,]   1   2  48 0.85569687 0.91867407
## [61,]   0   1  32 0.13124447 0.17003685
## [62,]   1   1  38 0.50249998 0.50922540
## [63,]   1   0  36 0.26114999 0.29774218
## [64,]   1   2  49 0.86645828 0.93220281
## [65,]   0   1  33 0.14185106 0.18117723
## [66,]   1   1  42 0.59145898 0.61006083
## [67,]   1   0  38 0.29733935 0.33406929
## [68,]   1   2  58 0.93583612 0.99361044
## [69,]   0   1  35 0.16520487 0.20540719
## [70,]   1   1  43 0.61301418 0.63579929
## [71,]   1   0  39 0.31647911 0.35341414
## [72,]   1   2  59 0.94103299 0.99557055
## [73,]   0   1  39 0.22097389 0.26230238
## [74,]   1   1  43 0.61301418 0.63579929
## [75,]   1   0  42 0.37754067 0.41605264
## [76,]   1   2  60 0.94583330 0.99700987
## [77,]   0   1  40 0.23685498 0.27839674
## [78,]   1   1  44 0.63413559 0.66151892
```