BIOST/EPI 536 R Output for HW7

Contents

```
infert = foreign::read.dta("infert.dta")
library(survey)
```

```
## Loading required package: grid
```

```
## Loading required package: Matrix
```

```
## Loading required package: survival
```

```
##
## Attaching package: 'survey'
```

```
## The following object is masked from 'package:graphics':
##
##     dotchart
```

```
head(infert)
```

```
##   educ age parity induced case spont matchset g2 g3 g4 g5 g6 g7 g8 stratum
## 1    0  26      6       1    1     2        1  0  0  0  0  0  0  1       3
## 2    0  42      1       1    1     0        2  1  0  0  0  0  0  0       1
## 3    0  39      6       2    1     0        3  0  1  0  0  0  0  0       4
## 4    0  34      4       2    1     0        4  0  1  0  0  0  0  0       2
## 5    1  35      3       1    1     1        5  0  0  0  1  0  0  0      32
## 6    1  36      4       2    1     1        6  0  0  0  0  1  0  0      36
```

```
attach(infert)
```

Model 1a

You can also embed plots, for example:

```
induced.ctg <- as.factor(induced)
m1a <- glm(case~induced.ctg, family="binomial")
summary(m1a)$coefficients
```

```
##                 Estimate Std. Error    z value     Pr(>|z|)
## (Intercept)  -0.71420059  0.1780260 -4.0117774 6.026332e-05
## induced.ctg1  0.04303232  0.3120797  0.1378889 8.903282e-01
## induced.ctg2  0.10109612  0.3876635  0.2607832 7.942597e-01
```

```
regTermTest(m1a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ induced.ctg, family = "binomial")
## Chisq =  0.07320483  on  2  df: p= 0.96406
```

Model 1b

```
spont.ctg <- as.factor(spont)
m1b <- glm(case ~ spont.ctg, family = "binomial")
summary(m1b)$coefficients
```

```
##               Estimate Std. Error   z value     Pr(>|z|)
## (Intercept) -1.395183  0.2111015 -6.609065 3.867538e-11
## spont.ctg1   1.140291  0.3190954  3.573511 3.522262e-04
## spont.ctg2   2.088330  0.4117812  5.071456 3.947829e-07
```

```
regTermTest(m1b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ spont.ctg, family = "binomial")
## Chisq =  29.60171  on  2  df: p= 3.7331e-07
```

Model 1c

```
m1c <- glm(case ~ induced.ctg + spont.ctg, family = "binomial")
summary(m1c)$coefficients
```

```
##                Estimate Std. Error   z value      Pr(>|z|)
## (Intercept)  -1.7442332  0.2882336 -6.051457 1.435415e-09
## induced.ctg1  0.4608354  0.3507441  1.313879 1.888869e-01
## induced.ctg2  0.8249893  0.4320588  1.909438 5.620567e-02
## spont.ctg1    1.2892855  0.3342274  3.857510 1.145482e-04
## spont.ctg2    2.3537835  0.4398742  5.351038 8.745128e-08
```

```
regTermTest(m1c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ induced.ctg + spont.ctg, family = "binomial")
## Chisq =  4.154616  on  2  df: p= 0.12527
```

```
regTermTest(m1c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ induced.ctg + spont.ctg, family = "binomial")
## Chisq =  32.17149  on  2  df: p= 1.0329e-07
```

Model 1d

```
m1d <- glm(case ~ g2 + g3 + g4 + g5 + g6 + g7 + g8, family = "binomial")
summary(m1d)$coefficients
```

```
##               Estimate Std. Error   z value      Pr(>|z|)
## (Intercept) -2.148434  0.3993839 -5.379372 7.474622e-08
## g2           1.136833  0.5226315  2.175210 2.961435e-02
## g3           1.349927  0.5662318  2.384053 1.712313e-02
## g4           2.020601  0.4949364  4.082547 4.454482e-05
## g5           1.359977  0.6711307  2.026397 4.272414e-02
## g6           2.148434  0.8121007  2.645527 8.156373e-03
## g7           2.640911  0.5531475  4.774334 1.803028e-06
## g8           3.940194  1.1515962  3.421506 6.227525e-04
```

```r
library(car)
```

```
## Loading required package: carData
```

```r
linearHypothesis(m1d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: case ~ g2 + g3 + g4 + g5 + g6 + g7 + g8
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    247
## 2    240  7 33.247  2.381e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
anova(m1c, m1d, test = "Chisq")
```

```
## Analysis of Deviance Table
##
## Model 1: case ~ induced.ctg + spont.ctg
## Model 2: case ~ g2 + g3 + g4 + g5 + g6 + g7 + g8
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1       243     279.47
## 2       240     273.15  3   6.3214  0.09698 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Model 2a

```r
educ.ctg <- as.factor(educ)
parity.ctg <- as.factor(parity)
m2a <- glm(case ~ educ.ctg + age + parity.ctg + induced.ctg, family = "binomial")
summary(m2a)$coefficients
```

```
##                 Estimate Std. Error    z value  Pr(>|z|)
## (Intercept)  -0.983033425 1.28789321 -0.76328799 0.4452917
## educ.ctg1     0.187715763 0.83930962  0.22365496 0.8230258
## educ.ctg2     0.193678135 0.84434598  0.22938243 0.8185717
```

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```
## age          0.002926411 0.02748755  0.10646315 0.9152149
## parity.ctg2  -0.025507816 0.33049703 -0.07718017 0.9384802
## parity.ctg3  -0.041707358 0.43978003 -0.09483686 0.9244444
## parity.ctg4  -0.028809531 0.59895504 -0.04809966 0.9616368
## parity.ctg5  -0.062896910 0.91710019 -0.06858238 0.9453220
## parity.ctg6   0.245423506 0.98572237  0.24897833 0.8033775
## induced.ctg1  0.053374710 0.32462639  0.16441889 0.8694014
## induced.ctg2  0.115492718 0.44902849  0.25720577 0.7970199
```

```
regTermTest(m2a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ educ.ctg + age + parity.ctg + induced.ctg,
##     family = "binomial")
## Chisq =  0.07334845  on  2  df: p= 0.96399
```

Model 2b

```
m2b <- glm(case ~ educ.ctg + age + parity.ctg + spont.ctg, family = "binomial")
summary(m2b)$coefficients
```

```
##                Estimate Std. Error     z value      Pr(>|z|)
## (Intercept) -1.25537262 1.36092297 -0.9224421 3.562980e-01
## educ.ctg1   -0.36241669 0.85184338 -0.4254499 6.705087e-01
## educ.ctg2   -0.56114896 0.87067593 -0.6444981 5.192525e-01
## age          0.01632638 0.02973905  0.5489880 5.830137e-01
## parity.ctg2 -0.36442643 0.36460382 -0.9995135 3.175460e-01
## parity.ctg3 -0.77126859 0.48938876 -1.5759835 1.150296e-01
## parity.ctg4 -1.08662117 0.64020329 -1.6973065 8.963874e-02
## parity.ctg5 -1.54854595 0.97521922 -1.5878952 1.123100e-01
## parity.ctg6 -0.73886983 1.04739954 -0.7054327 4.805410e-01
## spont.ctg1   1.35920792 0.34892773  3.8953852 9.804279e-05
## spont.ctg2   2.57494356 0.47416202  5.4305142 5.619191e-08
```

```
regTermTest(m2b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ educ.ctg + age + parity.ctg + spont.ctg,
##     family = "binomial")
## Chisq =  33.62346  on  2  df: p= 4.9976e-08
```

Model 2c

```
m2c <- glm(case ~ educ.ctg + age + parity.ctg + induced.ctg + spont.ctg, family = "binomial")
summary(m2c)$coefficients
```

```
##                 Estimate Std. Error    z value      Pr(>|z|)
## (Intercept)  -2.73054297 1.46038213 -1.8697455 6.151916e-02
## educ.ctg1    -0.22259543 0.89135027 -0.2497283 8.027974e-01
## educ.ctg2    -0.71384199 0.90686451 -0.7871540 4.311917e-01
## age           0.04102964 0.03172393  1.2933342 1.958955e-01
## parity.ctg2  -1.32700952 0.46264026 -2.8683399 4.126320e-03
## parity.ctg3  -2.41639719 0.65263605 -3.7025187 2.134696e-04
## parity.ctg4  -3.22391402 0.82662791 -3.9000789 9.616136e-05
## parity.ctg5  -4.13098501 1.16376526 -3.5496720 3.857113e-04
## parity.ctg6  -2.82551386 1.13354450 -2.4926360 1.267988e-02
## induced.ctg1  1.49100542 0.43716500  3.4106239 6.481442e-04
## induced.ctg2  3.05495111 0.68135336  4.4836517 7.337641e-06
## spont.ctg1    2.22305689 0.43114158  5.1562109 2.519971e-07
## spont.ctg2    4.55567520 0.70446169  6.4668885 1.000414e-10
```

```r
regTermTest(m2c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ educ.ctg + age + parity.ctg + induced.ctg +
##     spont.ctg, family = "binomial")
## Chisq =  44.67885  on  2  df: p= 1.9866e-10
```

```r
regTermTest(m2c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ educ.ctg + age + parity.ctg + induced.ctg +
##     spont.ctg, family = "binomial")
## Chisq =  21.07709  on  2  df: p= 2.6495e-05
```

Model 2d

```r
m2d <- glm(case ~ educ.ctg + age + parity.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8 , family = "binomial")
summary(m2d)$coefficients
```

```
##                 Estimate Std. Error    z value      Pr(>|z|)
## (Intercept) -3.22889873 1.54901573 -2.0844841 3.711615e-02
## educ.ctg1   -0.12143600 0.91004577 -0.1334394 8.938459e-01
## educ.ctg2   -0.61478517 0.92511018 -0.6645535 5.063361e-01
## age          0.04869416 0.03265459  1.4911888 1.359119e-01
## parity.ctg2 -1.12160597 0.47792177 -2.3468401 1.893338e-02
## parity.ctg3 -2.17319118 0.67330547 -3.2276452 1.248137e-03
## parity.ctg4 -2.91444269 0.87232345 -3.3410115 8.347376e-04
## parity.ctg5 -4.35229263 1.42095339 -3.0629383 2.191752e-03
## parity.ctg6 -2.63173467 1.15833227 -2.2720032 2.308631e-02
## g2           1.63336980 0.56911444  2.8700199 4.104459e-03
## g3           3.05788843 0.75208007  4.0659081 4.784580e-05
## g4           2.50252801 0.55304893  4.5249667 6.040502e-06
## g5           3.22508927 0.85179226  3.7862392 1.529444e-04
## g6           5.12179552 1.13655898  4.5064054 6.593507e-06
## g7           4.33125295 0.74401839  5.8214327 5.834530e-09
## g8           7.13497363 1.53381483  4.6517829 3.290774e-06
```

```
linearHypothesis(m2d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: case ~ educ.ctg + age + parity.ctg + g2 + g3 + g4 + g5 + g6 +
##     g7 + g8
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    239
## 2    232  7 45.144  1.282e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(m2c, m2d, test = "Chisq")
```

```
## Analysis of Deviance Table
##
## Model 1: case ~ educ.ctg + age + parity.ctg + induced.ctg + spont.ctg
## Model 2: case ~ educ.ctg + age + parity.ctg + g2 + g3 + g4 + g5 + g6 +
##     g7 + g8
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1       235     252.60
## 2       232     250.26  3   2.3439   0.5042
```

Model 3a

```
library(survival)
m3a <- clogit( case ~ induced.ctg + strata(matchset))
summary(m3a)$coefficients
```

```
##                    coef exp(coef)  se(coef)         z  Pr(>|z|)
## induced.ctg1 0.06942327  1.071890 0.3193922 0.2173606 0.8279273
## induced.ctg2 0.15007309  1.161919 0.4435286 0.3383617 0.7350906
```

```
regTermTest(m3a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + strata(matchset),
##     method = "exact")
## Chisq =  0.124041  on  2  df: p= 0.93986
```

Model 3b

```
m3b <- clogit( case ~ spont.ctg + strata(matchset))
summary(m3b)$coefficients
```

```
##                 coef exp(coef)  se(coef)        z      Pr(>|z|)
## spont.ctg1 1.328778  3.776426 0.3673247 3.617448 2.975217e-04
## spont.ctg2 2.274039  9.718576 0.4784818 4.752614 2.008038e-06
```

```
regTermTest(m3b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ spont.ctg + strata(matchset),
##     method = "exact")
## Chisq =  26.46239  on  2  df: p= 1.7938e-06
```

Model 3c

```
m3c <- clogit( case ~ induced.ctg + spont.ctg + strata(matchset))
summary(m3c)$coefficients
```

```
##                   coef exp(coef)  se(coef)        z      Pr(>|z|)
## induced.ctg1 1.386470  4.000705 0.4633692 2.992151 2.770196e-03
## induced.ctg2 2.819319 16.765432 0.7352533 3.834487 1.258266e-04
## spont.ctg1   2.043756  7.719547 0.4529099 4.512500 6.406797e-06
## spont.ctg2   3.935019 51.163142 0.7246445 5.430275 5.626717e-08
```

```
regTermTest(m3c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + spont.ctg +
##     strata(matchset), method = "exact")
## Chisq =  15.15024  on  2  df: p= 0.00051306
```

```
regTermTest(m3c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + spont.ctg +
##     strata(matchset), method = "exact")
## Chisq =  31.85475  on  2  df: p= 1.2101e-07
```

Model 3d

```
m3d <- clogit( case ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 + strata(matchset))
summary(m3d)$coefficients
```

```
##        coef exp(coef)  se(coef)       z      Pr(>|z|)
## g2 1.463510   4.321102 0.6067976 2.411859 1.587140e-02
## g3 2.822326  16.815924 0.8015050 3.521283 4.294635e-04
## g4 2.355308  10.541376 0.6159675 3.823754 1.314351e-04
## g5 2.808641  16.587362 0.9209914 3.049584 2.291582e-03
## g6 5.043972 155.084855 1.3185509 3.825391 1.305649e-04
## g7 3.597921  36.522210 0.7556564 4.761318 1.923323e-06
## g8 6.502709 666.945963 1.5322321 4.243945 2.196241e-05
```

```
linearHypothesis(m3d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: Surv(rep(1, 248L), case) ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 +
##     strata(matchset)
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    248
## 2    241  7 33.163  2.468e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(m3c, m3d, test = "Chisq")
```

```
## Analysis of Deviance Table
##  Cox model: response is  Surv(rep(1, 248L), case)
##  Model 1: ~ induced.ctg + spont.ctg + strata(matchset)
##  Model 2: ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 + strata(matchset)
##    loglik  Chisq Df Pr(>|Chi|)
## 1 -64.176
## 2 -62.680 2.9928  3     0.3927
```

Model 4a

```
matchset.ctg <- as.factor(matchset)
m4a <- glm(case ~ matchset.ctg + induced.ctg, family = "binomial")
summary(m4a)$coefficients
```

```
##                   Estimate Std. Error       z value  Pr(>|z|)
## (Intercept)  -8.793137e-01  1.2994325 -6.766906e-01 0.4986023
```

```
## matchset.ctg2    1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg3   -4.012307e-02  1.7412057 -2.304327e-02 0.9816158
## matchset.ctg4    1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg5    7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg6    7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg7    1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg8    1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg9    1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg10   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg11   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg12   7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg13   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg14   1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg15   8.192355e-02  1.7704911  4.627165e-02 0.9630937
## matchset.ctg16   7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg17   7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg18   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg19   7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg20   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg21   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg22   1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg23   1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg24   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg25   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg26   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg27   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg28   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg29   7.456804e-02  1.7424061  4.279601e-02 0.9658641
## matchset.ctg30   4.069716e-02  1.7420562  2.336157e-02 0.9813619
## matchset.ctg31   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg32   1.162641e-01  1.7661556  6.582891e-02 0.9475140
## matchset.ctg33   1.162641e-01  1.7661556  6.582891e-02 0.9475140
## matchset.ctg34   1.088880e-01  1.7520768  6.214797e-02 0.9504450
## matchset.ctg35   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg36   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg37   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg38   1.786125e-14  1.7326786  1.030846e-14 1.0000000
## matchset.ctg39   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg40   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg41   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg42   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg43   1.861665e-01  1.7856440  1.042574e-01 0.9169651
## matchset.ctg44   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg45   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg46   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg47   1.162641e-01  1.7661556  6.582891e-02 0.9475140
## matchset.ctg48  -4.012307e-02  1.7412057 -2.304327e-02 0.9816158
## matchset.ctg49   4.069716e-02  1.7420562  2.336157e-02 0.9813619
## matchset.ctg50   1.162641e-01  1.7661556  6.582891e-02 0.9475140
## matchset.ctg51   1.689374e-14  1.7326786  9.750070e-15 1.0000000
## matchset.ctg52   4.069716e-02  1.7420562  2.336157e-02 0.9813619
## matchset.ctg53   4.069716e-02  1.7420562  2.336157e-02 0.9813619
## matchset.ctg54   1.510211e-01  1.7710197  8.527352e-02 0.9320439
## matchset.ctg55   1.162641e-01  1.7661556  6.582891e-02 0.9475140
```

```
## matchset.ctg56   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg57   4.069716e-02   1.7420562   2.336157e-02 0.9813619
## matchset.ctg58   7.456804e-02   1.7424061   4.279601e-02 0.9658641
## matchset.ctg59   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg60   1.162641e-01   1.7661556   6.582891e-02 0.9475140
## matchset.ctg61   7.456804e-02   1.7424061   4.279601e-02 0.9658641
## matchset.ctg62   1.162641e-01   1.7661556   6.582891e-02 0.9475140
## matchset.ctg63   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg64   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg65   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg66   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg67   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg68   1.514636e-14   1.7326786   8.741588e-15 1.0000000
## matchset.ctg69   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg70   1.162641e-01   1.7661556   6.582891e-02 0.9475140
## matchset.ctg71   1.162641e-01   1.7661556   6.582891e-02 0.9475140
## matchset.ctg72   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg73   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg74   8.793137e-01   1.9205533   4.578440e-01 0.6470645
## matchset.ctg75   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg76   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg77   1.088880e-01   1.7520768   6.214797e-02 0.9504450
## matchset.ctg78   1.510211e-01   1.7710197   8.527352e-02 0.9320439
## matchset.ctg79   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg80   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg81   3.336294e-02   1.7379556   1.919666e-02 0.9846842
## matchset.ctg82   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## matchset.ctg83   1.861665e-01   1.7856440   1.042574e-01 0.9169651
## induced.ctg1     1.042430e-01   0.3916019   2.661964e-01 0.7900880
## induced.ctg2     2.262896e-01   0.5463831   4.141593e-01 0.6787575
```

```r
regTermTest(m4a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ matchset.ctg + induced.ctg, family = "binomial")
## Chisq =  0.1860423  on  2  df: p= 0.91117
```

Model 4b

```r
m4b <- glm( case ~ matchset.ctg + spont.ctg, family = "binomial")
summary(m4b)$coefficients
```

```
##                    Estimate Std. Error      z value      Pr(>|z|)
## (Intercept)    -2.289759e+00  1.8011721 -1.271261e+00 2.036360e-01
## matchset.ctg2   1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg3   1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg4  -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg5   7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg6  -1.161273e+00  2.2279900 -5.212200e-01 6.022135e-01
## matchset.ctg7   1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg8   7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
```

```
## matchset.ctg9  -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg10 -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg11  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg12 -5.252556e-01  2.2051298 -2.381971e-01 8.117282e-01
## matchset.ctg13  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg14 -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg15  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg16  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg17 -1.747902e+00  2.2089590 -7.912786e-01 4.287815e-01
## matchset.ctg18  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg19 -5.252556e-01  2.2051298 -2.381971e-01 8.117282e-01
## matchset.ctg20  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg21  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg22  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg23  3.539540e-14  2.5110824  1.409567e-14 1.000000e+00
## matchset.ctg24 -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg25 -1.161273e+00  2.2279900 -5.212200e-01 6.022135e-01
## matchset.ctg26  2.875028e-14  2.5110824  1.144936e-14 1.000000e+00
## matchset.ctg27  2.720495e-14  2.5110824  1.083395e-14 1.000000e+00
## matchset.ctg28  2.187748e-14  2.5110824  8.712372e-15 1.000000e+00
## matchset.ctg29 -1.747902e+00  2.2089590 -7.912786e-01 4.287815e-01
## matchset.ctg30 -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg31  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg32  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg33  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg34  2.550680e-14  2.5110824  1.015769e-14 1.000000e+00
## matchset.ctg35  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg36  3.990640e-14  2.5110824  1.589211e-14 1.000000e+00
## matchset.ctg37  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg38  1.666940e-14  2.5110824  6.638332e-15 1.000000e+00
## matchset.ctg39 -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg40  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg41  2.845680e-14  2.5110824  1.133248e-14 1.000000e+00
## matchset.ctg42  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg43  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg44  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg45  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg46  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg47  3.082109e-14  2.5110824  1.227402e-14 1.000000e+00
## matchset.ctg48  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg49  1.596612e+00  2.1781231  7.330218e-01 4.635451e-01
## matchset.ctg50  2.256641e-14  2.5110824  8.986727e-15 1.000000e+00
## matchset.ctg51 -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg52 -1.161273e+00  2.2279900 -5.212200e-01 6.022135e-01
## matchset.ctg53 -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg54 -1.420096e-02  2.2464610 -6.321482e-03 9.949562e-01
## matchset.ctg55 -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg56 -7.671864e-01  2.3118743 -3.318461e-01 7.400055e-01
## matchset.ctg57  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg58  3.856287e-14  2.5110824  1.535707e-14 1.000000e+00
## matchset.ctg59  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
## matchset.ctg60  2.438203e-14  2.5110824  9.709767e-15 1.000000e+00
## matchset.ctg61  1.516578e-14  2.5110824  6.039539e-15 1.000000e+00
## matchset.ctg62  7.601788e-01  2.2706152  3.347898e-01 7.377837e-01
```

```
## matchset.ctg63   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg64   1.430176e-14   2.5110824   5.695457e-15 1.000000e+00
## matchset.ctg65  -7.671864e-01   2.3118743  -3.318461e-01 7.400055e-01
## matchset.ctg66   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg67  -1.420096e-02   2.2464610  -6.321482e-03 9.949562e-01
## matchset.ctg68   1.769482e-14   2.5110824   7.046689e-15 1.000000e+00
## matchset.ctg69  -1.747902e+00   2.2089590  -7.912786e-01 4.287815e-01
## matchset.ctg70   1.596612e+00   2.1781231   7.330218e-01 4.635451e-01
## matchset.ctg71   1.596612e+00   2.1781231   7.330218e-01 4.635451e-01
## matchset.ctg72   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg73  -1.420096e-02   2.2464610  -6.321482e-03 9.949562e-01
## matchset.ctg74  -1.489816e+00   2.2947917  -6.492162e-01 5.161986e-01
## matchset.ctg75  -1.747902e+00   2.2089590  -7.912786e-01 4.287815e-01
## matchset.ctg76   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg77  -1.420096e-02   2.2464610  -6.321482e-03 9.949562e-01
## matchset.ctg78   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg79  -1.420096e-02   2.2464610  -6.321482e-03 9.949562e-01
## matchset.ctg80   7.601788e-01   2.2706152   3.347898e-01 7.377837e-01
## matchset.ctg81   1.596612e+00   2.1781231   7.330218e-01 4.635451e-01
## matchset.ctg82  -5.252556e-01   2.2051298  -2.381971e-01 8.117282e-01
## matchset.ctg83  -5.252556e-01   2.2051298  -2.381971e-01 8.117282e-01
## spont.ctg1       2.121867e+00   0.4776832   4.441997e+00 8.912772e-06
## spont.ctg2       3.779575e+00   0.6390155   5.914684e+00 3.325125e-09
```

```
regTermTest(m4b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ matchset.ctg + spont.ctg, family = "binomial")
## Chisq =  40.61021  on  2  df: p= 1.5192e-09
```

Model 4c

```
m4c <- glm(case ~ matchset.ctg + induced.ctg + spont.ctg, family = "binomial")
summary(m4c)$coefficients
```

```
##                     Estimate Std. Error      z value      Pr(>|z|)
## (Intercept)    -6.876327e+00  2.1813506 -3.152325e+00 1.619757e-03
## matchset.ctg2   5.351135e+00  2.5111929  2.130914e+00 3.309625e-02
## matchset.ctg3   1.765550e+00  2.2958531  7.690169e-01 4.418833e-01
## matchset.ctg4   1.230010e+00  2.4213261  5.079904e-01 6.114601e-01
## matchset.ctg5   1.962125e+00  2.4133005  8.130461e-01 4.161916e-01
## matchset.ctg6  -4.604211e-01  2.3428687 -1.965202e-01 8.442030e-01
## matchset.ctg7   6.183180e+00  2.5016576  2.471633e+00 1.344975e-02
## matchset.ctg8   2.989867e+00  2.4446516  1.223024e+00 2.213207e-01
## matchset.ctg9   3.245214e+00  2.4078866  1.347744e+00 1.777409e-01
## matchset.ctg10  3.539605e+00  2.4923621  1.420181e+00 1.555550e-01
## matchset.ctg11  4.063283e+00  2.4755784  1.641347e+00 1.007254e-01
## matchset.ctg12  2.512414e-01  2.5196400  9.971320e-02 9.205720e-01
## matchset.ctg13  5.351135e+00  2.5111929  2.130914e+00 3.309625e-02
## matchset.ctg14  1.230010e+00  2.4213261  5.079904e-01 6.114601e-01
## matchset.ctg15  2.714927e+00  2.5747728  1.054433e+00 2.916845e-01
```

```
## matchset.ctg16  3.519271e+00  2.5225732  1.395111e+00  1.629823e-01
## matchset.ctg17 -1.506750e+00  2.3207161 -6.492609e-01  5.161697e-01
## matchset.ctg18  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg19  2.512414e-01  2.5196400  9.971320e-02  9.205720e-01
## matchset.ctg20  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg21  4.826799e+00  2.6672416  1.809660e+00  7.034861e-02
## matchset.ctg22  4.282117e+00  2.8415644  1.506958e+00  1.318215e-01
## matchset.ctg23  1.436179e+00  2.4919915  5.763178e-01  5.644004e-01
## matchset.ctg24  3.539605e+00  2.4923621  1.420181e+00  1.555550e-01
## matchset.ctg25  8.393992e-01  2.3916503  3.509707e-01  7.256103e-01
## matchset.ctg26  3.295344e+00  3.7013928  8.902983e-01  3.733057e-01
## matchset.ctg27  3.295344e+00  3.7013928  8.902983e-01  3.733057e-01
## matchset.ctg28  3.295344e+00  3.7013928  8.902983e-01  3.733057e-01
## matchset.ctg29 -1.506750e+00  2.3207161 -6.492609e-01  5.161697e-01
## matchset.ctg30  1.086304e+00  2.3225557  4.677194e-01  6.399852e-01
## matchset.ctg31  4.826799e+00  2.6672416  1.809660e+00  7.034861e-02
## matchset.ctg32  4.580931e+00  2.4288607  1.886041e+00  5.928943e-02
## matchset.ctg33  4.580931e+00  2.4288607  1.886041e+00  5.928943e-02
## matchset.ctg34  1.436179e+00  2.4919915  5.763178e-01  5.644004e-01
## matchset.ctg35  5.351135e+00  2.5111929  2.130914e+00  3.309625e-02
## matchset.ctg36  3.295344e+00  3.7013928  8.902983e-01  3.733057e-01
## matchset.ctg37  4.826799e+00  2.6672416  1.809660e+00  7.034861e-02
## matchset.ctg38  7.507335e-14  2.6823486  2.798792e-14  1.000000e+00
## matchset.ctg39  1.995322e+00  2.7209231  7.333255e-01  4.633599e-01
## matchset.ctg40  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg41  2.530858e+00  2.9841866  8.480897e-01  3.963880e-01
## matchset.ctg42  6.183180e+00  2.5016576  2.471633e+00  1.344975e-02
## matchset.ctg43  6.183180e+00  2.5016576  2.471633e+00  1.344975e-02
## matchset.ctg44  3.815804e+00  3.1824556  1.199012e+00  2.305231e-01
## matchset.ctg45  5.351135e+00  2.5111929  2.130914e+00  3.309625e-02
## matchset.ctg46  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg47  2.212944e+00  2.7754605  7.973249e-01  4.252624e-01
## matchset.ctg48  4.091693e-01  2.5283504  1.618325e-01  8.714377e-01
## matchset.ctg49  3.153606e+00  2.4157634  1.305428e+00  1.917470e-01
## matchset.ctg50  2.212944e+00  2.7754605  7.973249e-01  4.252624e-01
## matchset.ctg51 -1.290900e+00  2.3830361 -5.417041e-01  5.880224e-01
## matchset.ctg52 -1.357038e+00  2.3627913 -5.743370e-01  5.657398e-01
## matchset.ctg53  1.086304e+00  2.3225557  4.677194e-01  6.399852e-01
## matchset.ctg54  3.245214e+00  2.4078866  1.347744e+00  1.777409e-01
## matchset.ctg55  9.211175e-01  2.4133727  3.816723e-01  7.027045e-01
## matchset.ctg56  1.841301e+00  2.6304231  7.000017e-01  4.839262e-01
## matchset.ctg57  1.866764e+00  2.3813883  7.838972e-01  4.331005e-01
## matchset.ctg58  1.364625e+00  2.4593875  5.548639e-01  5.789877e-01
## matchset.ctg59  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg60  2.212944e+00  2.7754605  7.973249e-01  4.252624e-01
## matchset.ctg61  1.364625e+00  2.4593875  5.548639e-01  5.789877e-01
## matchset.ctg62  3.642745e+00  2.3932647  1.522082e+00  1.279885e-01
## matchset.ctg63  4.826799e+00  2.6672416  1.809660e+00  7.034861e-02
## matchset.ctg64  2.530858e+00  2.9841866  8.480897e-01  3.963880e-01
## matchset.ctg65  1.841301e+00  2.6304231  7.000017e-01  4.839262e-01
## matchset.ctg66  4.063283e+00  2.4755784  1.641347e+00  1.007254e-01
## matchset.ctg67  3.539605e+00  2.4923621  1.420181e+00  1.555550e-01
## matchset.ctg68  8.154052e-14  2.6823486  3.039893e-14  1.000000e+00
## matchset.ctg69  4.994750e-02  2.3115089  2.160818e-02  9.827605e-01
```

```
## matchset.ctg70    4.580931e+00   2.4288607   1.886041e+00 5.928943e-02
## matchset.ctg71    4.580931e+00   2.4288607   1.886041e+00 5.928943e-02
## matchset.ctg72    4.063283e+00   2.4755784   1.641347e+00 1.007254e-01
## matchset.ctg73    3.539605e+00   2.4923621   1.420181e+00 1.555550e-01
## matchset.ctg74    4.357513e-01   2.4188786   1.801460e-01 8.570380e-01
## matchset.ctg75    4.994750e-02   2.3115089   2.160818e-02 9.827605e-01
## matchset.ctg76    4.063283e+00   2.4755784   1.641347e+00 1.007254e-01
## matchset.ctg77    2.489228e+00   2.3560224   1.056538e+00 2.907223e-01
## matchset.ctg78    4.063283e+00   2.4755784   1.641347e+00 1.007254e-01
## matchset.ctg79    3.539605e+00   2.4923621   1.420181e+00 1.555550e-01
## matchset.ctg80    4.826799e+00   2.6672416   1.809660e+00 7.034861e-02
## matchset.ctg81    2.435400e+00   2.3934589   1.017523e+00 3.089045e-01
## matchset.ctg82    2.915150e+00   2.4140854   1.207559e+00 2.272170e-01
## matchset.ctg83    2.915150e+00   2.4140854   1.207559e+00 2.272170e-01
## induced.ctg1      2.111872e+00   0.5865332   3.600601e+00 3.174819e-04
## induced.ctg2      4.417630e+00   0.9476961   4.661441e+00 3.140025e-06
## spont.ctg1        3.268029e+00   0.5916753   5.523349e+00 3.325988e-08
## spont.ctg2        6.440575e+00   0.9550339   6.743819e+00 1.542767e-11
```

```
regTermTest(m4c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ matchset.ctg + induced.ctg + spont.ctg,
##     family = "binomial")
## Chisq =  22.41132  on  2  df: p= 1.3597e-05
```

```
regTermTest(m4c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ matchset.ctg + induced.ctg + spont.ctg,
##     family = "binomial")
## Chisq =  48.69327  on  2  df: p= 2.6693e-11
```

Model 4d

```
m4d <- glm( case ~ matchset.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8, family = "binomial")
summary(m4d)$coefficients
```

```
##                    Estimate Std. Error       z value      Pr(>|z|)
## (Intercept)     -7.998323e+00  3.4096471 -2.345792e+00 1.898671e-02
## matchset.ctg2    6.453710e+00  3.6488223  1.768710e+00 7.694220e-02
## matchset.ctg3    2.912729e+00  3.5048415  8.310587e-01 4.059405e-01
## matchset.ctg4    2.558675e+00  3.5571657  7.193017e-01 4.719550e-01
## matchset.ctg5    3.564956e+00  3.5788179  9.961267e-01 3.191886e-01
## matchset.ctg6    8.450455e-01  3.6090023  2.341493e-01 8.148690e-01
## matchset.ctg7    7.305175e+00  3.6229399  2.016367e+00 4.376164e-02
## matchset.ctg8    3.927635e+00  3.5877293  1.094741e+00 2.736300e-01
## matchset.ctg9    4.034876e+00  3.5988229  1.121165e+00 2.622174e-01
## matchset.ctg10   4.271649e+00  3.6442734  1.172154e+00 2.411353e-01
## matchset.ctg11   4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
```

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```
## matchset.ctg12  1.474607e+00  3.7608390  3.920953e-01 6.949878e-01
## matchset.ctg13  6.453710e+00  3.6488223  1.768710e+00 7.694220e-02
## matchset.ctg14  2.558675e+00  3.5571657  7.193017e-01 4.719550e-01
## matchset.ctg15  4.246730e+00  3.6200514  1.173113e+00 2.407504e-01
## matchset.ctg16  4.634030e+00  3.6549462  1.267879e+00 2.048411e-01
## matchset.ctg17 -1.587805e+00  3.6416575 -4.360117e-01 6.628283e-01
## matchset.ctg18  4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
## matchset.ctg19  1.474607e+00  3.7608390  3.920953e-01 6.949878e-01
## matchset.ctg20  4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
## matchset.ctg21  5.755793e+00  3.7941398  1.517022e+00 1.292612e-01
## matchset.ctg22  5.416213e+00  3.8637203  1.401813e+00 1.609711e-01
## matchset.ctg23  2.879687e+00  3.6135837  7.969063e-01 4.255055e-01
## matchset.ctg24  4.271649e+00  3.6442734  1.172154e+00 2.411353e-01
## matchset.ctg25  2.546619e+00  3.5780532  7.117332e-01 4.766300e-01
## matchset.ctg26  4.723531e+00  4.2951323  1.099740e+00 2.714452e-01
## matchset.ctg27  4.723531e+00  4.2951323  1.099740e+00 2.714452e-01
## matchset.ctg28  4.723531e+00  4.2951323  1.099740e+00 2.714452e-01
## matchset.ctg29 -1.587805e+00  3.6416575 -4.360117e-01 6.628283e-01
## matchset.ctg30  2.889421e+00  3.5338997  8.176296e-01 4.135687e-01
## matchset.ctg31  5.755793e+00  3.7941398  1.517022e+00 1.292612e-01
## matchset.ctg32  5.665008e+00  3.6184380  1.565595e+00 1.174435e-01
## matchset.ctg33  5.665008e+00  3.6184380  1.565595e+00 1.174435e-01
## matchset.ctg34  2.879687e+00  3.6135837  7.969063e-01 4.255055e-01
## matchset.ctg35  6.453710e+00  3.6488223  1.768710e+00 7.694220e-02
## matchset.ctg36  4.723531e+00  4.2951323  1.099740e+00 2.714452e-01
## matchset.ctg37  5.755793e+00  3.7941398  1.517022e+00 1.292612e-01
## matchset.ctg38 -3.908519e-14  4.4359963 -8.810917e-15 1.000000e+00
## matchset.ctg39  3.227477e+00  3.7000912  8.722696e-01 3.830613e-01
## matchset.ctg40  4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
## matchset.ctg41  3.940040e+00  3.8790778  1.015716e+00 3.097648e-01
## matchset.ctg42  7.305175e+00  3.6229399  2.016367e+00 4.376164e-02
## matchset.ctg43  7.305175e+00  3.6229399  2.016367e+00 4.376164e-02
## matchset.ctg44  5.399445e+00  3.8997791  1.384552e+00 1.661896e-01
## matchset.ctg45  6.453710e+00  3.6488223  1.768710e+00 7.694220e-02
## matchset.ctg46  4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
## matchset.ctg47  3.608153e+00  3.7631550  9.588106e-01 3.376542e-01
## matchset.ctg48  1.326877e+00  3.6848615  3.600888e-01 7.187808e-01
## matchset.ctg49  4.262192e+00  3.5895232  1.187398e+00 2.350708e-01
## matchset.ctg50  3.608153e+00  3.7631550  9.588106e-01 3.376542e-01
## matchset.ctg51 -1.536032e+00  3.6725384 -4.182481e-01 6.757657e-01
## matchset.ctg52 -1.536654e+00  3.6731128 -4.183521e-01 6.756897e-01
## matchset.ctg53  2.889421e+00  3.5338997  8.176296e-01 4.135687e-01
## matchset.ctg54  4.034876e+00  3.5988229  1.121165e+00 2.622174e-01
## matchset.ctg55  2.775468e+00  3.6198728  7.667307e-01 4.432416e-01
## matchset.ctg56  3.091647e+00  3.6604407  8.446106e-01 3.983283e-01
## matchset.ctg57  3.424409e+00  3.5484847  9.650341e-01 3.345277e-01
## matchset.ctg58  2.790830e+00  3.5914735  7.770710e-01 4.371169e-01
## matchset.ctg59  4.973659e+00  3.6556535  1.360539e+00 1.736595e-01
## matchset.ctg60  3.608153e+00  3.7631550  9.588106e-01 3.376542e-01
## matchset.ctg61  2.790830e+00  3.5914735  7.770710e-01 4.371169e-01
## matchset.ctg62  4.569592e+00  3.6032256  1.268195e+00 2.047284e-01
## matchset.ctg63  5.755793e+00  3.7941398  1.517022e+00 1.292612e-01
## matchset.ctg64  3.940040e+00  3.8790778  1.015716e+00 3.097648e-01
## matchset.ctg65  3.091647e+00  3.6604407  8.446106e-01 3.983283e-01
```

```
## matchset.ctg66   4.973659e+00   3.6556535   1.360539e+00 1.736595e-01
## matchset.ctg67   4.271649e+00   3.6442734   1.172154e+00 2.411353e-01
## matchset.ctg68 -2.754814e-14   4.4359963 -6.210136e-15 1.000000e+00
## matchset.ctg69   1.869435e+00   3.5672706   5.240520e-01 6.002423e-01
## matchset.ctg70   5.665008e+00   3.6184380   1.565595e+00 1.174435e-01
## matchset.ctg71   5.665008e+00   3.6184380   1.565595e+00 1.174435e-01
## matchset.ctg72   4.973659e+00   3.6556535   1.360539e+00 1.736595e-01
## matchset.ctg73   4.271649e+00   3.6442734   1.172154e+00 2.411353e-01
## matchset.ctg74   2.180445e+00   3.6383861   5.992891e-01 5.489801e-01
## matchset.ctg75   1.869435e+00   3.5672706   5.240520e-01 6.002423e-01
## matchset.ctg76   4.973659e+00   3.6556535   1.360539e+00 1.736595e-01
## matchset.ctg77   3.370606e+00   3.5351563   9.534530e-01 3.403606e-01
## matchset.ctg78   4.973659e+00   3.6556535   1.360539e+00 1.736595e-01
## matchset.ctg79   4.271649e+00   3.6442734   1.172154e+00 2.411353e-01
## matchset.ctg80   5.755793e+00   3.7941398   1.517022e+00 1.292612e-01
## matchset.ctg81   3.582006e+00   3.5683748   1.003820e+00 3.154654e-01
## matchset.ctg82   3.625524e+00   3.5893626   1.010075e+00 3.124595e-01
## matchset.ctg83   3.625524e+00   3.5893626   1.010075e+00 3.124595e-01
## g2              2.156049e+00   0.7577975   2.845152e+00 4.439020e-03
## g3              4.392446e+00   1.0367726   4.236653e+00 2.268758e-05
## g4              3.679651e+00   0.7965940   4.619230e+00 3.851662e-06
## g5              4.427341e+00   1.1658676   3.797464e+00 1.461838e-04
## g6              8.149281e+00   1.7540555   4.645966e+00 3.384894e-06
## g7              5.817877e+00   0.9859729   5.900646e+00 3.620801e-09
## g8              1.088351e+01   2.1202160   5.133210e+00 2.848424e-07
```

```
linearHypothesis(m4d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: case ~ matchset.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    165
## 2    158  7 50.358  1.228e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(m4c, m4d, test = "Chisq")
```

```
## Analysis of Deviance Table
##
## Model 1: case ~ matchset.ctg + induced.ctg + spont.ctg
```

```
## Model 2: case ~ matchset.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1      161     231.88
## 2      158     227.02  3   4.8644    0.182
```

Model 5a

```
m5a <- clogit( case ~ induced.ctg + strata(stratum))
summary(m5a)$coefficients
```

```
##                      coef exp(coef)  se(coef)         z  Pr(>|z|)
## induced.ctg1 0.06941746  1.071884 0.3258281 0.2130493 0.8312885
## induced.ctg2 0.14846222  1.160049 0.4419953 0.3358910 0.7369531
```

```
regTermTest(m5a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + strata(stratum),
##     method = "exact")
## Chisq =  0.1228914  on  2  df: p= 0.9404
```

Model 5b

```
m5b <- clogit( case ~ spont.ctg + strata(stratum))
summary(m5b)$coefficients
```

```
##                   coef exp(coef)  se(coef)        z      Pr(>|z|)
## spont.ctg1 1.344412  3.835930 0.3611644 3.722438 1.973084e-04
## spont.ctg2 2.297035  9.944654 0.4673228 4.915307 8.864337e-07
```

```
regTermTest(m5b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ spont.ctg + strata(stratum),
##     method = "exact")
## Chisq =  28.13622  on  2  df: p= 7.7678e-07
```

Model 5c

```
m5c <- clogit( case ~ induced.ctg + spont.ctg + strata(stratum))
summary(m5c)$coefficients
```

```
##                   coef exp(coef)  se(coef)        z      Pr(>|z|)
## induced.ctg1 1.353944  3.872670 0.4571383 2.961782 3.058638e-03
## induced.ctg2 2.880405 17.821487 0.7155652 4.025356 5.688918e-05
## spont.ctg1   2.099081  8.158671 0.4494785 4.670037 3.011459e-06
## spont.ctg2   4.021096 55.762169 0.7100883 5.662811 1.489135e-08
```

```r
regTermTest(m5c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + spont.ctg +
##     strata(stratum), method = "exact")
## Chisq =  16.56401  on  2  df: p= 0.00025303
```

```r
regTermTest(m5c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in coxph(formula = Surv(rep(1, 248L), case) ~ induced.ctg + spont.ctg +
##     strata(stratum), method = "exact")
## Chisq =  34.46404  on  2  df: p= 3.2827e-08
```

Model 5d

```r
m5d <- clogit( case ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 + strata(stratum))
summary(m5d)$coefficients
```

```
##        coef  exp(coef)  se(coef)        z      Pr(>|z|)
## g2 1.549184   4.707625 0.6177136 2.507932 1.214401e-02
## g3 2.945574  19.021577 0.7926307 3.716200 2.022418e-04
## g4 2.534505  12.610182 0.6213458 4.079056 4.521886e-05
## g5 2.812056  16.644105 0.9044242 3.109223 1.875803e-03
## g6 5.148344 172.146158 1.3134604 3.919679 8.866681e-05
## g7 3.800630  44.729341 0.7516445 5.056419 4.272011e-07
## g8 6.599163 734.480408 1.5318227 4.308046 1.647029e-05
```

```r
linearHypothesis(m5d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: Surv(rep(1, 248L), case) ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 +
##     strata(stratum)
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    248
## 2    241  7 35.527  8.902e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
anova(m5c, m5d, test = "Chisq")
```

```
## Analysis of Deviance Table
##  Cox model: response is  Surv(rep(1, 248L), case)
##  Model 1: ~ induced.ctg + spont.ctg + strata(stratum)
##  Model 2: ~ g2 + g3 + g4 + g5 + g6 + g7 + g8 + strata(stratum)
##    loglik  Chisq Df Pr(>|Chi|)
## 1 -74.088
## 2 -72.272 3.6324  3     0.304
```

Model 6a

```
stratum.ctg <- as.factor(stratum)
m6a <- glm( case ~ stratum.ctg + induced.ctg, family = "binomial")
summary(m6a)$coefficients
```

```
##                  Estimate Std. Error      z value   Pr(>|z|)
## (Intercept)   -7.239142e-01  1.2317090 -5.877315e-01 0.5567125
## stratum.ctg2  -3.613275e-02  1.7423728 -2.073767e-02 0.9834549
## stratum.ctg3  -1.311098e-01  1.7659539 -7.424305e-02 0.9408170
## stratum.ctg4  -1.657359e-01  1.7979202 -9.218200e-02 0.9265534
## stratum.ctg5  -3.141279e-14  1.7324112 -1.813241e-14 1.0000000
## stratum.ctg6   3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg7  -3.556024e-14  1.7324112 -2.052644e-14 1.0000000
## stratum.ctg8  -2.920537e-14  1.7324112 -1.685822e-14 1.0000000
## stratum.ctg9  -2.573599e-14  1.7324112 -1.485559e-14 1.0000000
## stratum.ctg10  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg11  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg12  3.076697e-02  1.5056914  2.043378e-02 0.9836973
## stratum.ctg13 -3.072097e-14  1.7324112 -1.773307e-14 1.0000000
## stratum.ctg14  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg15  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg16 -3.046711e-02  1.7369797 -1.754028e-02 0.9860056
## stratum.ctg17 -3.155304e-14  1.7324112 -1.821337e-14 1.0000000
## stratum.ctg18 -3.329909e-02  1.5030929 -2.215371e-02 0.9823253
## stratum.ctg19 -2.836493e-03  1.5060441 -1.883406e-03 0.9984973
## stratum.ctg20 -3.123344e-14  1.7324112 -1.802889e-14 1.0000000
## stratum.ctg21 -6.061553e-02  1.7500669 -3.463612e-02 0.9723699
## stratum.ctg22 -3.613275e-02  1.5114240 -2.390643e-02 0.9809272
## stratum.ctg23 -3.046711e-02  1.7369797 -1.754028e-02 0.9860056
## stratum.ctg24 -2.836493e-03  1.5060441 -1.883406e-03 0.9984973
## stratum.ctg25 -2.599940e-14  1.7324112 -1.500764e-14 1.0000000
## stratum.ctg26  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg27  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg28 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
## stratum.ctg29 -3.613275e-02  1.7423728 -2.073767e-02 0.9834549
## stratum.ctg30  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg31 -5.124124e-02  1.5097809 -3.393952e-02 0.9729254
## stratum.ctg32 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
## stratum.ctg33 -2.738001e-14  1.7324112 -1.580457e-14 1.0000000
## stratum.ctg34 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
```

```
## stratum.ctg35 -9.606012e-02  1.7494468 -5.490886e-02 0.9562111
## stratum.ctg36 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
## stratum.ctg37 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
## stratum.ctg38 -6.626661e-02  1.7416438 -3.804831e-02 0.9696492
## stratum.ctg39  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg40  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg41 -1.527227e-02  1.3710595 -1.113902e-02 0.9911125
## stratum.ctg42 -3.195945e-14  1.5003121 -2.130187e-14 1.0000000
## stratum.ctg43  3.076697e-02  1.7369820  1.771289e-02 0.9858679
## stratum.ctg44 -3.014871e-14  1.7324112 -1.740275e-14 1.0000000
## stratum.ctg45  2.047925e-02  1.4170391  1.445214e-02 0.9884693
## stratum.ctg46 -1.527227e-02  1.5016584 -1.017027e-02 0.9918854
## stratum.ctg47  3.076697e-02  1.5056914  2.043378e-02 0.9836973
## stratum.ctg48 -3.090509e-14  1.7324112 -1.783935e-14 1.0000000
## stratum.ctg49 -3.235491e-02  1.4170158 -2.283313e-02 0.9817834
## stratum.ctg50 -3.046711e-02  1.7369797 -1.754028e-02 0.9860056
## stratum.ctg51 -6.438229e-02  1.4240613 -4.521034e-02 0.9639397
## stratum.ctg52 -3.046711e-02  1.7369797 -1.754028e-02 0.9860056
## stratum.ctg53 -1.810684e-02  1.5032368 -1.204523e-02 0.9903895
## stratum.ctg54 -8.402967e-02  1.5209105 -5.524958e-02 0.9559396
## stratum.ctg55 -3.116673e-14  1.7324112 -1.799038e-14 1.0000000
## stratum.ctg56 -1.311098e-01  1.7659539 -7.424305e-02 0.9408170
## stratum.ctg57 -9.606012e-02  1.7494468 -5.490886e-02 0.9562111
## stratum.ctg58 -1.311098e-01  1.7659539 -7.424305e-02 0.9408170
## stratum.ctg59 -3.265281e-14  1.7324112 -1.884819e-14 1.0000000
## stratum.ctg60 -3.046711e-02  1.7369797 -1.754028e-02 0.9860056
## stratum.ctg61 -1.657359e-01  1.7979202 -9.218200e-02 0.9265534
## stratum.ctg62 -9.606012e-02  1.7494468 -5.490886e-02 0.9562111
## stratum.ctg63  7.239142e-01  1.8753952  3.860062e-01 0.6994921
## induced.ctg1   9.138250e-02  0.3776048  2.420057e-01 0.8087758
## induced.ctg2   1.965029e-01  0.5101379  3.851956e-01 0.7000925
```

```
regTermTest(m6a, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ stratum.ctg + induced.ctg, family = "binomial")
## Chisq =  0.1621245  on  2  df: p= 0.92214
```

Model 6b

```
m6b <- glm( case ~ stratum.ctg + spont.ctg, family="binomial")
summary(m6b)$coefficients
```

```
##                  Estimate Std. Error        z value      Pr(>|z|)
## (Intercept)   -6.931472e-01  1.2247446 -5.659524e-01 5.714261e-01
## stratum.ctg2  -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg3  -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg4  -2.783152e-16  1.7320505 -1.606854e-16 1.000000e+00
## stratum.ctg5  -1.343116e+00  1.8178058 -7.388664e-01 4.599882e-01
## stratum.ctg6  -1.429688e-14  1.7320505 -8.254308e-15 1.000000e+00
## stratum.ctg7  -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
```

```
## stratum.ctg8  -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg9  -1.064202e-14  1.7320505 -6.144175e-15 1.000000e+00
## stratum.ctg10 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg11 -1.304452e-14  1.7320505 -7.531261e-15 1.000000e+00
## stratum.ctg12 -1.043467e+00  1.5697116 -6.647509e-01 5.062098e-01
## stratum.ctg13 -1.703035e-14  1.7320505 -9.832477e-15 1.000000e+00
## stratum.ctg14 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg15 -1.218386e-14  1.7320505 -7.034353e-15 1.000000e+00
## stratum.ctg16 -1.555434e-14  1.7320505 -8.980306e-15 1.000000e+00
## stratum.ctg17 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg18 -1.345344e+00  1.6121140 -8.345216e-01 4.039871e-01
## stratum.ctg19 -1.345344e+00  1.6121140 -8.345216e-01 4.039871e-01
## stratum.ctg20 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg21 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg22 -9.732712e-01  1.6155342 -6.024455e-01 5.468777e-01
## stratum.ctg23 -1.256781e-14  1.7320505 -7.256028e-15 1.000000e+00
## stratum.ctg24 -5.511789e-01  1.5912049 -3.463909e-01 7.290490e-01
## stratum.ctg25 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg26 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg27 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg28 -1.804333e+00  1.7838592 -1.011477e+00 3.117881e-01
## stratum.ctg29 -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg30 -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg31 -1.348831e+00  1.6989242 -7.939326e-01 4.272347e-01
## stratum.ctg32 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg33 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg34 -2.857819e+00  1.8360269 -1.556524e+00 1.195836e-01
## stratum.ctg35 -1.343116e+00  1.8178058 -7.388664e-01 4.599882e-01
## stratum.ctg36 -2.352120e+00  1.8284308 -1.286414e+00 1.982985e-01
## stratum.ctg37 -1.804333e+00  1.7838592 -1.011477e+00 3.117881e-01
## stratum.ctg38 -2.857819e+00  1.8360269 -1.556524e+00 1.195836e-01
## stratum.ctg39 -1.343116e+00  1.8178058 -7.388664e-01 4.599882e-01
## stratum.ctg40 -1.804333e+00  1.7838592 -1.011477e+00 3.117881e-01
## stratum.ctg41 -5.170219e-01  1.3982833 -3.697548e-01 7.115652e-01
## stratum.ctg42 -1.043467e+00  1.5697116 -6.647509e-01 5.062098e-01
## stratum.ctg43 -1.804333e+00  1.7838592 -1.011477e+00 3.117881e-01
## stratum.ctg44 -1.734405e-14  1.7320505 -1.001359e-14 1.000000e+00
## stratum.ctg45 -1.148958e+00  1.4753562 -7.787667e-01 4.361172e-01
## stratum.ctg46 -3.367499e-01  1.5328615 -2.196871e-01 8.261149e-01
## stratum.ctg47 -6.985386e-01  1.5583935 -4.482428e-01 6.539780e-01
## stratum.ctg48 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
## stratum.ctg49 -1.812443e+00  1.5321945 -1.182906e+00 2.368463e-01
## stratum.ctg50 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg51 -1.085746e+00  1.5183641 -7.150759e-01 4.745621e-01
## stratum.ctg52 -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg53 -1.345344e+00  1.6121140 -8.345216e-01 4.039871e-01
## stratum.ctg54 -5.511789e-01  1.5912049 -3.463909e-01 7.290490e-01
## stratum.ctg55 -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg56 -1.981679e+00  1.9085512 -1.038316e+00 2.991230e-01
## stratum.ctg57 -1.343116e+00  1.8178058 -7.388664e-01 4.599882e-01
## stratum.ctg58 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg59 -2.857819e+00  1.8360269 -1.556524e+00 1.195836e-01
## stratum.ctg60 -1.348831e+00  2.0496560 -6.580769e-01 5.104887e-01
## stratum.ctg61 -6.985386e-01  1.8230895 -3.831620e-01 7.015997e-01
```

```
## stratum.ctg62 -2.352120e+00  1.8284308 -1.286414e+00 1.982985e-01
## stratum.ctg63 -2.558663e+00  1.9572173 -1.307296e+00 1.911121e-01
## spont.ctg1      1.804333e+00  0.4267958  4.227626e+00 2.361703e-05
## spont.ctg2      3.251810e+00  0.5750654  5.654679e+00 1.561374e-08
```

```
regTermTest(m6b, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ stratum.ctg + spont.ctg, family = "binomial")
## Chisq =  37.27566  on  2  df: p= 8.0481e-09
```

Model 6c

```
m6c <- glm( case ~ stratum.ctg + induced.ctg + spont.ctg, family = "binomial")
summary(m6c)$coefficients
```

```
##                   Estimate Std. Error        z value      Pr(>|z|)
## (Intercept)   -1.453719e+00  1.3785645 -1.054517e+00 2.916465e-01
## stratum.ctg2  -3.712026e+00  2.0491008 -1.811539e+00 7.005747e-02
## stratum.ctg3  -4.852128e+00  2.3522293 -2.062778e+00 3.913368e-02
## stratum.ctg4  -3.317761e+00  1.9762044 -1.678855e+00 9.318026e-02
## stratum.ctg5  -1.905655e+00  1.8845030 -1.011224e+00 3.119093e-01
## stratum.ctg6   7.605719e-01  1.8440282  4.124514e-01 6.800086e-01
## stratum.ctg7  -1.148663e+00  1.9460024 -5.902681e-01 5.550109e-01
## stratum.ctg8  -1.148663e+00  1.9460024 -5.902681e-01 5.550109e-01
## stratum.ctg9   1.258163e-14  1.9202021  6.552244e-15 1.000000e+00
## stratum.ctg10 -4.542445e-01  2.0753078 -2.188805e-01 8.267431e-01
## stratum.ctg11  7.605719e-01  1.8440282  4.124514e-01 6.800086e-01
## stratum.ctg12 -1.120295e+00  1.7537912 -6.387845e-01 5.229631e-01
## stratum.ctg13  1.031039e-14  1.9202021  5.369431e-15 1.000000e+00
## stratum.ctg14 -4.542445e-01  2.0753078 -2.188805e-01 8.267431e-01
## stratum.ctg15  7.605719e-01  1.8440282  4.124514e-01 6.800086e-01
## stratum.ctg16 -7.026207e-01  1.8962304 -3.705355e-01 7.109835e-01
## stratum.ctg17 -1.148663e+00  1.9460024 -5.902681e-01 5.550109e-01
## stratum.ctg18 -3.091642e+00  1.8126510 -1.705591e+00 8.808422e-02
## stratum.ctg19 -2.463921e+00  1.8185133 -1.354910e+00 1.754463e-01
## stratum.ctg20 -1.148663e+00  1.9460024 -5.902681e-01 5.550109e-01
## stratum.ctg21 -2.402355e+00  2.1163933 -1.135117e+00 2.563262e-01
## stratum.ctg22 -2.773022e+00  1.8359364 -1.510413e+00 1.309381e-01
## stratum.ctg23 -7.026207e-01  1.8962304 -3.705355e-01 7.109835e-01
## stratum.ctg24 -1.261325e+00  2.0541921 -6.140248e-01 5.391990e-01
## stratum.ctg25 -1.378339e+00  2.6127635 -5.275408e-01 5.978181e-01
## stratum.ctg26 -1.801543e+00  3.0176146 -5.970090e-01 5.505014e-01
## stratum.ctg27 -1.801543e+00  3.0176146 -5.970090e-01 5.505014e-01
## stratum.ctg28 -4.632220e+00  2.2219246 -2.084778e+00 3.708944e-02
## stratum.ctg29 -3.712026e+00  2.0491008 -1.811539e+00 7.005747e-02
## stratum.ctg30 -2.954473e+00  2.2752238 -1.298542e+00 1.941012e-01
## stratum.ctg31 -3.848223e+00  1.9564809 -1.966911e+00 4.919351e-02
## stratum.ctg32 -3.063143e+00  2.0711748 -1.478940e+00 1.391564e-01
## stratum.ctg33 -2.493908e+00  2.4797090 -1.005726e+00 3.145474e-01
## stratum.ctg34 -6.203901e+00  2.1102765 -2.939852e+00 3.283691e-03
```

```
## stratum.ctg35 -3.900273e+00  1.9612013 -1.988716e+00 4.673252e-02
## stratum.ctg36 -5.267378e+00  2.0742021 -2.539472e+00 1.110200e-02
## stratum.ctg37 -4.632220e+00  2.2219246 -2.084778e+00 3.708944e-02
## stratum.ctg38 -6.203901e+00  2.1102765 -2.939852e+00 3.283691e-03
## stratum.ctg39 -1.598729e+00  1.9713617 -8.109768e-01 4.173790e-01
## stratum.ctg40 -2.201591e+00  1.8914606 -1.163963e+00 2.444389e-01
## stratum.ctg41 -1.160171e+00  1.5294190 -7.585697e-01 4.481100e-01
## stratum.ctg42 -1.577585e+00  1.6746640 -9.420308e-01 3.461769e-01
## stratum.ctg43 -2.201591e+00  1.8914606 -1.163963e+00 2.444389e-01
## stratum.ctg44  1.274877e-14  1.9202021  6.639285e-15 1.000000e+00
## stratum.ctg45 -1.454197e+00  1.6168131 -8.994216e-01 3.684282e-01
## stratum.ctg46 -9.190310e-01  1.6705317 -5.501428e-01 5.822214e-01
## stratum.ctg47 -4.542445e-01  1.7626451 -2.577062e-01 7.966337e-01
## stratum.ctg48 -1.148663e+00  1.9460024 -5.902681e-01 5.550109e-01
## stratum.ctg49 -3.597917e+00  1.7166663 -2.095874e+00 3.609334e-02
## stratum.ctg50 -2.808002e+00  2.2918406 -1.225217e+00 2.204934e-01
## stratum.ctg51 -3.233540e+00  1.7106322 -1.890260e+00 5.872317e-02
## stratum.ctg52 -3.954320e+00  2.0559708 -1.923335e+00 5.443805e-02
## stratum.ctg53 -2.580579e+00  1.7856244 -1.445197e+00 1.484025e-01
## stratum.ctg54 -3.102134e+00  1.8233850 -1.701305e+00 8.888569e-02
## stratum.ctg55 -3.128377e+00  2.1740594 -1.438956e+00 1.501629e-01
## stratum.ctg56 -5.997879e+00  2.1882651 -2.740929e+00 6.126574e-03
## stratum.ctg57 -3.900273e+00  1.9612013 -1.988716e+00 4.673252e-02
## stratum.ctg58 -4.852128e+00  2.3522293 -2.062778e+00 3.913368e-02
## stratum.ctg59 -4.758650e+00  1.9699821 -2.415580e+00 1.571016e-02
## stratum.ctg60 -2.808002e+00  2.2918406 -1.225217e+00 2.204934e-01
## stratum.ctg61 -4.532577e+00  2.2475670 -2.016660e+00 4.373105e-02
## stratum.ctg62 -6.070376e+00  2.1541888 -2.817941e+00 4.833276e-03
## stratum.ctg63 -4.324324e+00  2.1095824 -2.049848e+00 4.037924e-02
## induced.ctg1   1.948110e+00  0.5495909  3.544655e+00 3.931274e-04
## induced.ctg2   4.078333e+00  0.8727317  4.673066e+00 2.967361e-06
## spont.ctg1     2.962163e+00  0.5494861  5.390787e+00 7.014959e-08
## spont.ctg2     5.778043e+00  0.8775333  6.584414e+00 4.566819e-11
```

```
regTermTest(m6c, "induced.ctg", df=Inf)
```

```
## Wald test for induced.ctg
##  in glm(formula = case ~ stratum.ctg + induced.ctg + spont.ctg, family = "binomial")
## Chisq =  22.54523  on  2  df: p= 1.2716e-05
```

```
regTermTest(m6c, "spont.ctg", df=Inf)
```

```
## Wald test for spont.ctg
##  in glm(formula = case ~ stratum.ctg + induced.ctg + spont.ctg, family = "binomial")
## Chisq =  46.18332  on  2  df: p= 9.3631e-11
```

Model 6d

```
m6d <- glm(case ~ stratum.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8, family = "binomial")
summary(m6d)$coefficients
```

```
##                  Estimate Std. Error       z value      Pr(>|z|)
## (Intercept)   -1.554327e+00  1.4318887 -1.085508e+00 2.776965e-01
## stratum.ctg2  -3.550262e+00  2.0113568 -1.765108e+00 7.754562e-02
## stratum.ctg3  -6.015942e+00  3.4851392 -1.726170e+00 8.431688e-02
## stratum.ctg4  -3.227959e+00  2.0306101 -1.589650e+00 1.119138e-01
## stratum.ctg5  -2.269503e+00  1.9486690 -1.164643e+00 2.441636e-01
## stratum.ctg6   8.611801e-01  1.8842254  4.570473e-01 6.476370e-01
## stratum.ctg7  -1.394425e+00  2.0210500 -6.899509e-01 4.902251e-01
## stratum.ctg8  -1.394425e+00  2.0210500 -6.899509e-01 4.902251e-01
## stratum.ctg9   1.801352e-14  1.9701997  9.142993e-15 1.000000e+00
## stratum.ctg10 -6.025172e-01  2.2075803 -2.729311e-01 7.849062e-01
## stratum.ctg11  8.611801e-01  1.8842254  4.570473e-01 6.476370e-01
## stratum.ctg12 -1.455135e+00  1.8340702 -7.933910e-01 4.275500e-01
## stratum.ctg13  2.190162e-14  1.9701997  1.111645e-14 1.000000e+00
## stratum.ctg14 -6.025172e-01  2.2075803 -2.729311e-01 7.849062e-01
## stratum.ctg15  8.611801e-01  1.8842254  4.570473e-01 6.476370e-01
## stratum.ctg16 -7.979759e-01  1.9437503 -4.105342e-01 6.814141e-01
## stratum.ctg17 -1.394425e+00  2.0210500 -6.899509e-01 4.902251e-01
## stratum.ctg18 -2.782140e+00  1.8061857 -1.540340e+00 1.234776e-01
## stratum.ctg19 -2.566562e+00  1.8241024 -1.407027e+00 1.594193e-01
## stratum.ctg20 -1.394425e+00  2.0210500 -6.899509e-01 4.902251e-01
## stratum.ctg21 -2.001981e+00  1.9975007 -1.002243e+00 3.162262e-01
## stratum.ctg22 -2.720490e+00  1.8446977 -1.474762e+00 1.402766e-01
## stratum.ctg23 -7.979759e-01  1.9437503 -4.105342e-01 6.814141e-01
## stratum.ctg24 -1.119091e+00  2.0605190 -5.431112e-01 5.870533e-01
## stratum.ctg25 -8.167521e-01  2.3457763 -3.481799e-01 7.277051e-01
## stratum.ctg26 -1.503576e+00  2.8371991 -5.299507e-01 5.961461e-01
## stratum.ctg27 -1.503576e+00  2.8371991 -5.299507e-01 5.961461e-01
## stratum.ctg28 -4.557387e+00  2.4949767 -1.826625e+00 6.775617e-02
## stratum.ctg29 -3.550262e+00  2.0113568 -1.765108e+00 7.754562e-02
## stratum.ctg30 -2.909894e+00  2.1589856 -1.347806e+00 1.777208e-01
## stratum.ctg31 -3.715376e+00  2.0089990 -1.849367e+00 6.440486e-02
## stratum.ctg32 -2.499883e+00  2.1073655 -1.186260e+00 2.355198e-01
## stratum.ctg33 -2.296379e+00  2.3396484 -9.815060e-01 3.263433e-01
## stratum.ctg34 -7.524526e+00  2.7022037 -2.784589e+00 5.359568e-03
## stratum.ctg35 -3.136549e+00  2.0260647 -1.548099e+00 1.215984e-01
## stratum.ctg36 -5.141874e+00  2.2969996 -2.238517e+00 2.518733e-02
## stratum.ctg37 -4.557387e+00  2.4949767 -1.826625e+00 6.775617e-02
## stratum.ctg38 -7.524526e+00  2.7022037 -2.784589e+00 5.359568e-03
## stratum.ctg39 -1.998949e+00  2.0371986 -9.812246e-01 3.264820e-01
## stratum.ctg40 -2.636415e+00  1.9474001 -1.353812e+00 1.757962e-01
## stratum.ctg41 -1.370607e+00  1.5893204 -8.623859e-01 3.884752e-01
## stratum.ctg42 -1.899528e+00  1.7418995 -1.090492e+00 2.754963e-01
## stratum.ctg43 -2.636415e+00  1.9474001 -1.353812e+00 1.757962e-01
## stratum.ctg44  3.236850e-14  1.9701997  1.642904e-14 1.000000e+00
## stratum.ctg45 -1.810368e+00  1.6862276 -1.073620e+00 2.829929e-01
## stratum.ctg46 -1.080869e+00  1.7291455 -6.250883e-01 5.319131e-01
## stratum.ctg47 -6.025172e-01  1.8563289 -3.245746e-01 7.455031e-01
## stratum.ctg48 -1.394425e+00  2.0210500 -6.899509e-01 4.902251e-01
## stratum.ctg49 -3.222370e+00  1.7178066 -1.875863e+00 6.067410e-02
## stratum.ctg50 -2.640010e+00  2.1788838 -1.211634e+00 2.256525e-01
## stratum.ctg51 -2.899163e+00  1.7176263 -1.687889e+00 9.143251e-02
## stratum.ctg52 -3.259967e+00  2.0913135 -1.558813e+00 1.190406e-01
## stratum.ctg53 -2.676578e+00  1.7928380 -1.492928e+00 1.354560e-01
```

```
## stratum.ctg54 -2.947751e+00   1.8450976 -1.597612e+00 1.101293e-01
## stratum.ctg55 -3.077783e+00   2.0777637 -1.481296e+00 1.385278e-01
## stratum.ctg56 -7.473684e+00   2.7621023 -2.705796e+00 6.814095e-03
## stratum.ctg57 -3.136549e+00   2.0260647 -1.548099e+00 1.215984e-01
## stratum.ctg58 -6.015942e+00   3.4851392 -1.726170e+00 8.431688e-02
## stratum.ctg59 -4.124304e+00   2.0232397 -2.038465e+00 4.150341e-02
## stratum.ctg60 -2.640010e+00   2.1788838 -1.211634e+00 2.256525e-01
## stratum.ctg61 -4.738444e+00   2.4314909 -1.948781e+00 5.132153e-02
## stratum.ctg62 -7.470993e+00   2.7655873 -2.701413e+00 6.904558e-03
## stratum.ctg63 -3.820206e+00   2.1308152 -1.792838e+00 7.299888e-02
## g2              2.178098e+00   0.7503628  2.902727e+00 3.699291e-03
## g3              4.089139e+00   0.9604287  4.257619e+00 2.066160e-05
## g4              3.497595e+00   0.7640695  4.577587e+00 4.703699e-06
## g5              3.950980e+00   1.0831130  3.647800e+00 2.644952e-04
## g6              7.686272e+00   1.7174574  4.475378e+00 7.627608e-06
## g7              5.374533e+00   0.9214728  5.832547e+00 5.458775e-09
## g8              1.032700e+01   2.1168654  4.878438e+00 1.069292e-06
```

```r
linearHypothesis(m6d, c( "g2 = 0", "g3=0", "g4=0", "g5=0", "g6=0", "g7=0", "g8=0"), test = "Chisq")
```

```
## Linear hypothesis test
##
## Hypothesis:
## g2 = 0
## g3 = 0
## g4 = 0
## g5 = 0
## g6 = 0
## g7 = 0
## g8 = 0
##
## Model 1: restricted model
## Model 2: case ~ stratum.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8
##
##   Res.Df Df  Chisq Pr(>Chisq)
## 1    185
## 2    178  7 47.459  4.542e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
anova(m6c, m6d, test = "Chisq")
```

```
## Analysis of Deviance Table
##
## Model 1: case ~ stratum.ctg + induced.ctg + spont.ctg
## Model 2: case ~ stratum.ctg + g2 + g3 + g4 + g5 + g6 + g7 + g8
##   Resid. Df Resid. Dev Df Deviance Pr(>Chi)
## 1       181     239.37
## 2       178     233.30  3   6.0678   0.1084
```