A02g Gender Correlations (P101 Final exam - Jan, 2018)

Joss Ives

June 7, 2018

*updated by Joss Ives 2018 June 07, 11:42:22*

# Overview

This is a companion report for “A02 Initial Explain Your Answee Report (P101 Final exam - Jan, 2018)”. In this report, correlations between the treatment and gender are examined in more detail. It has the same setup section as A02

# Setup

## Loading required package: Matrix

## Loading required package: xts

## Loading required package: zoo

##   
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':  
##   
## as.Date, as.Date.numeric

##   
## Attaching package: 'PerformanceAnalytics'

## The following object is masked from 'package:graphics':  
##   
## legend

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:xts':  
##   
## first, last

## The following objects are masked from 'package:plyr':  
##   
## arrange, count, desc, failwith, id, mutate, rename, summarise,  
## summarize

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

### Add additional calculated values

The following is a summary of the variables present in the data file. The final 4 were caculated in this notebook. “Fix” refers to removing from the overall score on the test, the score of the specific question.

names(dat.raw)

## [1] "ID" "QNUM" "QCORRECT"   
## [4] "TREATMENT" "f.Atot40" "f.Btot38"   
## [7] "f.tot78" "course.grade" "d.version"   
## [10] "f.version" "NCRT" "Gender"   
## [13] "EYAfinal" "course.grade.frac" "CRT.medsplit"   
## [16] "final.grade.LMH" "final.grade.fix" "final.gradeA.fix"   
## [19] "f.tot100" "CONTROL" "GRELEVEL"

# Treatment x Gender

In this section we compare making data subset for each Gender with using the TREATMENT x Gender interaction terms

### Run the regressions on the two groups individually

Female-only data first

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ TREATMENT + final.grade.fix + (1 | QNUM) + (1 | ID)  
## Data: subset(dat.trt, Gender == "Female")  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 2049.9 2076.8 -1019.9 2039.9 1611   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -2.2436 -0.9573 0.5055 0.7934 2.4346   
##   
## Random effects:  
## Groups Name Variance Std.Dev.   
## ID (Intercept) 3.455e-14 1.859e-07  
## QNUM (Intercept) 1.485e-01 3.854e-01  
## Number of obs: 1616, groups: ID, 402; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -2.0462 0.2904 -7.045 1.85e-12 \*\*\*  
## TREATMENT1 0.2685 0.1064 2.523 0.0116 \*   
## final.grade.fix 3.4859 0.3242 10.751 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) TREATM  
## TREATMENT1 -0.198   
## finl.grd.fx -0.703 0.025

## Est LL UL  
## (Intercept) 0.1292214 0.07313322 0.2283254  
## TREATMENT1 1.3079709 1.06175964 1.6112760  
## final.grade.fix 32.6528362 17.29545442 61.6467012

Male-only data

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ TREATMENT + final.grade.fix + (1 | QNUM) + (1 | ID)  
## Data: subset(dat.trt, Gender == "Male")  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 1048.5 1073.0 -519.3 1038.5 979   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.6274 -0.7583 0.4255 0.5859 1.6886   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.0000 0.0000   
## QNUM (Intercept) 0.1338 0.3658   
## Number of obs: 984, groups: ID, 246; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -1.9646 0.3726 -5.273 1.34e-07 \*\*\*  
## TREATMENT1 0.1605 0.1535 1.046 0.296   
## final.grade.fix 4.2389 0.4576 9.263 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) TREATM  
## TREATMENT1 -0.218   
## finl.grd.fx -0.822 0.021

## Est LL UL  
## (Intercept) 0.140209 0.06755419 0.2910044  
## TREATMENT1 1.174093 0.86905952 1.5861923  
## final.grade.fix 69.330748 28.27511499 169.9994029

Gender effect for control condition only, controlling for question difficulty and test perfromance

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ Gender + final.grade.fix + (1 | QNUM) + (1 | ID)  
## Data: subset(dat.trt, TREATMENT == 0)  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 1564.7 1590.5 -777.3 1554.7 1295   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.0900 -0.8981 0.4519 0.7256 2.2723   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.04443 0.2108   
## QNUM (Intercept) 0.19198 0.4382   
## Number of obs: 1300, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -2.2167 0.3365 -6.588 4.46e-11 \*\*\*  
## GenderMale 0.5958 0.1347 4.422 9.78e-06 \*\*\*  
## final.grade.fix 3.7630 0.3901 9.646 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) GndrMl  
## GenderMale -0.062   
## finl.grd.fx -0.724 -0.087

## Est LL UL  
## (Intercept) 0.1089703 0.05634971 0.2107291  
## GenderMale 1.8145142 1.39337058 2.3629477  
## final.grade.fix 43.0770297 20.05244705 92.5388551

Gender effect for treatment condition only, controlling for question difficulty and test performance

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ Gender + final.grade.fix + (1 | QNUM) + (1 | ID)  
## Data: subset(dat.trt, TREATMENT == 1)  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 1537.3 1563.2 -763.7 1527.3 1295   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.0714 -0.9446 0.4659 0.6817 2.1944   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.09722 0.3118   
## QNUM (Intercept) 0.08945 0.2991   
## Number of obs: 1300, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -1.9530 0.2966 -6.585 4.54e-11 \*\*\*  
## GenderMale 0.4740 0.1381 3.432 0.000599 \*\*\*  
## final.grade.fix 3.7767 0.3985 9.477 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) GndrMl  
## GenderMale -0.058   
## finl.grd.fx -0.821 -0.101

## Est LL UL  
## (Intercept) 0.1418534 0.07932385 0.2536739  
## GenderMale 1.6064248 1.22547491 2.1057963  
## final.grade.fix 43.6709021 19.99778254 95.3679580

### Run the regressions on the entire data set with TREATMENT x Gender interaction term

First run with Gender=Female and TREATMENT=Control as the base levels

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ TREATMENT \* Gender + final.grade.fix + (1 | QNUM) +   
## (1 | ID)  
## Data: dat.trt  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 3088.9 3129.9 -1537.4 3074.9 2593   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.3553 -0.9291 0.4659 0.7041 2.5013   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.000 0.0000   
## QNUM (Intercept) 0.141 0.3755   
## Number of obs: 2600, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -2.2064 0.2619 -8.425 < 2e-16 \*\*\*  
## TREATMENT1 0.2700 0.1069 2.527 0.0115 \*   
## GenderMale 0.5788 0.1302 4.444 8.82e-06 \*\*\*  
## final.grade.fix 3.7416 0.2647 14.135 < 2e-16 \*\*\*  
## TREATMENT1:GenderMale -0.1149 0.1857 -0.618 0.5362   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) TREATMENT1 GndrMl fnl.g.  
## TREATMENT1 -0.214   
## GenderMale -0.109 0.404   
## finl.grd.fx -0.636 0.021 -0.088   
## TREATMENT1: 0.118 -0.576 -0.695 -0.003

## Est LL UL  
## (Intercept) 0.1100948 0.06589364 0.1839459  
## TREATMENT1 1.3099603 1.06242436 1.6151699  
## GenderMale 1.7839230 1.38201987 2.3027031  
## final.grade.fix 42.1643213 25.09685022 70.8387697  
## TREATMENT1:GenderMale 0.8914947 0.61950686 1.2828958

Then run with Gender=Male and TREATMENT=Control as the base levels

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ TREATMENT \* GRELEVEL + final.grade.fix + (1 | QNUM) +   
## (1 | ID)  
## Data: dat.trt  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 3088.9 3129.9 -1537.4 3074.9 2593   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.3553 -0.9291 0.4659 0.7041 2.5013   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.000 0.0000   
## QNUM (Intercept) 0.141 0.3755   
## Number of obs: 2600, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -1.6276 0.2795 -5.823 5.79e-09 \*\*\*  
## TREATMENT1 0.1551 0.1518 1.022 0.307   
## GRELEVELFemale -0.5788 0.1302 -4.444 8.82e-06 \*\*\*  
## final.grade.fix 3.7416 0.2647 14.134 < 2e-16 \*\*\*  
## TREATMENT1:GRELEVELFemale 0.1149 0.1857 0.619 0.536   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) TREATMENT1 GRELEV fnl.g.  
## TREATMENT1 -0.270   
## GRELEVELFml -0.364 0.566   
## finl.grd.fx -0.637 0.010 0.088   
## TREATMENT1: 0.213 -0.818 -0.695 0.003

## Est LL UL  
## (Intercept) 0.1964011 0.1135562 0.3396853  
## TREATMENT1 1.1678199 0.8672156 1.5726232  
## GRELEVELFemale 0.5605612 0.4342706 0.7235786  
## final.grade.fix 42.1643382 25.0963156 70.8403354  
## TREATMENT1:GRELEVELFemale 1.1217146 0.7794870 1.6141945

Then run with Gender=Male and TREATMENT=Treatment as the base levels

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ CONTROL \* GRELEVEL + final.grade.fix + (1 | QNUM) +   
## (1 | ID)  
## Data: dat.trt  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 3088.9 3129.9 -1537.4 3074.9 2593   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.3553 -0.9291 0.4659 0.7041 2.5013   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.000 0.0000   
## QNUM (Intercept) 0.141 0.3755   
## Number of obs: 2600, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -1.4725 0.2798 -5.263 1.42e-07 \*\*\*  
## CONTROL1 -0.1551 0.1518 -1.022 0.306895   
## GRELEVELFemale -0.4640 0.1335 -3.475 0.000511 \*\*\*  
## final.grade.fix 3.7416 0.2647 14.134 < 2e-16 \*\*\*  
## CONTROL1:GRELEVELFemale -0.1149 0.1857 -0.619 0.536231   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) CONTROL1 GRELEV fnl.g.  
## CONTROL1 -0.273   
## GRELEVELFml -0.376 0.586   
## finl.grd.fx -0.630 -0.010 0.091   
## CONTROL1:GR 0.231 -0.818 -0.713 -0.003

## Est LL UL  
## (Intercept) 0.2293609 0.1325474 0.3968877  
## CONTROL1 0.8562958 0.6358852 1.1531052  
## GRELEVELFemale 0.6287900 0.4840124 0.8168734  
## final.grade.fix 42.1642954 25.0966237 70.8393219  
## CONTROL1:GRELEVELFemale 0.8914928 0.6195108 1.2828821

And then for completion run with Gender=Female and TREATMENT=Treatment as the base levels

## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: QCORRECT ~ CONTROL \* Gender + final.grade.fix + (1 | QNUM) +   
## (1 | ID)  
## Data: dat.trt  
## Control: glmerControl(optimizer = "bobyqa")  
##   
## AIC BIC logLik deviance df.resid   
## 3088.9 3129.9 -1537.4 3074.9 2593   
##   
## Scaled residuals:   
## Min 1Q Median 3Q Max   
## -3.3553 -0.9291 0.4659 0.7041 2.5013   
##   
## Random effects:  
## Groups Name Variance Std.Dev.  
## ID (Intercept) 0.000 0.0000   
## QNUM (Intercept) 0.141 0.3755   
## Number of obs: 2600, groups: ID, 648; QNUM, 4  
##   
## Fixed effects:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -1.9364 0.2608 -7.425 1.13e-13 \*\*\*  
## CONTROL1 -0.2700 0.1069 -2.527 0.011515 \*   
## GenderMale 0.4640 0.1335 3.475 0.000511 \*\*\*  
## final.grade.fix 3.7416 0.2647 14.134 < 2e-16 \*\*\*  
## CONTROL1:GenderMale 0.1149 0.1857 0.619 0.536242   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Correlation of Fixed Effects:  
## (Intr) CONTROL1 GndrMl fnl.g.  
## CONTROL1 -0.195   
## GenderMale -0.109 0.407   
## finl.grd.fx -0.630 -0.021 -0.091   
## CONTROL1:GM 0.118 -0.576 -0.713 0.003

## Est LL UL  
## (Intercept) 0.1442198 0.08650373 0.2404444  
## CONTROL1 0.7633818 0.61913030 0.9412425  
## GenderMale 1.5903575 1.22417843 2.0660688  
## final.grade.fix 42.1643590 25.09669828 70.8393251  
## CONTROL1:GenderMale 1.1217128 0.77948923 1.6141847

### Summary of results

*Format table in markdown instead of R for fun*

None of the cross terms were statistically significant

|  |  |  |
| --- | --- | --- |
| ODDS RATIOS [95%CI] | Data Subset | Interaction Term |
| Treatment (Female) | 1.308\* [1.062, 1.611] | 1.31\* [1.062, 1.615] |
| Treatment (Male) | 1.174 [0.869, 1.586] | 1.168 [0.867, 1.573] |
| Gender (Control) | 1.815\*\*\* [1.393, 2.363] | 1.784\*\*\* [1.382, 2.303] |
| Gender (Treatment) | 1.606\*\*\* [1.225, 2.106] | 1.59\*\*\* [1.224, 2.066] |