PICK Pilot Mixed Methods Evaluation

Quantitative Analyses and Results

18 June 2018

Contents

1 Univariate Type III Repeated-Measures ANOVA **3**
- 1.1 Testing with and without Assumpsion of Sphericity. . . . 3
- 1.2 Pillai test statistic . . . 3
- 1.3 Paired Comparisons . . . 4
- 1.4 Paired Comparisons with Tukey Adjustment . . . 4
- 1.5 Plot with Confidence Intervals . . . 5

2 MLM Analyses **5**
- 2.1 Calculating ICC . . . 5
- 2.2 Baseline Model: No Predictors . . . 6
- 2.3 Model Examining Effect of Outcome Level . . . 7
  - 2.3.1 Model Comparison: Testing the Effect of the Outcome Level . . . 8
  - 2.3.2 Pairwise Comparisons of Mean Change Scores by Outcome Level . . . 8
  - 2.3.3 Plot of Model Only Examining Outcome "Level" and Change . . . 9
- 2.4 Adding All Predictors . . . 10
  - 2.4.1 Collapsing Dosage . . . 11
  - 2.4.2 Examining Age Categories Instead of Continuous Age . . . 12
  - 2.4.3 Model Comparison: Testing whether the Addition of all Predictors Improves Model Fit . . . 13
  - 2.4.4 Testing Main Effects . . . 13
    - 2.4.4.1 Testing Significance of Main Effects . . . 13
    - 2.4.4.2 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates . . . 14
  - 2.4.5 Final Model Estimates . . . 16
    - 2.4.5.1 Refitting Final Model with REML . . . 16
    - 2.4.5.2 Plotting the Effect of Predictors . . . 18
- 2.5 Trimming Non-Significant Predictors . . . 21
  - 2.5.1 Model Comparison: Testing whether the Removal of Non-Significan Predictors Affects Model Fit . . . 22
  - 2.5.2 Testing Main Effects . . . 22
    - 2.5.2.1 Race/Ethnicity . . . 22
    - 2.5.2.2 Prior Relationship Education . . . 22
    - 2.5.2.3 Dosage . . . 22
    - 2.5.2.4 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates . . . 23
  - 2.5.3 Trimmed Model Estimates . . . 24
    - 2.5.3.1 Refitting Trimmed Model with REML . . . 24
    - 2.5.3.2 Plotting the Effect of Predictors . . . 26

2.6 Fitting Trimmed Model on All Available Data (i.e., using individuals droped because of missing data only on non-significant predictors) . . . 29
2.6.1 Model Building and Comparison . . . 29
2.6.2 Testing Individual Main Effects . . . 29
2.6.2.1 Race/Ethnicity . . . 29
2.6.2.2 Prior Relationship Education . . . 29
2.6.2.3 Dosage . . . 30
2.6.2.4 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates with All Available Data . . . 30
2.6.3 Trimmed Model Estimates on All Available Data . . . 31
2.6.3.1 Refitting Trimmed Model with REML . . . 31
2.6.3.2 Plotting the Effect of Predictors . . . 33

3 Textual Summary **36**
3.1 Methods (using results from full model; will need to edit if using trimmed model) . . 36
3.1.1 Notes on Methods Section . . . 36
3.2 Results . . . 36
3.2.1 Notes on Results Section . . . 36

1 Univariate Type III Repeated-Measures ANOVA

1.1 Testing with and without Assumpsion of Sphericity.

- Significant even after correcting for departure from sphericity
- "Sphericity is an important assumption of a repeated-measures ANOVA. It refers to the condition where the variances of the differences between all possible pairs of within-subject conditions (i.e., levels of the independent variable) are equal." (https://en.wikipedia.org/wiki/Mauchly%27s_sphericity_test)

```
Univariate Type III Repeated-Measures ANOVA Assuming Sphericity

            Sum Sq num Df Error SS den Df F value    Pr(>F)
(Intercept) 823.44      1   367.14    123 275.870 < 2.2e-16 ***
var          31.81      3   144.42    369  27.088 7.437e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Mauchly Tests for Sphericity

    Test statistic   p-value
var        0.51592 6.461e-16


Greenhouse-Geisser and Huynh-Feldt Corrections
 for Departure from Sphericity

     GG eps Pr(>F[GG])
var 0.68824  1.191e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

       HF eps   Pr(>F[HF])
var 0.7001693 8.217078e-12
```

1.2 Pillai test statistic

```
Type III Repeated Measures MANOVA Tests: Pillai test statistic
            Df test stat approx F num Df den Df    Pr(>F)
(Intercept)  1   0.69163  275.870      1    123 < 2.2e-16 ***
var          1   0.34520   21.263      3    121 3.945e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

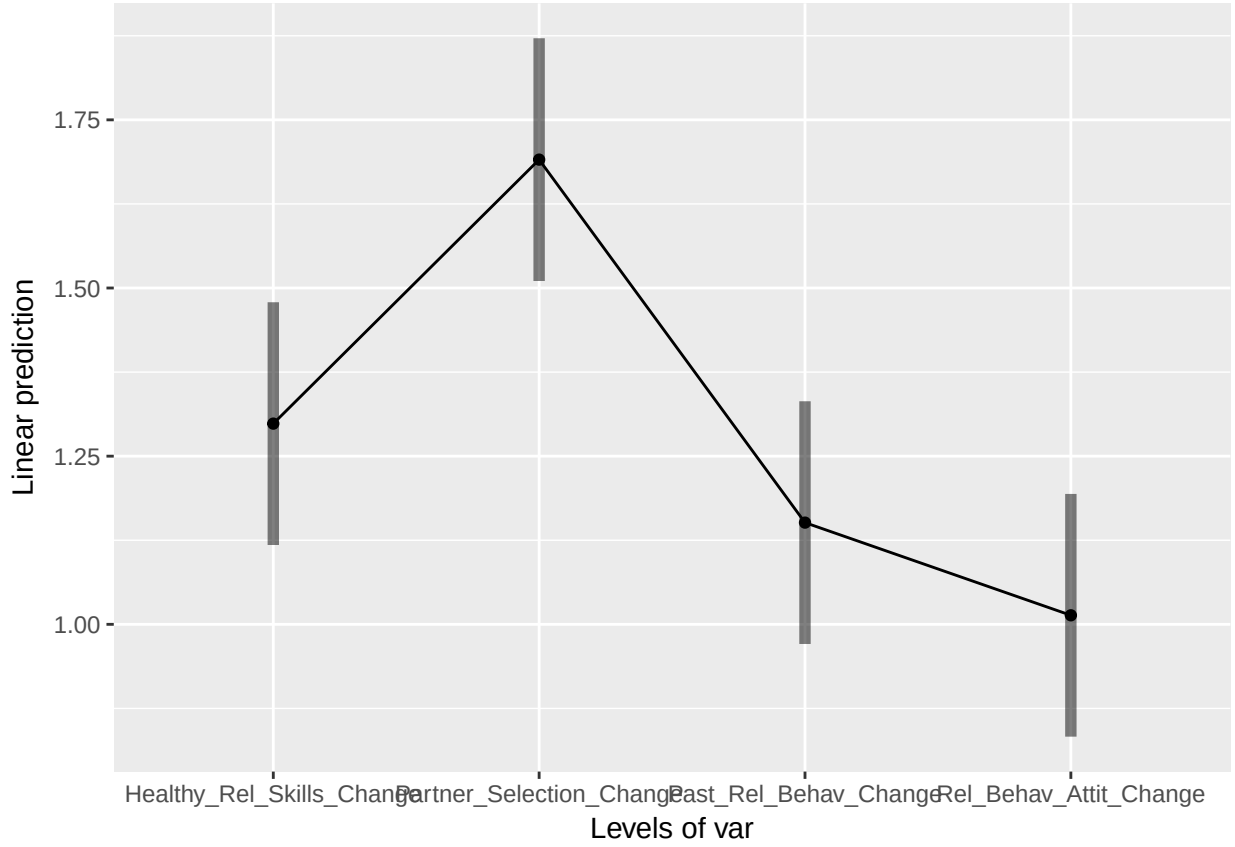
1.3 Paired Comparisons

```
 var                          emmean         SE     df  lower.CL upper.CL
 Healthy_Rel_Skills_Change 1.298387 0.09157073 227.09 1.1179501 1.478824
 Partner_Selection_Change  1.690860 0.09157073 227.09 1.5104233 1.871297
 Past_Rel_Behav_Change     1.151210 0.09157073 227.09 0.9707727 1.331647
 Rel_Behav_Attit_Change    1.013441 0.09157073 227.09 0.8330039 1.193878

Confidence level used: 0.95
```

1.4 Paired Comparisons with Tukey Adjustment

```
 contrast                                                estimate
 Healthy_Rel_Skills_Change - Partner_Selection_Change -0.3924731
 Healthy_Rel_Skills_Change - Past_Rel_Behav_Change     0.1471774
 Healthy_Rel_Skills_Change - Rel_Behav_Attit_Change    0.2849462
 Partner_Selection_Change - Past_Rel_Behav_Change      0.5396505
 Partner_Selection_Change - Rel_Behav_Attit_Change     0.6774194
 Past_Rel_Behav_Change - Rel_Behav_Attit_Change        0.1377688
         SE  df t.ratio p.value
 0.07945244 369  -4.940  <.0001
 0.07945244 369   1.852  0.2507
 0.07945244 369   3.586  0.0021
 0.07945244 369   6.792  <.0001
 0.07945244 369   8.526  <.0001
 0.07945244 369   1.734  0.3075

P value adjustment: tukey method for comparing a family of 4 estimates
```

1.5 Plot with Confidence Intervals



2 MLM Analyses

2.1 Calculating ICC

- Indicates how much variance in change scores is between respondents vs. within respondents (i.e., across outcomes). A little over half of the variance is between respondents. So change scores vary both between respondents and within respondents (across outcomes).

```
Linear mixed model
 Family: gaussian (identity)
Formula: Change.Score ~ 1 + (1 | ID)

  ICC (ID): 0.560648
```

2.2 Baseline Model: No Predictors

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ 1 + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1298.3   1311.0   -646.2   1292.3      504

Scaled residuals:
   Min     1Q Median     3Q    Max
 -2.90  -0.53  -0.07   0.48   3.69

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.602    0.776
 Residual             0.476    0.690
Number of obs: 507, groups:  ID, 129

Fixed effects:
            Estimate Std. Error t value
(Intercept)   1.2911     0.0749    17.2
```

2.3 Model Examining Effect of Outcome Level

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1225.0   1250.3   -606.5   1213.0      501

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.813 -0.517 -0.007  0.490  3.478

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.623    0.789
 Residual             0.386    0.621
Number of obs: 507, groups:  ID, 129

Fixed effects:
                            Estimate Std. Error t value
(Intercept)                   1.2912     0.0886   14.57
varPartner_Selection_Change   0.4078     0.0776    5.26
varPast_Rel_Behav_Change     -0.1425     0.0784   -1.82
varRel_Behav_Attit_Change    -0.2879     0.0784   -3.67

Correlation of Fixed Effects:
            (Intr) vP_S_C vP_R_B
vrPrtnr_S_C -0.440
vrPst_R_B_C -0.435  0.497
vrRl_Bh_A_C -0.435  0.497  0.498
```

2.3.1 Model Comparison: Testing the Effect of the Outcome Level

```
Data: PICK_clean_long
Models:
mlm.change.baseline.ML: Change.Score ~ 1 + (1 | ID)
mlm.change.no.preds.ML: Change.Score ~ var + (1 | ID)
                        Df    AIC    BIC  logLik deviance  Chisq Chi Df
mlm.change.baseline.ML   3 1298.3 1311.0 -646.17   1292.3
mlm.change.no.preds.ML   6 1225.0 1250.3 -606.48   1213.0 79.376      3
                        Pr(>Chisq)
mlm.change.baseline.ML
mlm.change.no.preds.ML   < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The effect of outcome level was significant ($\chi^2 = 79.38$, $df = 3$, $p < .001$), indicating that at least one outcome had a significantly higher change score than another.

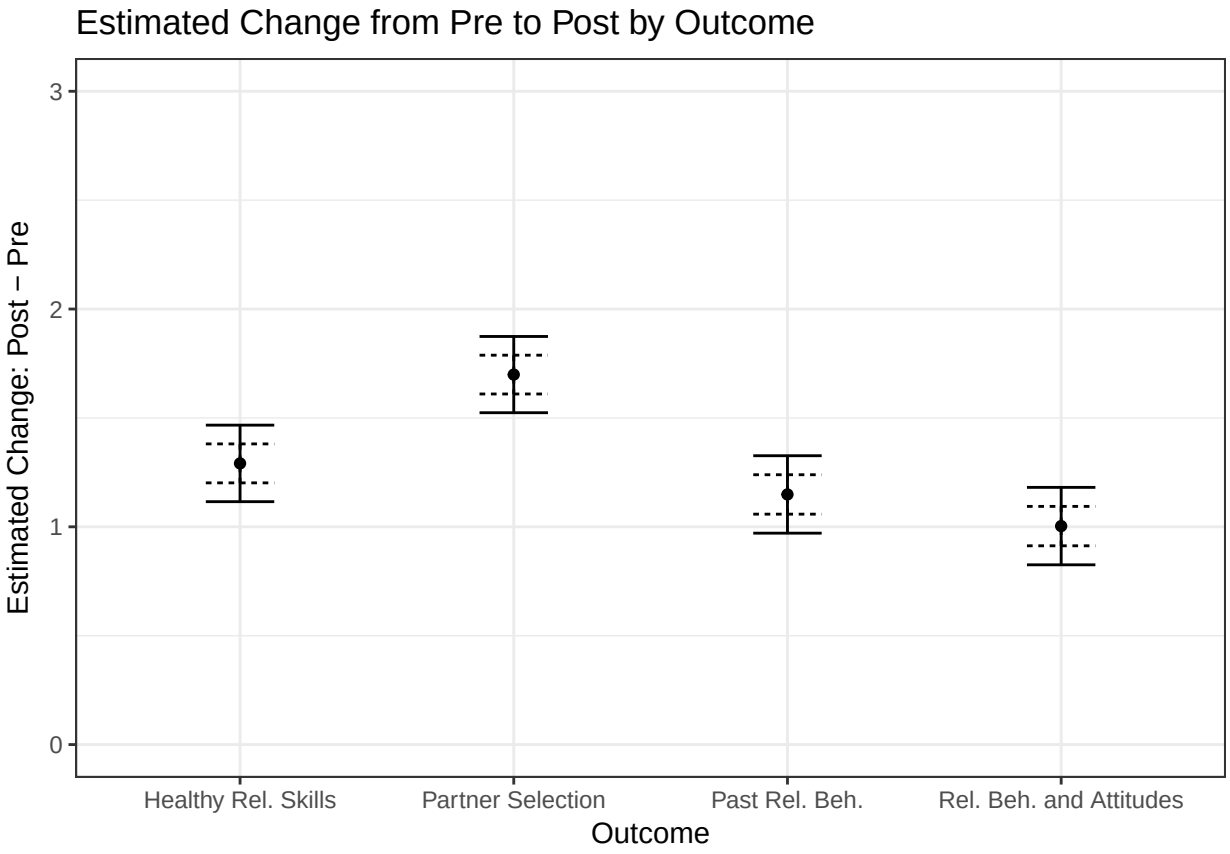
2.3.2 Pairwise Comparisons of Mean Change Scores by Outcome Level

- Ask Sarah for reference: kenward-roger (p.34 text)
- Any pair that does not share a Group Number is significantly different (see http://www.tandfonline.com/doi/pdf/10.1198/1061860043515)

```
 var                          emmean         SE     df  lower.CL upper.CL
 Rel_Behav_Attit_Change    1.003296 0.08952762 246.87 0.8269605 1.179631
 Past_Rel_Behav_Change     1.148629 0.08952762 246.87 0.9722938 1.324965
 Healthy_Rel_Skills_Change 1.291176 0.08894682 242.33 1.1159683 1.466383
 Partner_Selection_Change  1.698966 0.08877721 240.91 1.5240877 1.873845
 .group
  1
  12
   2
    3

Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 4 estimates
significance level used: alpha = 0.05
```

2.3.3 Plot of Model Only Examining Outcome "Level" and Change

```
geom_path: Each group consists of only one observation. Do you need to
adjust the group aesthetic?
```



2.4 Adding All Predictors

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ Age_Decades + Ethnic_Code + Education_collapsed +
    +Prior_RshpEducation_collapsed + FinancialWorry_cat + Number_Attended +
    Gender + Divorced_Dichotomous + var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1215.9   1296.2   -588.9   1177.9      488

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.905 -0.536 -0.016  0.468  3.577

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.450    0.671
 Residual             0.386    0.621
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                           Estimate Std. Error t value
(Intercept)                                 0.60515    0.34613    1.75
Age_Decades                                 0.06669    0.06900    0.97
Ethnic_CodeHispanic/Latino                  0.37999    0.19209    1.98
Ethnic_CodeOther                           -0.38251    0.19668   -1.94
Education_collapsedSome college            -0.04491    0.17446   -0.26
Education_collapsedCollege or technical degree  0.03794    0.18635    0.20
Education_collapsedGraduate degree         -0.51856    0.25725   -2.02
Prior_RshpEducation_collapsedSome/A lot    -0.21802    0.14224   -1.53
FinancialWorry_catOften                     0.00553    0.19781    0.03
FinancialWorry_catAlmost all the time       0.09414    0.18472    0.51
Number_AttendedTwo Sessions                 0.21313    0.17715    1.20
Number_AttendedThree Sessions               0.63483    0.16109    3.94
GenderFemale                                0.22182    0.18081    1.23
Divorced_DichotomousDivorced                0.12749    0.14780    0.86
varPartner_Selection_Change                 0.40805    0.07758    5.26
varPast_Rel_Behav_Change                   -0.14208    0.07842   -1.81
varRel_Behav_Attit_Change                  -0.28741    0.07842   -3.67
```

2.4.1 Collapsing Dosage

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ Age_Decades + Ethnic_Code + Education_collapsed +
    +Prior_RshpEducation_collapsed + FinancialWorry_cat + Dosage +
    Gender + Divorced_Dichotomous + var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1215.3   1291.4   -589.7   1179.3      489

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.869 -0.547 -0.012  0.458  3.562

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.456    0.676
 Residual             0.386    0.622
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                           Estimate Std. Error t value
(Intercept)                                  0.7224     0.3339    2.16
Age_Decades                                  0.0667     0.0694    0.96
Ethnic_CodeHispanic/Latino                   0.3948     0.1928    2.05
Ethnic_CodeOther                            -0.3969     0.1974   -2.01
Education_collapsedSome college             -0.0517     0.1753   -0.30
Education_collapsedCollege or technical degree  0.0465     0.1872    0.25
Education_collapsedGraduate degree          -0.5096     0.2586   -1.97
Prior_RshpEducation_collapsedSome/A lot     -0.2115     0.1429   -1.48
FinancialWorry_catOften                      0.0254     0.1982    0.13
FinancialWorry_catAlmost all the time        0.0762     0.1851    0.41
DosageFull                                   0.5376     0.1402    3.84
GenderFemale                                 0.1924     0.1801    1.07
Divorced_DichotomousDivorced                 0.1232     0.1486    0.83
varPartner_Selection_Change                  0.4083     0.0776    5.26
varPast_Rel_Behav_Change                    -0.1420     0.0784   -1.81
varRel_Behav_Attit_Change                   -0.2873     0.0784   -3.66
```

2.4.2 Examining Age Categories Instead of Continuous Age

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ Age_Groups + Ethnic_Code + Education_collapsed +
    +Prior_RshpEducation_collapsed + FinancialWorry_cat + Dosage +
    Gender + Divorced_Dichotomous + var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1217.9   1302.4   -588.9   1177.9      487

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.852 -0.541 -0.010  0.460  3.562

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.450    0.671
 Residual             0.386    0.622
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                            Estimate Std. Error t value
(Intercept)                                   0.8697     0.2662    3.27
Age_Groups31-40                               0.0189     0.1833    0.10
Age_Groups41-50                               0.1958     0.2006    0.98
Age_Groups51+                                 0.3011     0.2303    1.31
Ethnic_CodeHispanic/Latino                    0.3985     0.1914    2.08
Ethnic_CodeOther                             -0.4044     0.1961   -2.06
Education_collapsedSome college              -0.0567     0.1753   -0.32
Education_collapsedCollege or technical degree  0.0324     0.1926    0.17
Education_collapsedGraduate degree           -0.5313     0.2554   -2.08
Prior_RshpEducation_collapsedSome/A lot      -0.2140     0.1421   -1.51
FinancialWorry_catOften                       0.0227     0.2013    0.11
FinancialWorry_catAlmost all the time         0.0846     0.1865    0.45
DosageFull                                    0.5527     0.1399    3.95
GenderFemale                                  0.2056     0.1820    1.13
Divorced_DichotomousDivorced                  0.1055     0.1444    0.73
varPartner_Selection_Change                   0.4083     0.0776    5.26
varPast_Rel_Behav_Change                     -0.1415     0.0784   -1.80
varRel_Behav_Attit_Change                    -0.2868     0.0784   -3.66
```

2.4.3 Model Comparison: Testing whether the Addition of all Predictors Improves Model Fit

- Dosage is collaped to two categories.
- Age is continuous.

```
Data: PICK_clean_long
Models:
mlm.change.no.preds.ML: Change.Score ~ var + (1 | ID)
mlm.change.3.ML: Change.Score ~ Age_Decades + Ethnic_Code + Education_collapsed +
mlm.change.3.ML:     +Prior_RshpEducation_collapsed + FinancialWorry_cat + Dosage +
mlm.change.3.ML:     Gender + Divorced_Dichotomous + var + (1 | ID)
                       Df    AIC    BIC  logLik deviance  Chisq Chi Df
mlm.change.no.preds.ML  6 1225.0 1250.3 -606.48   1213.0
mlm.change.3.ML        18 1215.3 1291.4 -589.65   1179.3 33.659     12
                       Pr(>Chisq)
mlm.change.no.preds.ML
mlm.change.3.ML         0.0007634 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The addition of all predictors significantly improved model fit ($\chi^2 = 33.66$, $df = 12$, $p = .001$).

2.4.4 Testing Main Effects

2.4.4.1 Testing Significance of Main Effects

2.4.4.1.1 Age (Continuous)

Age (continuous) was not a significant predictor of change ($\chi^2 = 0.92$, $df = 1$, $p = .337$).

2.4.4.1.2 Age (Categorical)

Age (categorical) was not a significant predictor of change ($\chi^2 = 2.36$, $df = 3$, $p = .502$).

2.4.4.1.3 Race/Ethnicity

Race/Ethnicity was a significant predictor of change ($\chi^2 = 10.16$, $df = 2$, $p = .006$).

Pairwise Comparisons of Mean Change Scores by Race/Ethnicity

```
 Ethnic_Code        emmean        SE     df  lower.CL upper.CL .group
 Other           0.7904227 0.2022922 142.85 0.3905497 1.190296  1
 Caucasian       1.1873499 0.1082775 142.84 0.9733166 1.401383  12
 Hispanic/Latino 1.5821599 0.1921802 144.27 1.2023071 1.962013   2

Results are averaged over the levels of: Education_collapsed, Prior_RshpEducation_collapsed, Fi
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 3 estimates
significance level used: alpha = 0.05
```

Only "Hispanic/Latino" and "Other" are significantly different.

2.4.4.1.4 Education

Education was not a significant predictor of change ($\chi^2 = 5.09$, $df = 3$, $p = .165$).

2.4.4.1.5 Prior Relationship Education

Prior Relationship Education was a significant predictor of change ($\chi^2 = 2.17$, $df = 1$, $p = .140$).

2.4.4.1.6 Financial Worry

Financial worry was not a significant predictor of change ($\chi^2 = 0.21$, $df = 2$, $p = .899$).

2.4.4.1.7 Dosage

Dosage was a significant predictor of change ($\chi^2 = 13.92$, $df = 1$, $p < .001$).

2.4.4.1.8 Gender

Gender worry was not a significant predictor of change ($\chi^2 = 1.13$, $df = 1$, $p = .287$).

2.4.4.1.9 Divorce history

Divorce history worry was not a significant predictor of change ($\chi^2 = 0.69$, $df = 1$, $p = .408$).

2.4.4.2 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates

- Ask Sarah for reference: kenward-roger (p.34 text)
- Any pair that does not share a Group Number is significantly different (see http://www.tandfonline.com/doi/pdf/10.1198/1061860043515)

```
 var                          emmean        SE     df  lower.CL upper.CL
 Rel_Behav_Attit_Change    0.9045816 0.1245103 203.73 0.6590875 1.150076
 Past_Rel_Behav_Change     1.0499149 0.1245103 203.73 0.8044209 1.295409
 Healthy_Rel_Skills_Change 1.1918877 0.1240923 201.36 0.9472006 1.436575
 Partner_Selection_Change  1.6001924 0.1239198 200.31 1.3558378 1.844547
 .group
  1
  12
   2
    3

Results are averaged over the levels of: Ethnic_Code, Education_collapsed, Prior_RshpEducation_
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 4 estimates
significance level used: alpha = 0.05
```

2.4.5 Final Model Estimates

2.4.5.1 Refitting Final Model with REML

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ Age_Decades + Ethnic_Code + Education_collapsed +
    +Prior_RshpEducation_collapsed + FinancialWorry_cat + Dosage +
    Gender + Divorced_Dichotomous + var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1215.3   1291.4   -589.7   1179.3      489

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.869 -0.547 -0.012  0.458  3.562

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.456    0.676
 Residual             0.386    0.622
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                            Estimate Std. Error t value
(Intercept)                                   0.7224     0.3339    2.16
Age_Decades                                   0.0667     0.0694    0.96
Ethnic_CodeHispanic/Latino                    0.3948     0.1928    2.05
Ethnic_CodeOther                             -0.3969     0.1974   -2.01
Education_collapsedSome college              -0.0517     0.1753   -0.30
Education_collapsedCollege or technical degree  0.0465     0.1872    0.25
Education_collapsedGraduate degree           -0.5096     0.2586   -1.97
Prior_RshpEducation_collapsedSome/A lot      -0.2115     0.1429   -1.48
FinancialWorry_catOften                       0.0254     0.1982    0.13
FinancialWorry_catAlmost all the time         0.0762     0.1851    0.41
DosageFull                                    0.5376     0.1402    3.84
GenderFemale                                  0.1924     0.1801    1.07
Divorced_DichotomousDivorced                  0.1232     0.1486    0.83
varPartner_Selection_Change                   0.4083     0.0776    5.26
varPast_Rel_Behav_Change                     -0.1420     0.0784   -1.81
varRel_Behav_Attit_Change                    -0.2873     0.0784   -3.66
```

2.4.5.1.1 Table

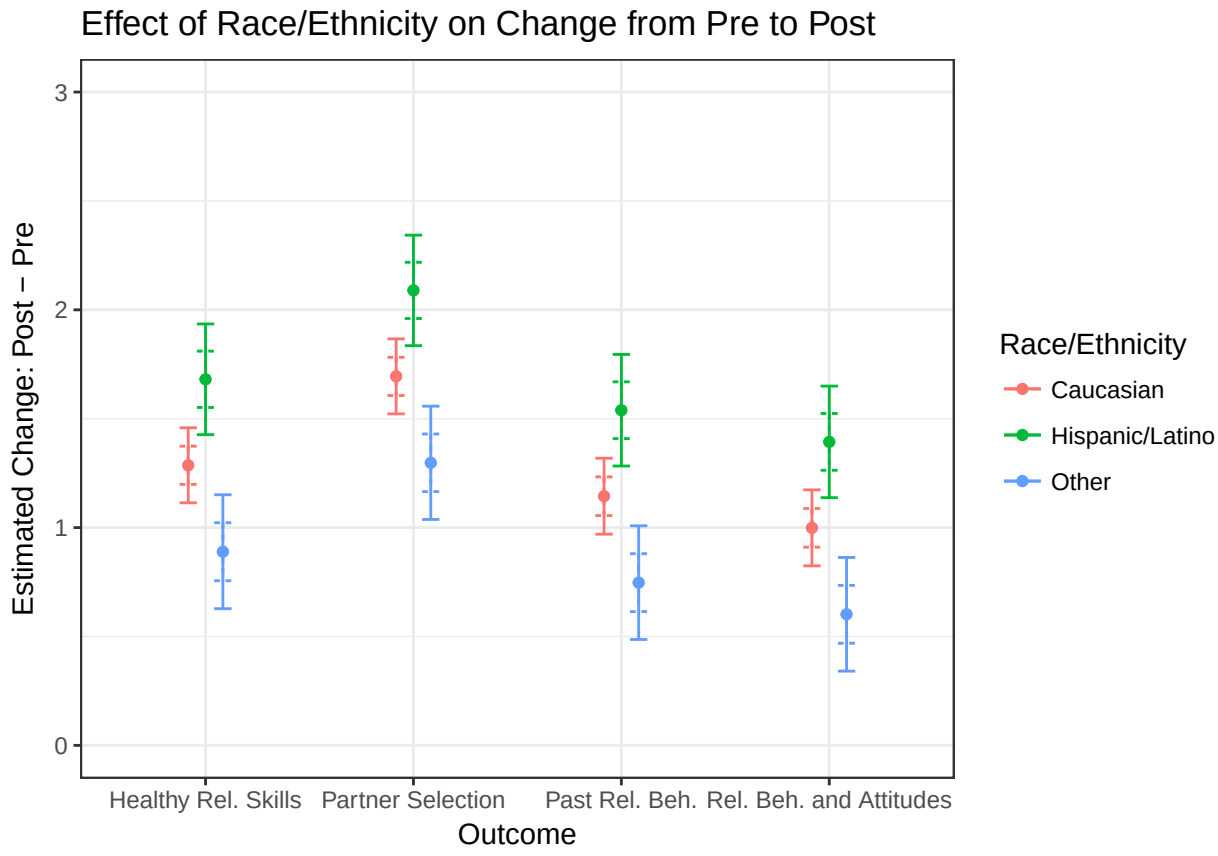
	Model 1	Model 2	Model 3
(Intercept)	1.29 ***	0.72 *	0.72 *
	(0.09)	(0.33)	(0.33)
varPartner_Selection_Change	0.41 ***	0.41 ***	0.41 ***
	(0.08)	(0.08)	(0.08)
varPast_Rel_Behav_Change	-0.14	-0.14	-0.14
	(0.08)	(0.08)	(0.08)
varRel_Behav_Attit_Change	-0.29 ***	-0.29 ***	-0.29 ***
	(0.08)	(0.08)	(0.08)
Age_Decades		0.07	0.07
		(0.07)	(0.07)
Ethnic_CodeHispanic/Latino		0.39 *	0.39 *
		(0.19)	(0.19)
Ethnic_CodeOther		-0.40 *	-0.40 *
		(0.20)	(0.20)
Education_collapsedSome college		-0.05	-0.05
		(0.18)	(0.18)
Education_collapsedCollege or technical degree		0.05	0.05
		(0.19)	(0.19)
Education_collapsedGraduate degree		-0.51 *	-0.51 *
		(0.26)	(0.26)
Prior_RshpEducation_collapsedSome/A lot		-0.21	-0.21
		(0.14)	(0.14)
FinancialWorry_catOften		0.03	0.03
		(0.20)	(0.20)
FinancialWorry_catAlmost all the time		0.08	0.08
		(0.19)	(0.19)
DosageFull		0.54 ***	0.54 ***
		(0.14)	(0.14)
GenderFemale		0.19	0.19
		(0.18)	(0.18)
Divorced_DichotomousDivorced		0.12	0.12
		(0.15)	(0.15)
AIC	1224.96	1215.31	1215.31
BIC	1250.34	1291.42	1291.42
Log Likelihood	-606.48	-589.65	-589.65
Num. obs.	507	507	507
Num. groups: ID	129	129	129
Var: ID (Intercept)	0.62	0.46	0.46
Var: Residual	0.39	0.39	0.39

*** p < 0.001, ** p < 0.01, * p < 0.05

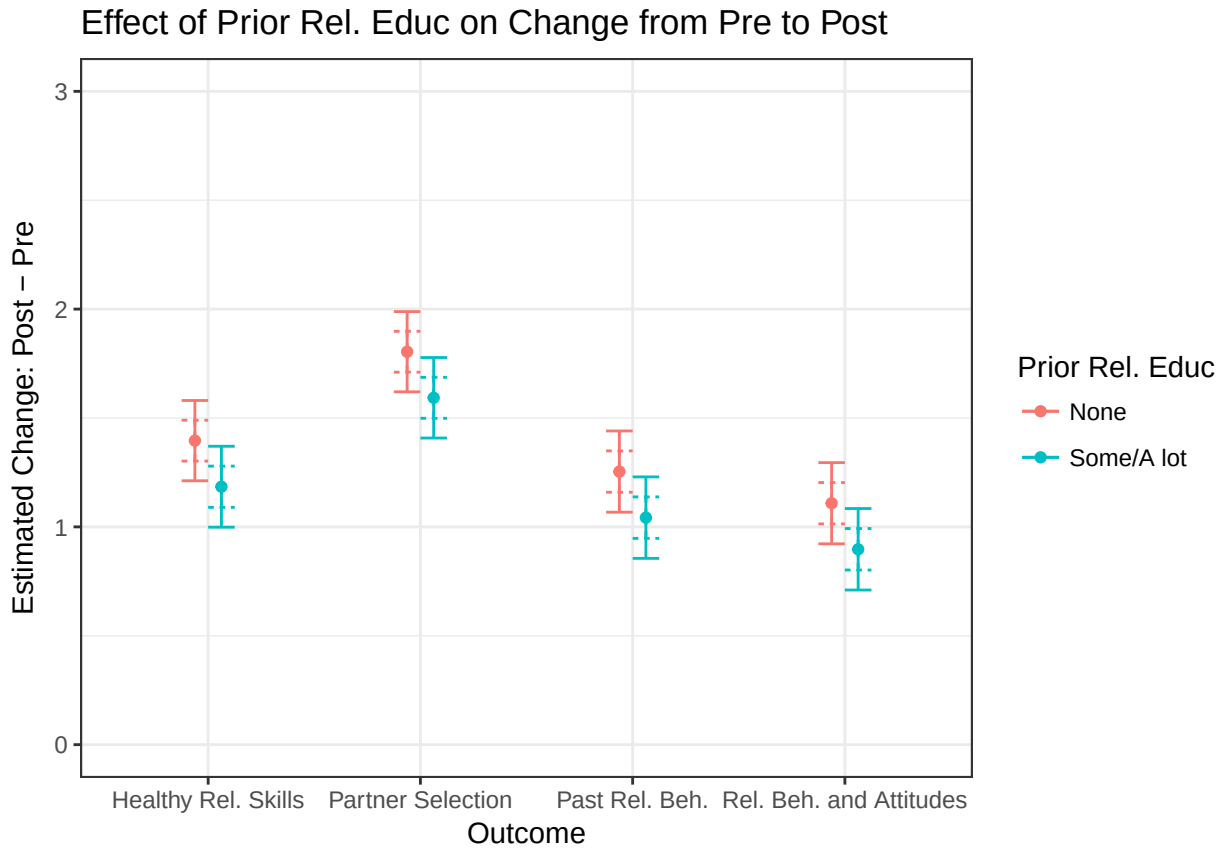
2.4.5.2 Plotting the Effect of Predictors

- Should this be based on REML or ML?

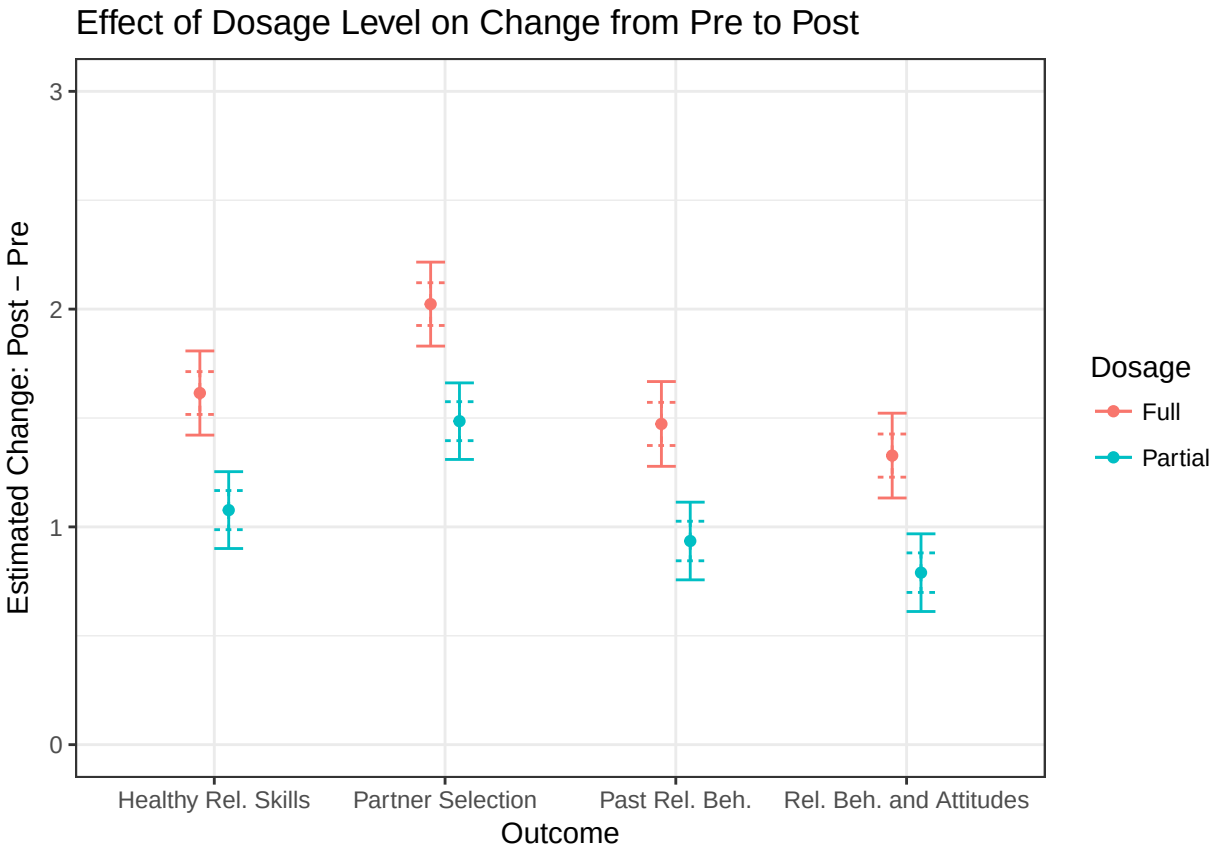
2.4.5.2.1 Race/Ethnicity



2.4.5.2.2 Prior Relationship Education



2.4.5.2.3 Dosage



2.5 Trimming Non-Significant Predictors

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Change.Score ~ Ethnic_Code + Prior_RshpEducation_collapsed +
    Dosage + var + (1 | ID)
   Data: PICK_clean_long

     AIC      BIC   logLik deviance df.resid
  1208.9   1251.1   -594.4   1188.9      497

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.872 -0.526  0.003  0.467  3.536

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.500    0.707
 Residual             0.386    0.621
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                       Estimate Std. Error t value
(Intercept)                              1.2515     0.1415    8.84
Ethnic_CodeHispanic/Latino               0.3452     0.1905    1.81
Ethnic_CodeOther                        -0.3540     0.2005   -1.77
Prior_RshpEducation_collapsedSome/A lot -0.3097     0.1400   -2.21
DosageFull                               0.4762     0.1414    3.37
varPartner_Selection_Change              0.4088     0.0776    5.27
varPast_Rel_Behav_Change                -0.1415     0.0784   -1.80
varRel_Behav_Attit_Change               -0.2868     0.0784   -3.66

Correlation of Fixed Effects:
            (Intr) E_CH/L Eth_CO P_RE_l DsgFll vP_S_C vP_R_B
Ethnc_CdH/L -0.370
Ethnc_CdOth -0.401  0.213
Prr_RE_S/Al -0.602  0.145  0.187
DosageFull  -0.497  0.091  0.142  0.106
vrPrtnr_S_C -0.274  0.000 -0.004 -0.002  0.001
vrPst_R_B_C -0.269  0.001 -0.007 -0.002 -0.002  0.497
vrRl_Bh_A_C -0.269  0.001 -0.007 -0.002 -0.002  0.497  0.498
```

2.5.1 Model Comparison: Testing whether the Removal of Non-Significan Predictors Affects Model Fit

The addition of all predictors significantly improved model fit ($\chi^2 = 9.56$, $df = 8$, $p = .297$).

2.5.2 Testing Main Effects

2.5.2.1 Race/Ethnicity

Race/Ethnicity was not quite a significant predictor of change ($\chi^2 = 7.89$, $df = 2$, $p = .019$).

2.5.2.1.1 Pairwise Comparisons of Mean Change Scores by Race/Ethnicity

Ethnic_Code	emmean	SE	df	lower.CL	upper.CL	.group
Other	0.9759046	0.1865151	133.80	0.6070053	1.344804	1
Caucasian	1.3298837	0.0845213	134.11	1.1627165	1.497051	12
Hispanic/Latino	1.6751067	0.1751841	134.56	1.3286361	2.021577	2

```
Results are averaged over the levels of: Prior_RshpEducation_collapsed, Dosage, var
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 3 estimates
significance level used: alpha = 0.05
```

No significant differences. Because it was significant in the larger model, we should report the larger model (or an abreviated versions of it) rather than the trimmed model).

2.5.2.2 Prior Relationship Education

Prior Relationship Education was a significant predictor of change ($\chi^2 = 4.81$, $df = 1$, $p = .028$).

2.5.2.3 Dosage

Prior Relationship Education was a significant predictor of change ($\chi^2 = 10.86$, $df = 1$, $p = .001$).

2.5.2.4 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates

```
 var                          emmean        SE     df  lower.CL upper.CL
 Rel_Behav_Attit_Change    1.045035 0.1037346 216.22 0.8405745 1.249496
 Past_Rel_Behav_Change     1.190368 0.1037346 216.22 0.9859079 1.394829
 Healthy_Rel_Skills_Change 1.331833 0.1034414 214.32 1.1279406 1.535726
 Partner_Selection_Change  1.740623 0.1031967 212.61 1.5372035 1.944043
 .group
  1
  12
   2
    3

Results are averaged over the levels of: Ethnic_Code, Prior_RshpEducation_collapsed, Dosage
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 4 estimates
significance level used: alpha = 0.05
```

2.5.3 Trimmed Model Estimates

2.5.3.1 Refitting Trimmed Model with REML

```
Linear mixed model fit by REML ['lmerMod']
Formula: Change.Score ~ Ethnic_Code + Prior_RshpEducation_collapsed +
    Dosage + var + (1 | ID)
   Data: PICK_clean_long

REML criterion at convergence: 1209.9

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.844 -0.525  0.005  0.466  3.527

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.523    0.723
 Residual             0.389    0.624
Number of obs: 507, groups:  ID, 129

Fixed effects:
                                     Estimate Std. Error t value
(Intercept)                            1.2516     0.1441    8.69
Ethnic_CodeHispanic/Latino             0.3453     0.1943    1.78
Ethnic_CodeOther                      -0.3540     0.2045   -1.73
Prior_RshpEducation_collapsedSome/A lot -0.3098     0.1428   -2.17
DosageFull                             0.4761     0.1442    3.30
varPartner_Selection_Change            0.4088     0.0779    5.25
varPast_Rel_Behav_Change              -0.1415     0.0787   -1.80
varRel_Behav_Attit_Change             -0.2868     0.0787   -3.64

Correlation of Fixed Effects:
            (Intr) E_CH/L Eth_CO P_RE_l DsgFll vP_S_C vP_R_B
Ethnc_CdH/L -0.371
Ethnc_CdOth -0.402  0.213
Prr_RE_S/Al -0.603  0.145  0.187
DosageFull  -0.498  0.091  0.142  0.106
vrPrtnr_S_C -0.270  0.000 -0.003 -0.002  0.001
vrPst_R_B_C -0.265  0.001 -0.007 -0.002 -0.002  0.497
vrRl_Bh_A_C -0.265  0.001 -0.007 -0.002 -0.002  0.497  0.498
```

2.5.3.1.1 Table

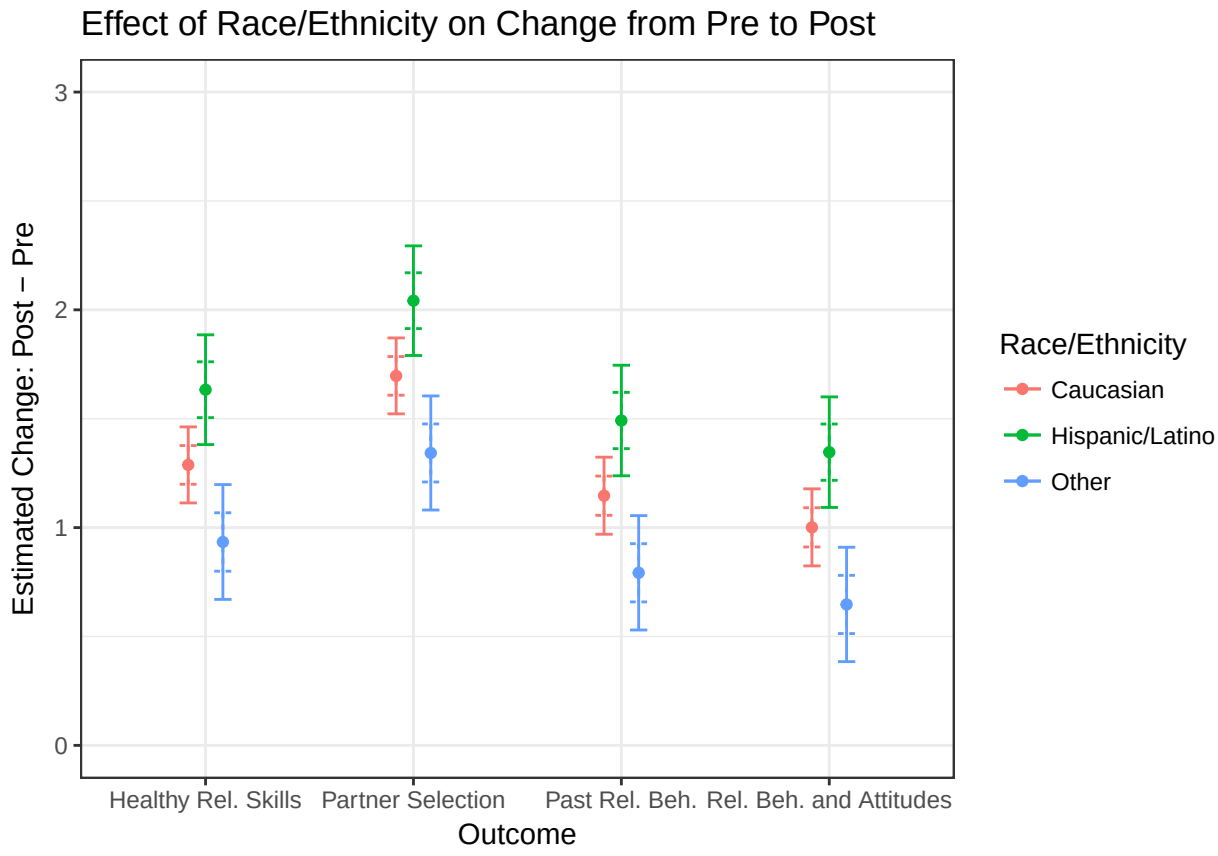
	Model 1	Model 2	Model 3	Model 4
(Intercept)	1.29 ***	1.29 ***	1.25 ***	1.25 ***
	(0.07)	(0.09)	(0.14)	(0.14)
varPartner_Selection_Change		0.41 ***	0.41 ***	0.41 ***
		(0.08)	(0.08)	(0.08)
varPast_Rel_Behav_Change		-0.14	-0.14	-0.14
		(0.08)	(0.08)	(0.08)
varRel_Behav_Attit_Change		-0.29 ***	-0.29 ***	-0.29 ***
		(0.08)	(0.08)	(0.08)
Ethnic_CodeHispanic/Latino			0.35	0.35
			(0.19)	(0.19)
Ethnic_CodeOther			-0.35	-0.35
			(0.20)	(0.20)
Prior_RshpEducation_collapsedSome/A lot			-0.31 *	-0.31 *
			(0.14)	(0.14)
DosageFull			0.48 ***	0.48 ***
			(0.14)	(0.14)
AIC	1298.34	1224.96	1208.86	1229.90
BIC	1311.03	1250.34	1251.15	1272.19
Log Likelihood	-646.17	-606.48	-594.43	-604.95
Num. obs.	507	507	507	507
Num. groups: ID	129	129	129	129
Var: ID (Intercept)	0.60	0.62	0.50	0.52
Var: Residual	0.48	0.39	0.39	0.39

*** p < 0.001, ** p < 0.01, * p < 0.05

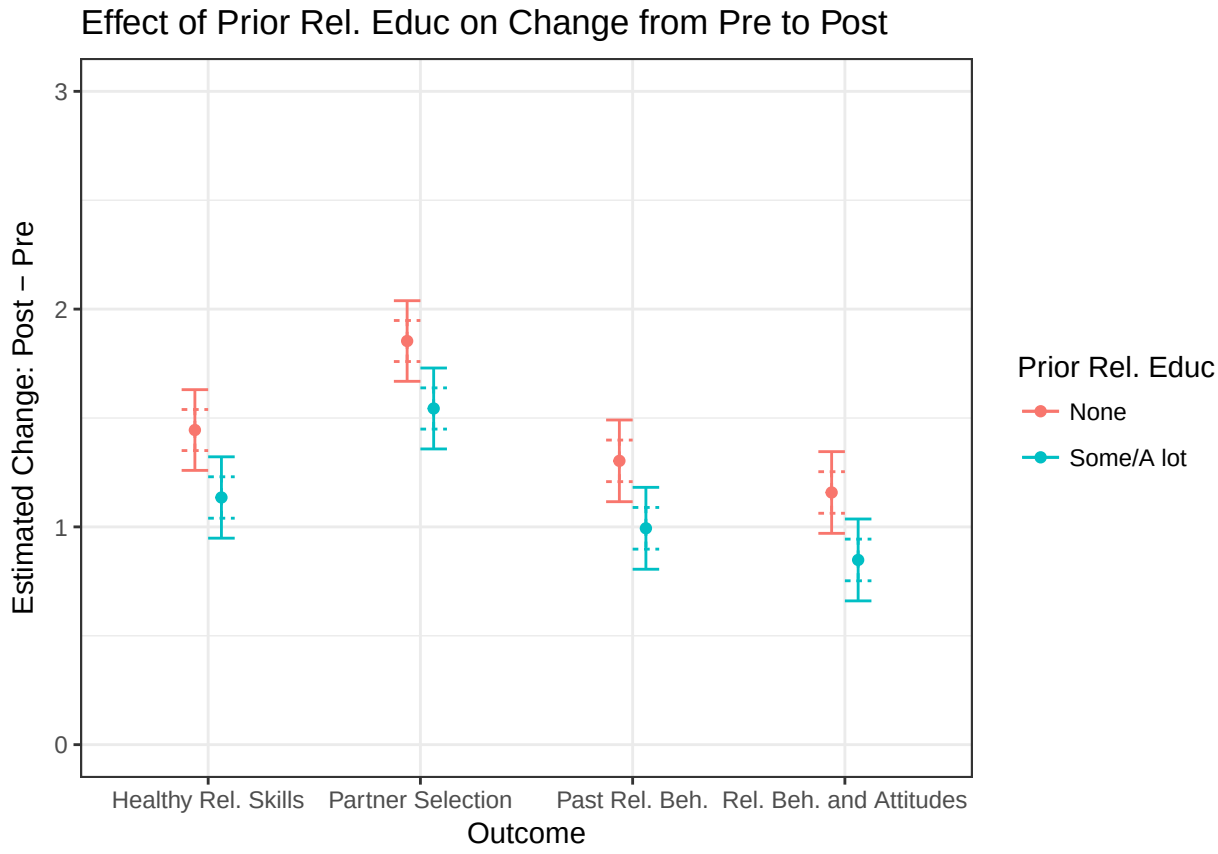
2.5.3.2 Plotting the Effect of Predictors

- Should this be based on REML or ML?

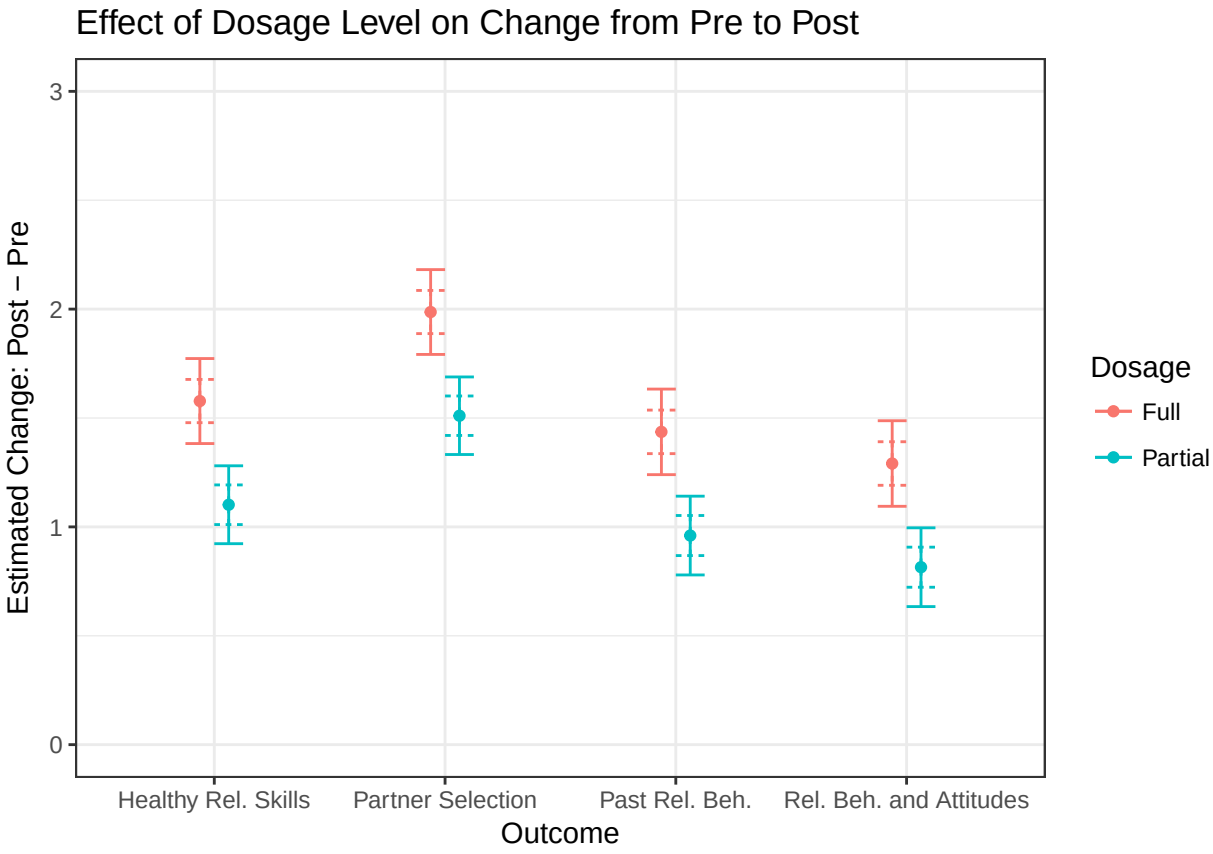
2.5.3.2.1 Race/Ethnicity



2.5.3.2.2 Prior Relationship Education



2.5.3.2.3 Dosage



2.6 Fitting Trimmed Model on All Available Data (i.e., using individuals droped because of missing data only on non-significant predictors)

2.6.1 Model Building and Comparison

The effect of outcome level was significant ($\chi^2 = 99.94$, $df = 3$, $p < .001$), indicating that at least one outcome had a significantly higher change score than another.

The addition of predictors significantly improved model fit ($\chi^2 = 31.18$, $df = 4$, $p < .001$).

2.6.2 Testing Individual Main Effects

2.6.2.1 Race/Ethnicity

Race/Ethnicity was a significant predictor of change ($\chi^2 = 14.44$, $df = 2$, $p = .001$).

2.6.2.1.1 Pairwise Comparisons of Mean Change Scores by Race/Ethnicity

```
 Ethnic_Code        emmean         SE     df  lower.CL upper.CL .group
 Other           0.8807864 0.17219081 161.91 0.5407571 1.220816  1
 Caucasian       1.2799252 0.07576034 163.03 1.1303271 1.429523  1
 Hispanic/Latino 1.7417726 0.15577049 162.59 1.4341786 2.049367   2

Results are averaged over the levels of: Prior_RshpEducation_collapsed, Dosage, var
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 3 estimates
significance level used: alpha = 0.05
```

Hispanic/Latino significantly diffrent from both Caucasian and Other.

2.6.2.2 Prior Relationship Education

Prior Relationship Education was a significant predictor of change ($\chi^2 = 7.90$, $df = 1$, $p = .005$).

2.6.2.3 Dosage

Prior Relationship Education was a significant predictor of change ($\chi^2 = 9.57$, $df = 1$, $p = .002$).

2.6.2.4 Pairwise Comparisons of Mean Change Scores by Outcome Level After Controlling for Covariates with All Available Data

```
var                          emmean         SE     df  lower.CL upper.CL
Rel_Behav_Attit_Change    0.9912199 0.09400084 265.48 0.8061379 1.176302
Past_Rel_Behav_Change     1.1584675 0.09408173 266.23 0.9732286 1.343706
Healthy_Rel_Skills_Change 1.3340745 0.09386301 264.35 1.1492603 1.518889
Partner_Selection_Change  1.7195502 0.09366447 262.49 1.5351209 1.903980
.group
 1
 12
  2
   3

Results are averaged over the levels of: Ethnic_Code, Prior_RshpEducation_collapsed, Dosage
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
P value adjustment: tukey method for comparing a family of 4 estimates
significance level used: alpha = 0.05
```

2.6.3 Trimmed Model Estimates on All Available Data

2.6.3.1 Refitting Trimmed Model with REML

```
Linear mixed model fit by REML ['lmerMod']
Formula: Change.Score ~ Ethnic_Code + Prior_RshpEducation_collapsed +
    Dosage + var + (1 | ID)
   Data: PICK_clean_long2

REML criterion at convergence: 1484.6

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.804 -0.522 -0.009  0.478  3.452

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.509    0.714
 Residual             0.404    0.636
Number of obs: 616, groups:  ID, 158

Fixed effects:
                                       Estimate Std. Error t value
(Intercept)                              1.2950     0.1305    9.93
Ethnic_CodeHispanic/Latino               0.4619     0.1734    2.66
Ethnic_CodeOther                        -0.3991     0.1888   -2.11
Prior_RshpEducation_collapsedSome/A lot -0.3606     0.1288   -2.80
DosageFull                               0.3969     0.1284    3.09
varPartner_Selection_Change              0.3855     0.0721    5.34
varPast_Rel_Behav_Change                -0.1757     0.0729   -2.41
varRel_Behav_Attit_Change               -0.3429     0.0728   -4.71

Correlation of Fixed Effects:
            (Intr) E_CH/L Eth_CO P_RE_l DsgFll vP_S_C vP_R_B
Ethnc_CdH/L -0.373
Ethnc_CdOth -0.410  0.213
Prr_RE_S/Al -0.603  0.153  0.220
DosageFull  -0.480  0.084  0.133  0.070
vrPrtnr_S_C -0.276  0.000 -0.003 -0.002  0.001
vrPst_R_B_C -0.273  0.001 -0.006 -0.003 -0.001  0.497
vrRl_Bh_A_C -0.274  0.001 -0.005 -0.004  0.000  0.498  0.500
```

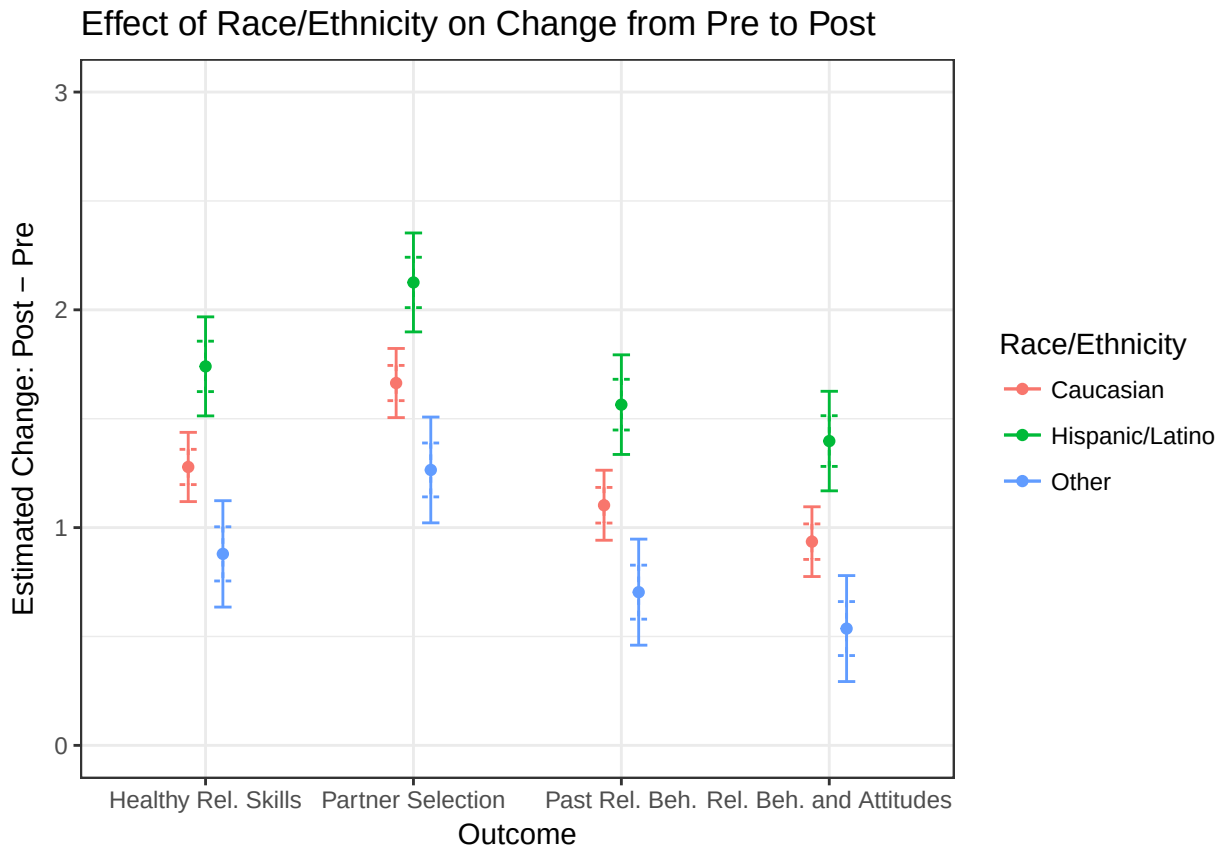
	Model 1	Model 2	Model 3	Model 4
(Intercept)	1.27 ***	1.30 ***	1.30 ***	1.30 ***
	(0.07)	(0.08)	(0.13)	(0.13)
varPartner_Selection_Change		0.38 ***	0.39 ***	0.39 ***
		(0.07)	(0.07)	(0.07)
varPast_Rel_Behav_Change		-0.18 *	-0.18 *	-0.18 *
		(0.07)	(0.07)	(0.07)
varRel_Behav_Attit_Change		-0.35 ***	-0.34 ***	-0.34 ***
		(0.07)	(0.07)	(0.07)
Ethnic_CodeHispanic/Latino			0.46 **	0.46 **
			(0.17)	(0.17)
Ethnic_CodeOther			-0.40 *	-0.40 *
			(0.19)	(0.19)
Prior_RshpEducation_collapsedSome/A lot			-0.36 **	-0.36 **
			(0.13)	(0.13)
DosageFull			0.40 **	0.40 **
			(0.13)	(0.13)
AIC	1599.23	1505.29	1482.10	1504.64
BIC	1612.50	1531.83	1526.34	1548.87
Log Likelihood	-796.61	-746.64	-731.05	-742.32
Num. obs.	616	616	616	616
Num. groups: ID	158	158	158	158
Var: ID (Intercept)	0.59	0.62	0.49	0.51
Var: Residual	0.50	0.40	0.40	0.40

*** p < 0.001, ** p < 0.01, * p < 0.05

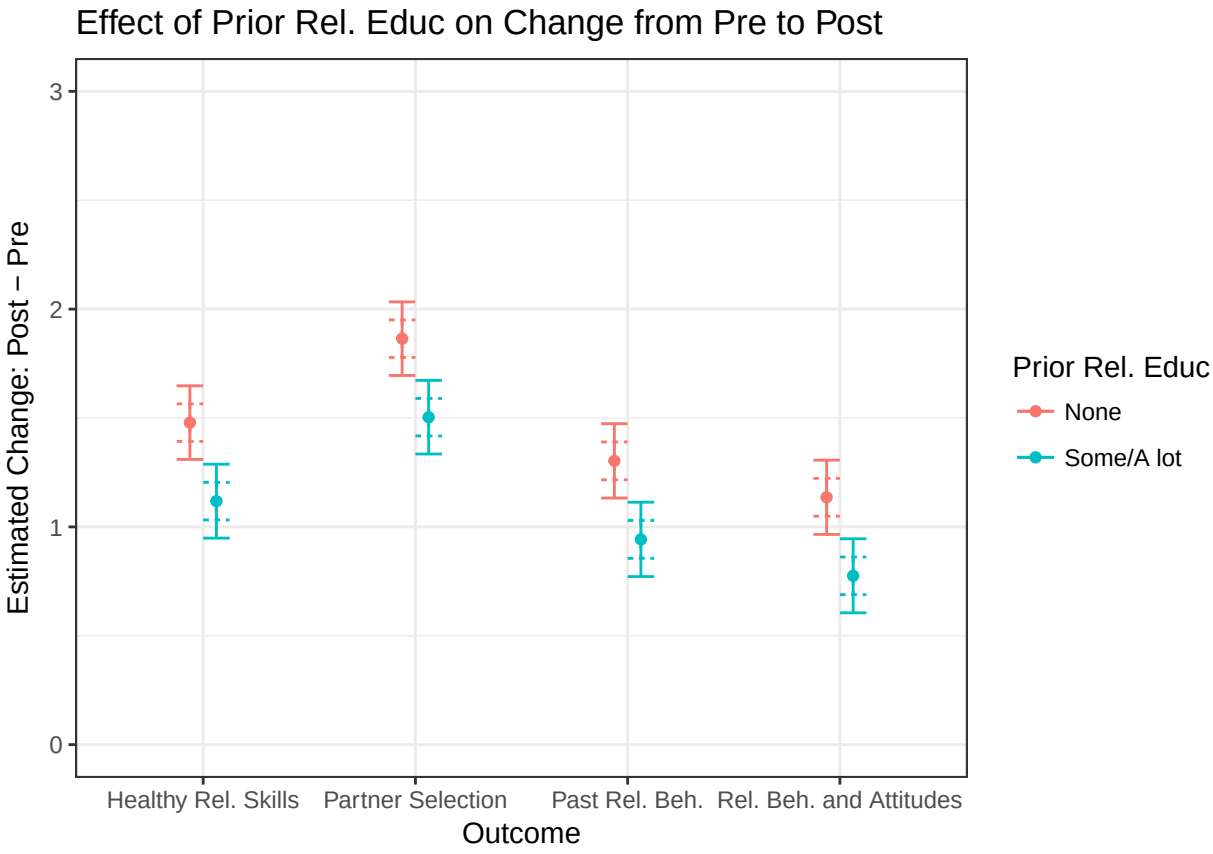
2.6.3.2 Plotting the Effect of Predictors

- Should this be based on REML or ML?

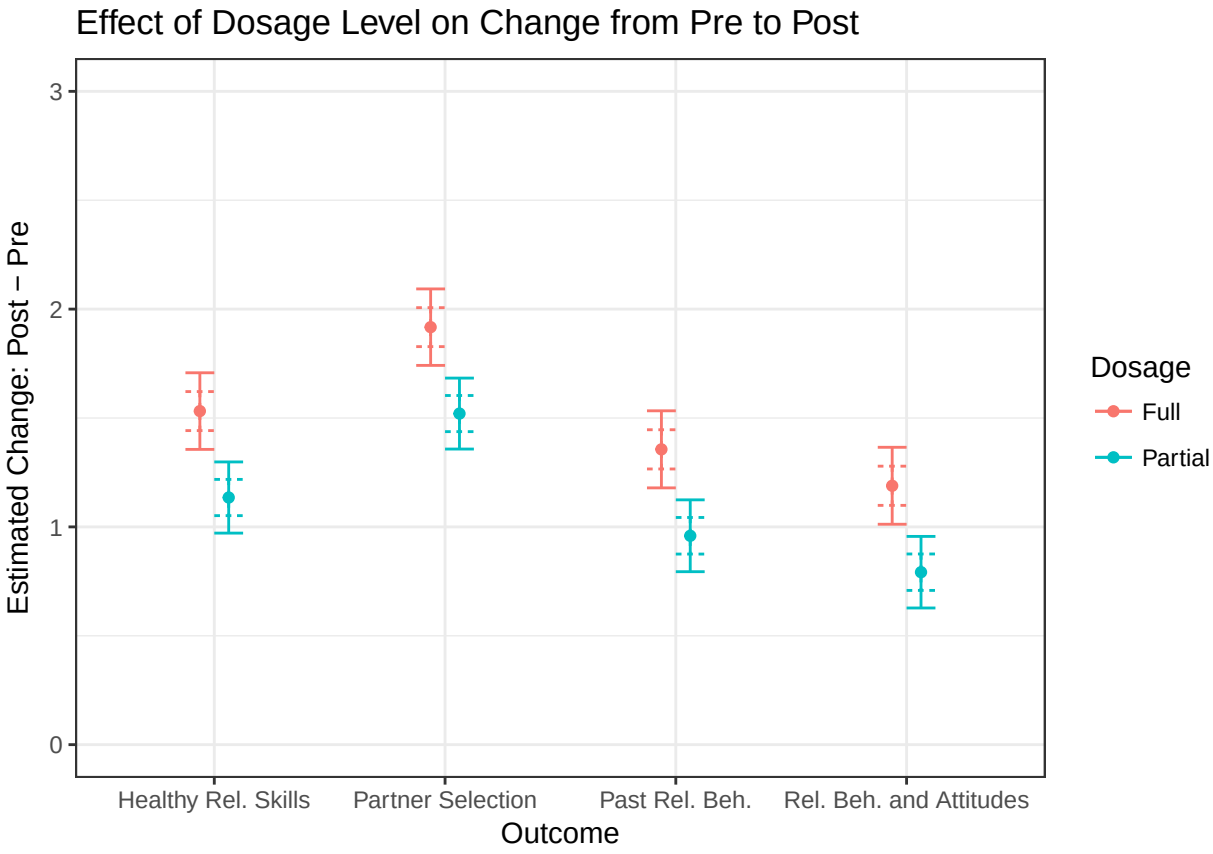
2.6.3.2.1 Race/Ethnicity



2.6.3.2.2 Prior Relationship Education



2.6.3.2.3 Dosage



3 Textual Summary

3.1 Methods (using results from full model; will need to edit if using trimmed model)

To examine the impact of the program quantitatively, we looked at gains (post – pre) on the four key outcomes (Skills, Partner Selection, Relationship Patterns, Behavior and Attitudes) described above. First, we tested whether the average gain across all four outcomes was significant. As the assumption of sphericity was violated, we used a linear mixed effects model instead of a repeated measures MANOVA. Specifically, we used a random intercept multilevel regression model (RI MLM). We then tested whether change differed by outcome. We then examined whether change varied by age, ethnicity, prior relationship education, the number of classes attended (dosage), education level, financial worry, income, gender, and divorce history. Full details and results of quantitative analyses are available upon request.

3.1.1 Notes on Methods Section

- Add short descriptors to the factor descriptions used below to the measurement section.

3.2 Results

Analyses using multilevel regression (RI MLM) indicated that, on average, participants reported gains in knowledge and skills ($\beta = 1.29$, $df = 1$, $t = 17.23$). The amount of change reported by participants varied by outcome (Skills, $\beta = 0.72$; Partner Selection, $\beta = 1.13$; Relationship Patterns, $\beta = 0.58$; and Behavior and Attitudes, $\beta = 0.44$;), but was significantly greater than 0 for all outcomes even after controlling for age, ethnicity, prior relationship education, the number of classes attended (dosage), education level, financial worry, income, gender, and divorce history.

Our analyses also tested for predictors of change The amount of change reported by participants varied by race/ethnicity, prior experience with relationship education, and dosage. Although the addition of race/ethnicity indicators to the model significantly improved model fit, post-hoc analyses (available on request) indicated that individuals who identified as Hispanic/Latino gained significantly more on average than individuals who identified with a race in the "Another race" category; no other group comparisons were significant. Participants who had previously received relationship education through courses, counseling, workshops, etc. gained less than those who had not (β = -0.21). Participants who participated in all 3 classes gained more than those who participated in only 1 or 2 ($\beta = 0.54$).

3.2.1 Notes on Results Section

- Can we get a p-value for average gains?
- Can we get p-values on comparisons using kenward-roger method? For dichtomous, would the anova p-values be appropriate? What about betas for race/ethnicity?
- Which betas should we report? Don't match table currently.
- How do we get effect sizes?
- Make sure methods section says "Another race" rather than "Other"