PICK Pilot Mixed Methods Evaluation

Revised Quantitative Analyses and Results: Dropping Non-Significant Predictors

18 July 2018

Contents

1 Revised MLM Analyses

1.1 Analytic Plan

- Step 1: Test whether Time (i.e., Post Assessment compared to Retrospective Pre-Program Assessment) has a significant effect on the 4 outcomes (tested simultaneously) even after controlling for demographic covariates.
  - Compare
    - Model 1 with only demographic variables.
    - Model 2 with demographic variables and Time
- Step 2: If Step 1 is significant, test whether the effect of time varies significantly by outcome (controlling for demographic covariates).
  - Compare
    - Model 3 with demographic variables, Time, and Outcome Level
    - Model 4 with demographic variables, Time, Outcome Level, and an interaction between Time and Outcome Level.
- Step 3: Test whether the effect of Time varies by Dosage and Prior Exposure to relationship education. * Model 5 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, and Dosage and Prior Exposure * Model 6 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, Dosage and Prior Exposure,and an interaction between Time and Dosage and Time and Prior Exposure.
- Step 4: Test whether the effect of Time varies by demographic variables using a Bonferroni correction.
  - Model 6 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, and, finally, Dosage and Exposure and their respective interactions with Time.
  - Model 7.X with all predictors from Model 6 and an interaction between Time and a given demographic covariate.

1.2 Calculating ICC

- If ICC is low enough, multilevel modeling is not needed.

1.2.1 Variance Between Respondents at Retrospective Pre-Assessment

- Indicates how much variance in retrospective pre-scores is between respondents vs. within respondents (i.e., across outcomes). About a quarter of the variance is between respondents. So retrospective pre-scores vary both between respondents and within respondents (across outcomes).

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

  ICC (ID): 0.287794
```

1.2.2 Variance Between Respondents *within domain (outcome level)* at Retrospective Pre-Assessment

- Indicates how much variance in retrospective pre-scores is between respondents vs. within respondents (i.e., across outcomes). About a quarter of the variance is between respondents. So retrospective pre-scores vary both between respondents and within respondents (across outcomes).

1.2.3 ICC in a Specific Domain

- Indicates how much variance in retrospective pre-scores is between respondents vs. within respondents within a specific domain (i.e., outcome). About a quarter of the variance is between respondents. So retrospective pre-scores vary both between respondents and within respondents.

```
Linear mixed model
 Family: gaussian (identity)
Formula: Score ~ Time * Domain + (1 | ID)

  ICC (ID): 0.312200
```

1.3 Step 1: Test whether Time (i.e., Post Assessment compared to Retrospective Pre-Program Assessment) has a significant effect on the 4 outcomes (tested simultaneously) even after controlling for demographic covariates.

- Compare
  - Model 0 with no predictors
  - Model 1 with only demographic variables.
  - Model 2 with demographic variables and Time

1.3.1 Model Comparison

1.3.1.1 Effect of Demographics

The effect of demographic covariates was not significant ($\chi^2 = 2.109$, $df = 2$, $p = .348$).

1.3.1.2 Effect of Time Controlling for Demographics

The effect of Time was significant ($\chi^2 = 753.075$, $df = 1$, $p < .001$), indicating that on average respondents increased in knowledge and skills.

1.4 Step 2: If Step 1 is significant, test whether the effect of time varies significantly by outcome (controlling for demographic covariates).

- Compare
  - Model 3 with demographic variables, Time, and Outcome Level
  - Model 4 with demographic variables, Time, Outcome Level, and an interaction between Time and Outcome Level.

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula: Score ~ Ethnic_Code + Time + Domain + Time:Domain + (1 | ID)
   Data: PICK_clean_longlong2

     AIC      BIC   logLik deviance df.resid
  1478.2   1537.6   -727.1   1454.2     1030

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9305 -0.6736 -0.0014  0.6683  2.9993

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0872   0.295
 Residual             0.1951   0.442
Number of obs: 1042, groups:  ID, 134

Fixed effects:
                                 Estimate Std. Error t value
(Intercept)                        3.4546     0.0504   68.49
Ethnic_CodeHispanic/Latino        -0.0150     0.0786   -0.19
Ethnic_CodeOther                  -0.1015     0.0831   -1.22
TimePost                           0.9833     0.0547   17.99
DomainPartner_Selection           -0.1329     0.0547   -2.43
DomainPast_Rel_Behav               0.1804     0.0552    3.27
DomainRel_Behav_Attit              0.3314     0.0551    6.02
TimePost:DomainPartner_Selection   0.2310     0.0772    2.99
TimePost:DomainPast_Rel_Behav     -0.0750     0.0776   -0.97
TimePost:DomainRel_Behav_Attit    -0.1371     0.0775   -1.77

Correlation of Fixed Effects:
            (Intr) E_CH/L Eth_CO TimPst DmnP_S DP_R_B DR_B_A TP:DP_S
Ethnc_CdH/L -0.312
Ethnc_CdOth -0.298  0.189
TimePost    -0.544  0.002  0.008
DmnPrtnr_Sl -0.541  0.000  0.004  0.499
DmnPst_Rl_B -0.536  0.001  0.002  0.495  0.494
DmnRl_Bhv_A -0.536  0.001 -0.002  0.495  0.494  0.492
TmPst:DmP_S  0.384  0.000 -0.005 -0.706 -0.709 -0.350 -0.350
```

```
TmPs:DP_R_B  0.383 -0.002 -0.006 -0.705 -0.352 -0.712 -0.351  0.498
TmPs:DR_B_A  0.381 -0.002  0.000 -0.704 -0.351 -0.350 -0.711  0.498
            TP:DP_R
Ethnc_CdH/L
Ethnc_CdOth
TimePost
DmnPrtnr_Sl
DmnPst_Rl_B
DmnRl_Bhv_A
TmPst:DmP_S
TmPs:DP_R_B
TmPs:DR_B_A  0.498
```

1.4.1 Model Comparison

1.4.1.1 Effect of Outcome Level

The effect of outcomes level was significant ($\chi^2 = 64.162$, $df = 3$, $p < .001$), indicating that the domains (averaged jointly across Retrospective Pre and Post) different significantly.

1.4.1.2 Effect of Time X Domain

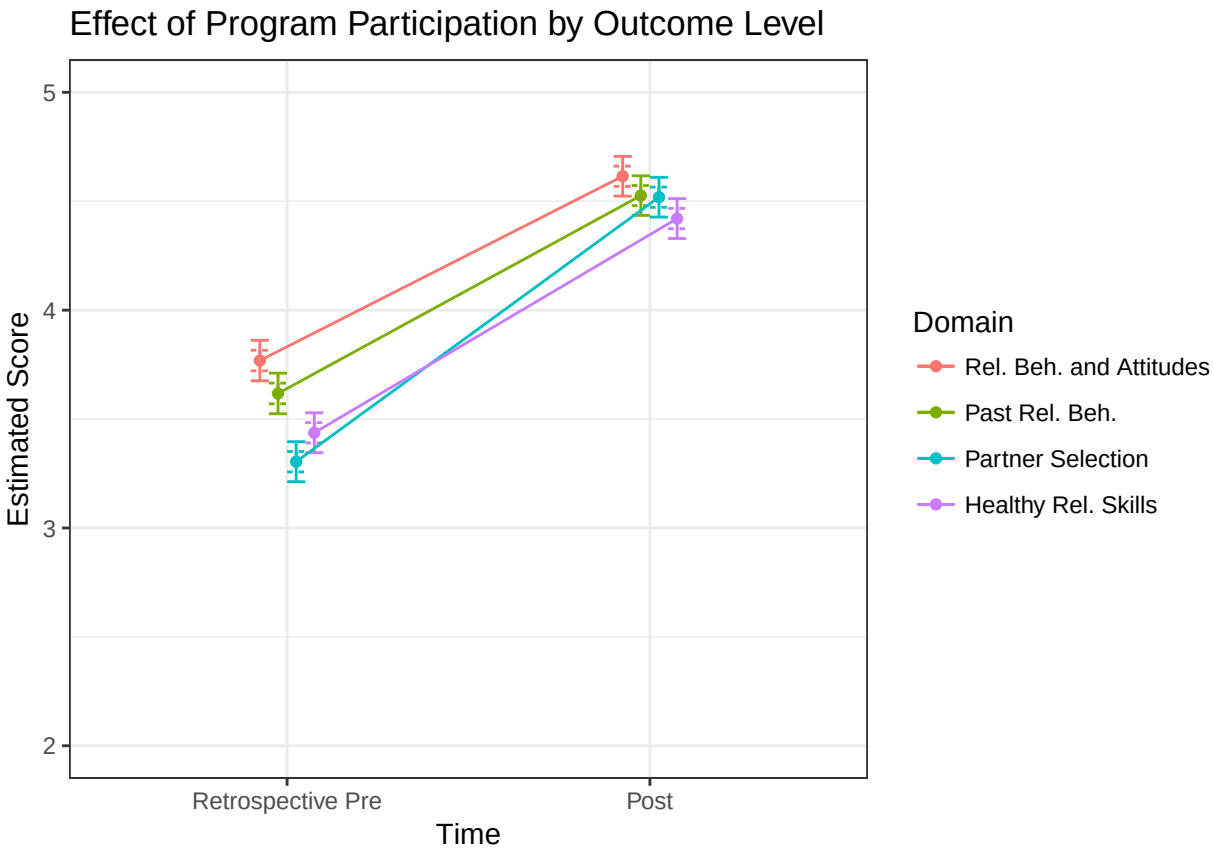
The effect of Time varied significantly by outcome level ($\chi^2 = 25.555$, $df = 3$, $p < .001$), indicating that the average effect of program participation varied by outcome.

1.4.1.3 Effect of Outcome Level and Time X Outcome Level

Accounting for outcome level and allowing the effect of time to vary by outcome level significantly improved model fit ($\chi^2 = 89.717$, $df = 6$, $p < .001$).

1.4.2 Plotting the Effect of Time X Outcome "Level"

- **Plot indicates a different pattern of significant differences at pre and post?**



1.4.3 Determining which Outcomes are Significantly Different at Each Timepoint

- Any pair that does not share a Group Number is significantly different (see http://www.tandfonline.com/doi/pdf/10.1198/1061860043515)
- The outcomes differ by question type: Agreement vs. Importance.

```
Time = RPre:
 Domain               emmean         SE     df lower.CL upper.CL .group
 Partner_Selection  3.396543 0.04608408 328.93 3.305886 3.487199  1
 Healthy_Rel_Skills 3.413049 0.04602152 328.06 3.322515 3.503584  1
 Past_Rel_Behav     3.554796 0.04622170 332.82 3.463872 3.645719   2
 Rel_Behav_Attit    3.674444 0.04618835 331.99 3.583585 3.765303    3

Time = Post:
 Domain               emmean         SE     df lower.CL upper.CL .group
 Partner_Selection  4.385391 0.04605579 328.69 4.294790 4.475993  1
 Healthy_Rel_Skills 4.401898 0.04605516 329.46 4.311299 4.492497  1
 Past_Rel_Behav     4.543644 0.04600669 328.28 4.453139 4.634150   2
 Rel_Behav_Attit    4.663293 0.04603875 329.08 4.572725 4.753860    3

Results are averaged over the levels of: Ethnic_Code
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
```

1.4.4 Determining for which Outcomes the Effect of Time is Significantly Different from 0 and Different from Other Outcomes.

Outcome	Slope	t	vs. 1	t	vs. 2	t	vs. 3	t
1. Rel. Skills	0.98	17.99	—	—	—	—	—	—
2. Partner Sel.	1.21	22.22	0.23	2.99	—	—	—	—
3. Past Rel. Beh.	0.91	16.50	-0.07	-0.97	-0.31	-3.95	—	—
4. Rel. Beh. Att.	0.85	15.37	-0.14	-1.77	-0.37	-4.75	-0.06	-0.80

1.5 Step 3: Test whether the effect of Time varies by Dosage and Prior Exposure to relationship education.

- Compare
  - Model 5 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, and Dosage and Prior Exposure.
  - Model 6 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, Dosage and Prior Exposure,and an interaction between Time and Dosage and Time and Prior Exposure.

1.5.1 Model Comparison:

1.5.1.1 Effect of Dosage and Prior Exposure

The effect of Dosage and Prior Exposure was not significant ($\chi^2 = 6.258$, $df = 3$, $p = .100$).

1.5.1.2 Effect of Time X Prior Exposure

The include of Time varied significantly by Prior Exposure ($\chi^2 = 5.246$, $df = 1$, $p = .022$).

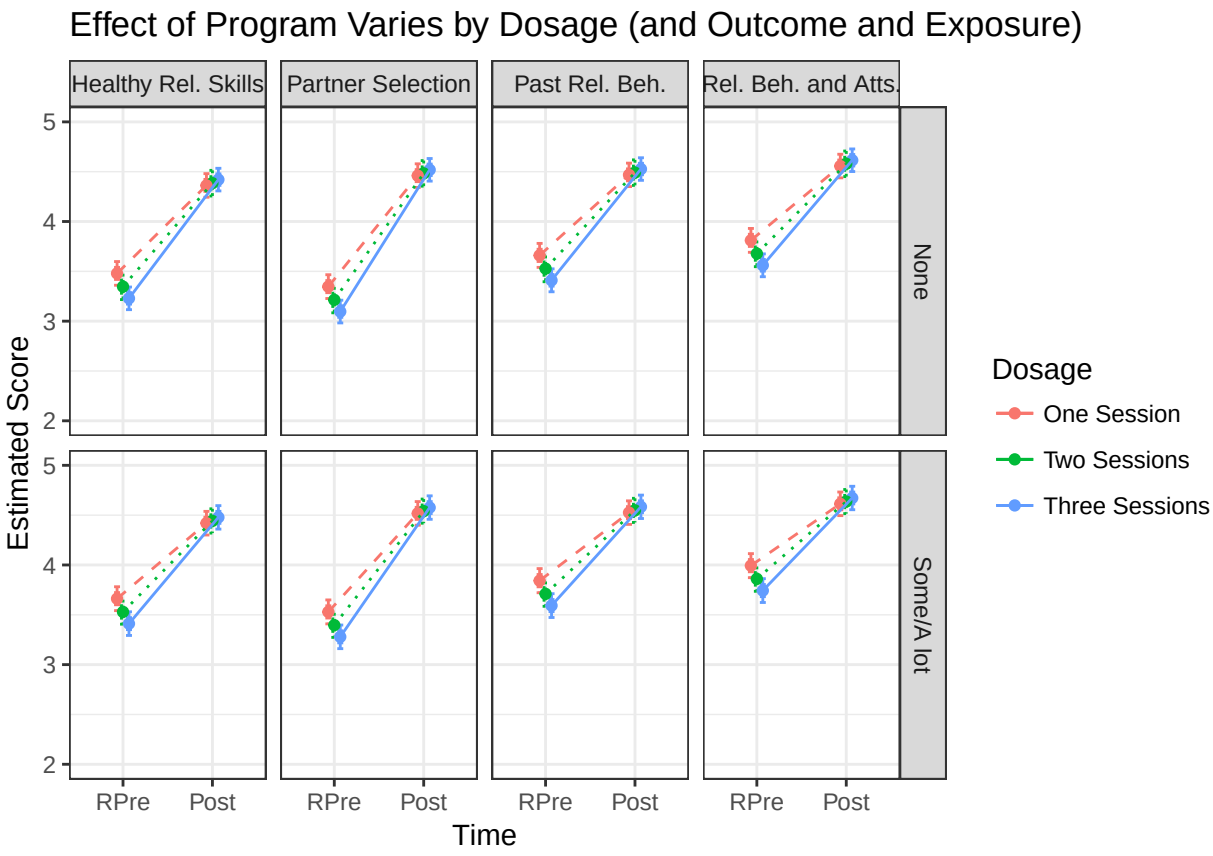
1.5.1.3 Effect of Time X Dosage

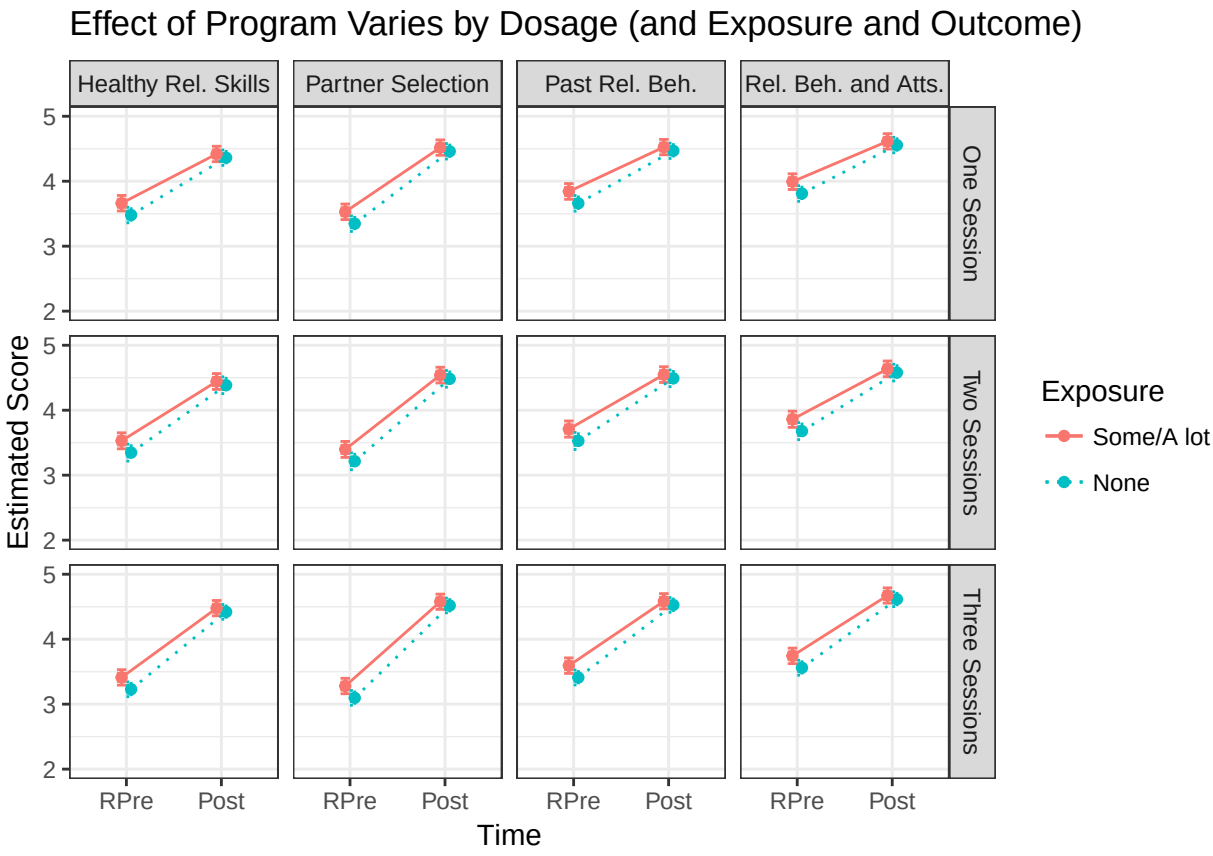
The effect of Time varied by Dosage ($\chi^2 = 23.481$, $df = 2$, $p < .001$).

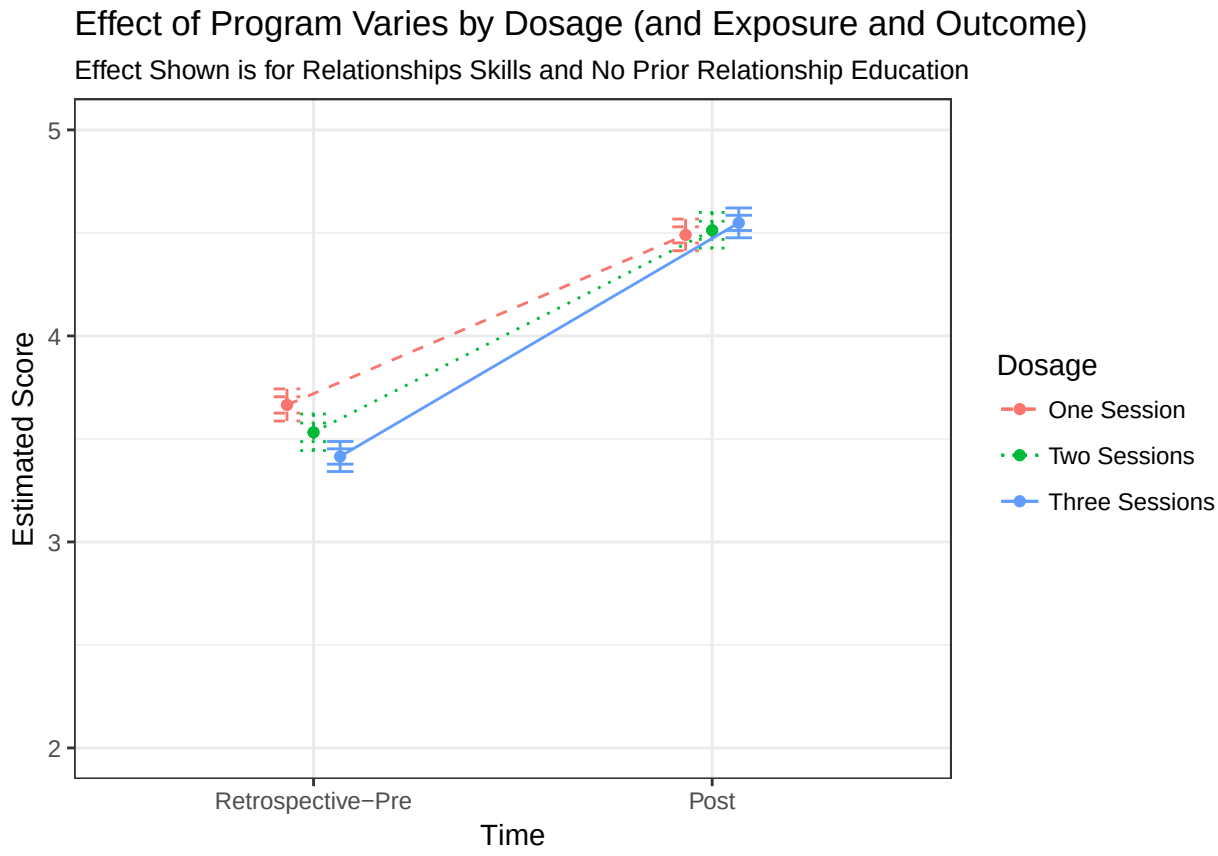
1.5.1.4 Effect of Time X Prior Exposure and Time X Dosage

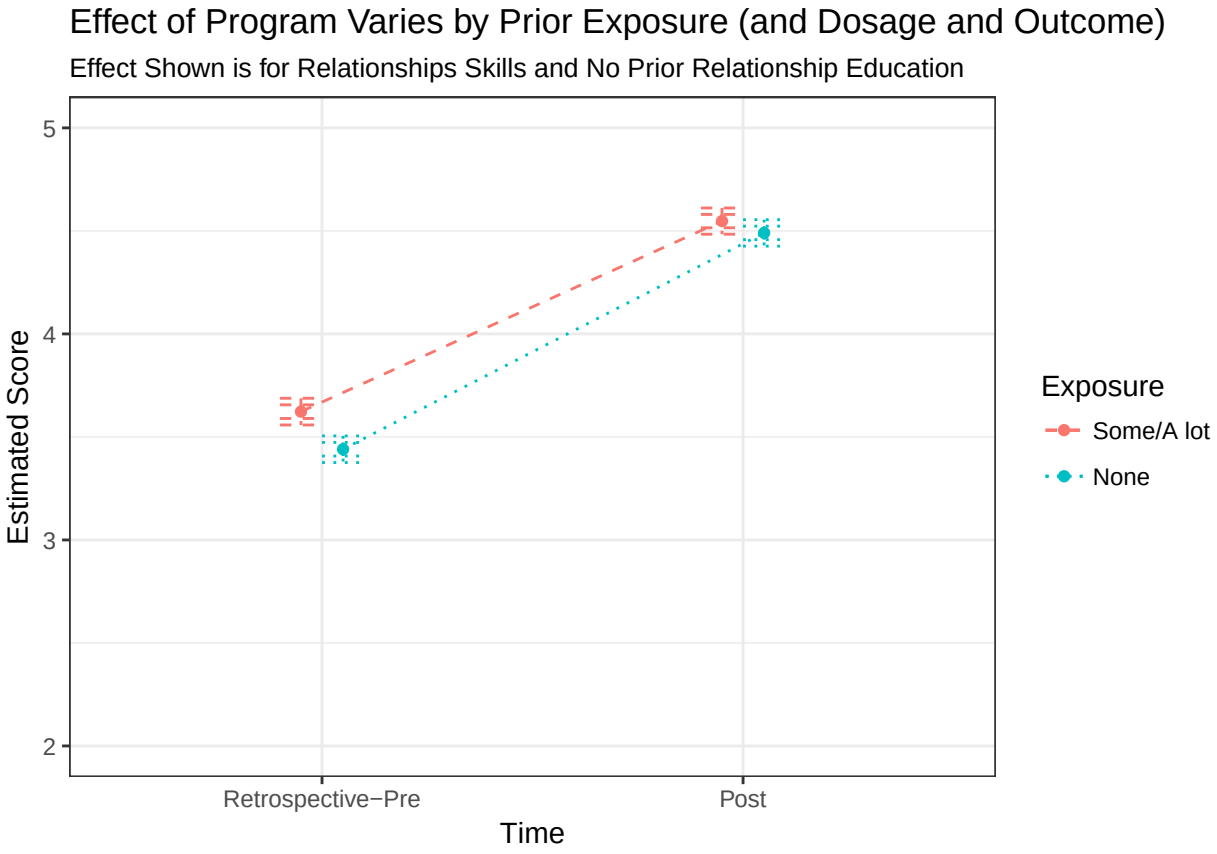
The addition of prior exposure, dosage, and their respective interactions with time as predictors significantly improved model fit ($\chi^2 = 35.639$, $df = 6$, $p < .001$).

1.5.2 Plotting the Effects of Prior Exposure and Dosage




Effect of Program Varies by Dosage (and Exposure and Outcome)
Healthy Rel. Skills
Partner Selection
Past Rel. Beh.
Rel. Beh. and Atts.
One Session
Two Sessions
Three Sessions
Estimated Score
5
4
3
2
RPre
Post
Time
Exposure
Some/A lot
None


Effect of Program Varies by Dosage (and Exposure and Outcome)
Effect Shown is for Relationships Skills and No Prior Relationship Education
Estimated Score
5
4
3
2
Retrospective−Pre
Post
Time
Dosage
One Session
Two Sessions
Three Sessions


Effect of Program Varies by Prior Exposure (and Dosage and Outcome)
Effect Shown is for Relationships Skills and No Prior Relationship Education
Estimated Score
5
4
3
2
Retrospective−Pre
Post
Time
Exposure
Some/A lot
None

1.5.2.1 Examining How Respondents Scores Differed by Prior Exposure at Each Time Point

- Those who had previous experience with relationship education rated themselves higher at Retrospective Pre, but not Post.
- The ceiling effect is clearly shown.
- **Are these analyses appropriate given the interaction?**

```
Time = RPre:
 Prior_RshpEducation_collapsed   emmean         SE     df lower.CL
 None                           3.429236 0.04890167 200.28 3.332808
 Some/A lot                     3.611693 0.05320977 191.37 3.506740
 upper.CL .group
 3.525664  1
 3.716646   2

Time = Post:
 Prior_RshpEducation_collapsed   emmean         SE     df lower.CL
 None                           4.471408 0.04884931 199.23 4.375080
 Some/A lot                     4.528713 0.05278679 186.80 4.424578
 upper.CL .group
 4.567736  1
 4.632848  1

Results are averaged over the levels of: Ethnic_Code, Domain, Number_Attended
Degrees-of-freedom method: kenward-roger
Confidence level used: 0.95
significance level used: alpha = 0.05
```

1.5.2.2 Examining How Respondents Scores Differed by Dosage Level at Each Time Point

- Those who attended all 3 sessions rated their prior knowledge as lower. . . you don't know what you don't know. . .
- The ceiling effect is clearly shown.

```
Time = RPre:
 Number_Attended   emmean         SE     df lower.CL upper.CL .group
 Three Sessions  3.397885 0.05886025 188.23 3.281774 3.513995  1
 Two Sessions    3.515375 0.06561847 207.76 3.386012 3.644738  12
 One Session     3.648134 0.05725733 206.69 3.535251 3.761018   2

Time = Post:
 Number_Attended   emmean         SE     df lower.CL upper.CL .group
 One Session     4.473131 0.05680277 201.24 4.361126 4.585136  1
 Two Sessions    4.495576 0.06496815 201.72 4.367473 4.623680  1
 Three Sessions  4.531475 0.05875856 187.04 4.415560 4.647389  1

Results are averaged over the levels of: Ethnic_Code, Domain, Prior_RshpEducation_collapsed
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
```

1.5.2.3 Determining for which Dosage Levels the Effect of Time is Significantly Different from 0 and Different from Other Dosage Levels.

- The simple slopes are for when Relationship Skills is the outcome and the participant has no prior relationship education.
- The difference between simple slopes for dosage levels will be consistent across combinations of outcomes and dosage.
- To know which simple slopes are significantly different from 0 would require testing by changing the base categories of outcome, dosage, and exposure.

Outcome	Slope	t	vs. 1	t	vs. 2	t
1. Att. 1 Sess.	0.883	12.510	—	—	—	—
2. Att. 2 Sess.	1.038	13.399	0.155	2.204	—	—
3. Att. 3 Sess.	1.191	17.520	0.309	4.874	0.153	2.235

1.6 Step 4: Test whether the effect of Time varies by demographic variables using a Bonferroni correction, $p = .05/6 = 0.00833$.

- Compare
  - Model 6 with demographic variables, Time, Outcome Level, an interaction between Time and Outcome Level, and, finally, Dosage and Exposure and their respective interactions with Time.
  - Model 7.X with all predictors from Model 6 and an interaction between Time and a given demographic covariate.

1.6.1 Testing Whether Time Varies by Demographic Covariates

1.6.1.0.1 Race/Ethnicity

The effect of Time varied by Race/Ethnicity ($\chi^2 = 20.593$, $df = 2$, $p < .001$).

1.7 Diagnostics

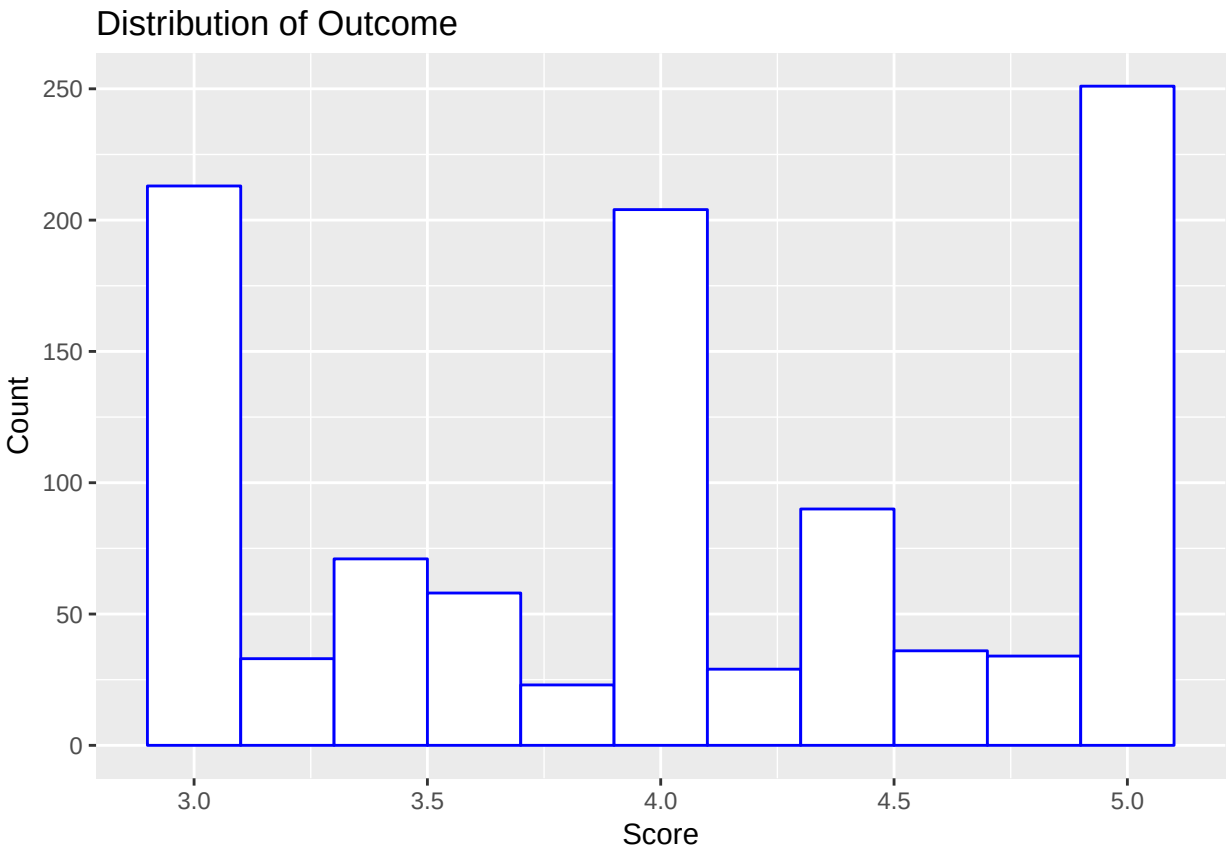
1.7.1 The model

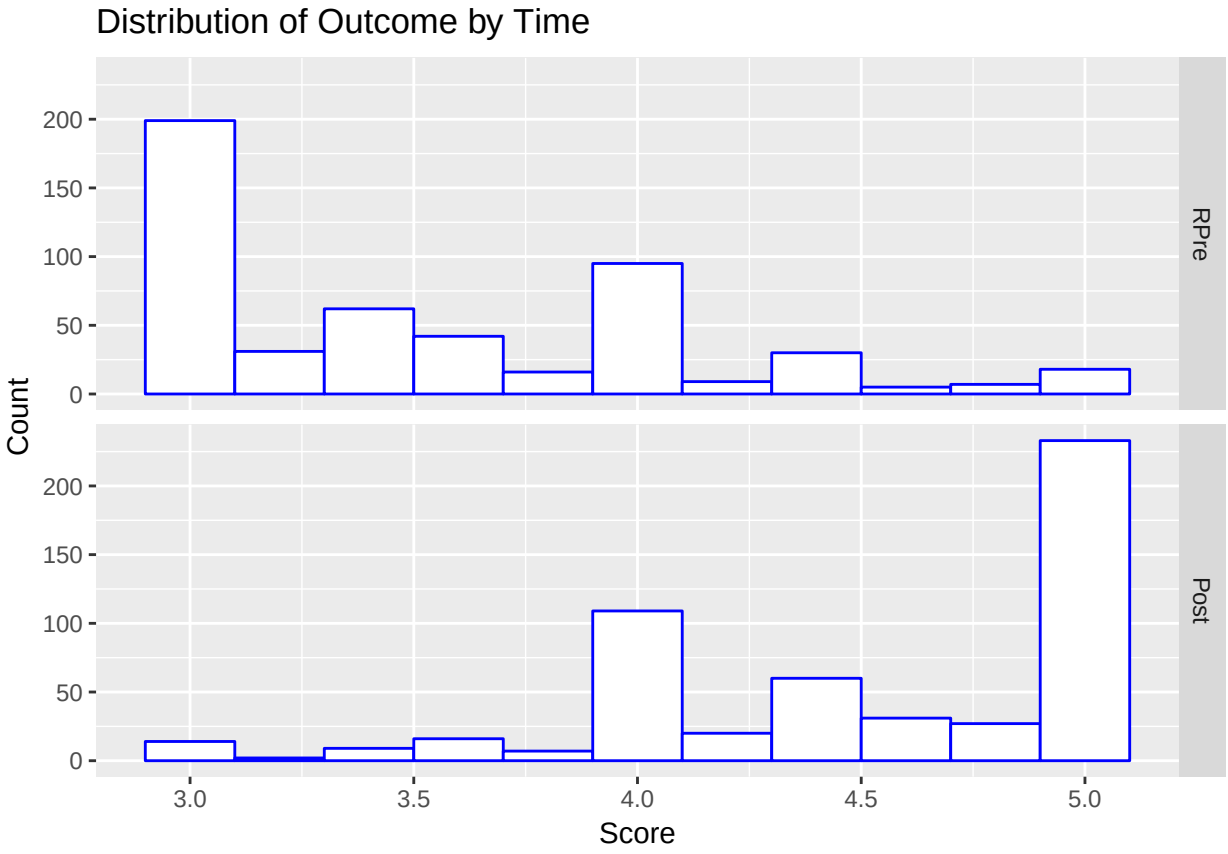
```
Linear mixed model fit by REML ['lmerMod']
Formula:
Score ~ Ethnic_Code + Time + Domain + Time:Domain + Prior_RshpEducation_collapsed +
    Number_Attended + Time:Prior_RshpEducation_collapsed + Time:Number_Attended +
    Time:Ethnic_Code + (1 | ID)
   Data: PICK_clean_longlong2

REML criterion at convergence: 1469.7

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.170 -0.694  0.009  0.655  3.016

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0873   0.295
 Residual             0.1873   0.433
Number of obs: 1042, groups:  ID, 134

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4641     0.0792
Ethnic_CodeHispanic/Latino                       -0.0739     0.0881
Ethnic_CodeOther                                  0.0516     0.0943
TimePost                                          0.9379     0.0763
DomainPartner_Selection                          -0.1319     0.0536
DomainPast_Rel_Behav                              0.1807     0.0541
DomainRel_Behav_Attit                             0.3307     0.0540
Prior_RshpEducation_collapsedSome/A lot           0.1923     0.0660
Number_AttendedTwo Sessions                      -0.1112     0.0835
Number_AttendedThree Sessions                    -0.2297     0.0764
TimePost:DomainPartner_Selection                  0.2315     0.0756
TimePost:DomainPast_Rel_Behav                    -0.0722     0.0760
TimePost:DomainRel_Behav_Attit                   -0.1349     0.0759
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1472     0.0556
TimePost:Number_AttendedTwo Sessions              0.1162     0.0706
TimePost:Number_AttendedThree Sessions            0.2717     0.0641
Ethnic_CodeHispanic/Latino:TimePost               0.1390     0.0748
Ethnic_CodeOther:TimePost                        -0.2912     0.0797
                                                t value
(Intercept)                                       43.72
Ethnic_CodeHispanic/Latino                        -0.84
Ethnic_CodeOther                                   0.55
```

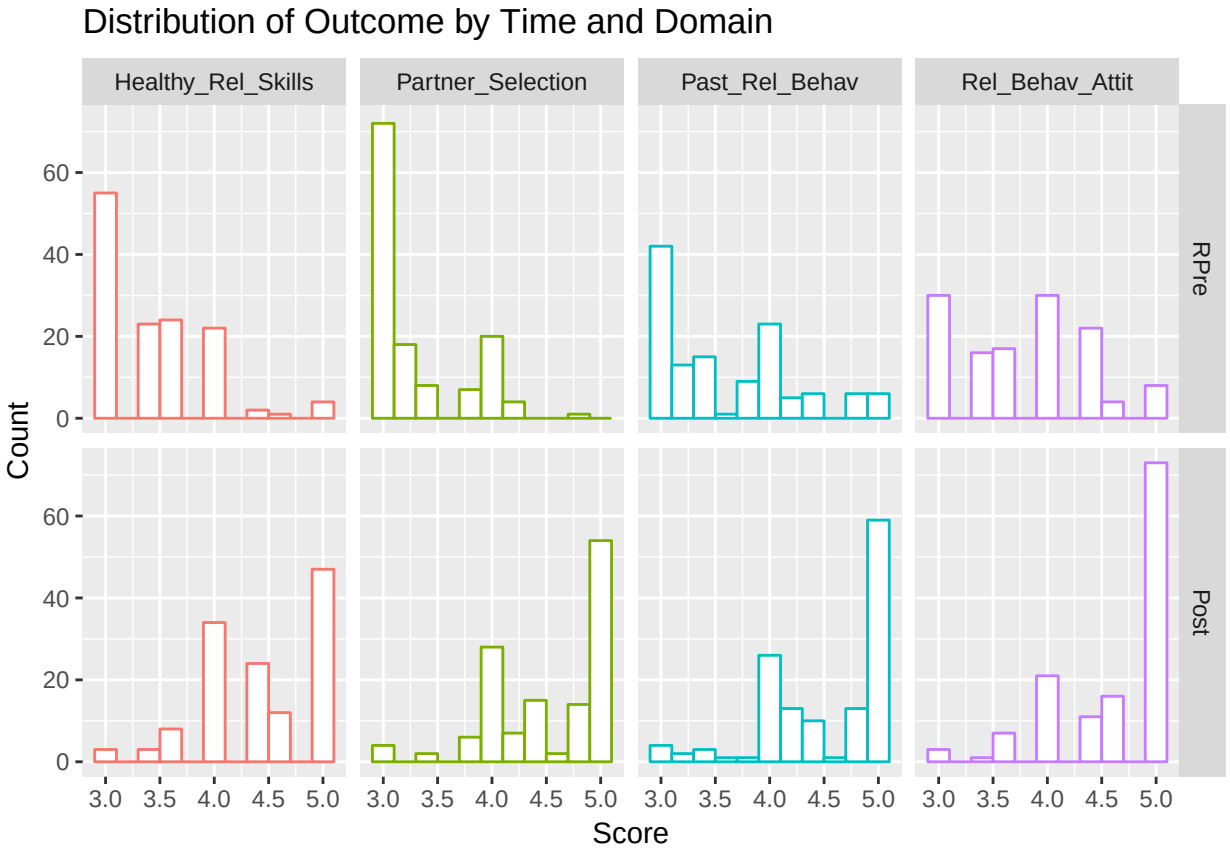
```
TimePost                                              12.30
DomainPartner_Selection                               -2.46
DomainPast_Rel_Behav                                   3.34
DomainRel_Behav_Attit                                  6.13
Prior_RshpEducation_collapsedSome/A lot                2.91
Number_AttendedTwo Sessions                           -1.33
Number_AttendedThree Sessions                         -3.01
TimePost:DomainPartner_Selection                       3.06
TimePost:DomainPast_Rel_Behav                         -0.95
TimePost:DomainRel_Behav_Attit                        -1.78
TimePost:Prior_RshpEducation_collapsedSome/A lot      -2.65
TimePost:Number_AttendedTwo Sessions                   1.65
TimePost:Number_AttendedThree Sessions                 4.24
Ethnic_CodeHispanic/Latino:TimePost                    1.86
Ethnic_CodeOther:TimePost                             -3.65

Correlation matrix not shown by default, as p = 18 > 12.
Use print(summary(Model.8.REML), correlation=TRUE)  or
     vcov(summary(Model.8.REML))     if you need it
```

1.7.2 Distribution of Outcome

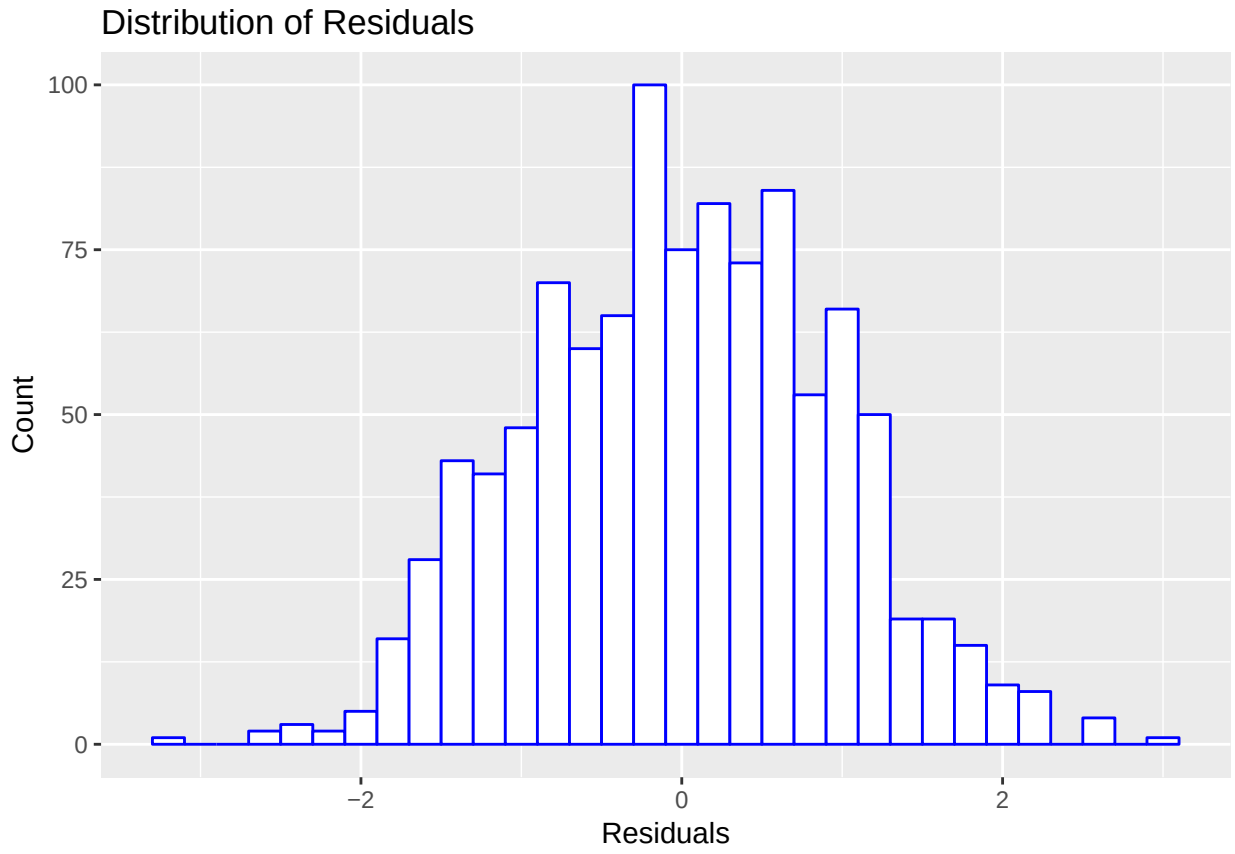
- Not an assumption, but could indicate need for a different link function.

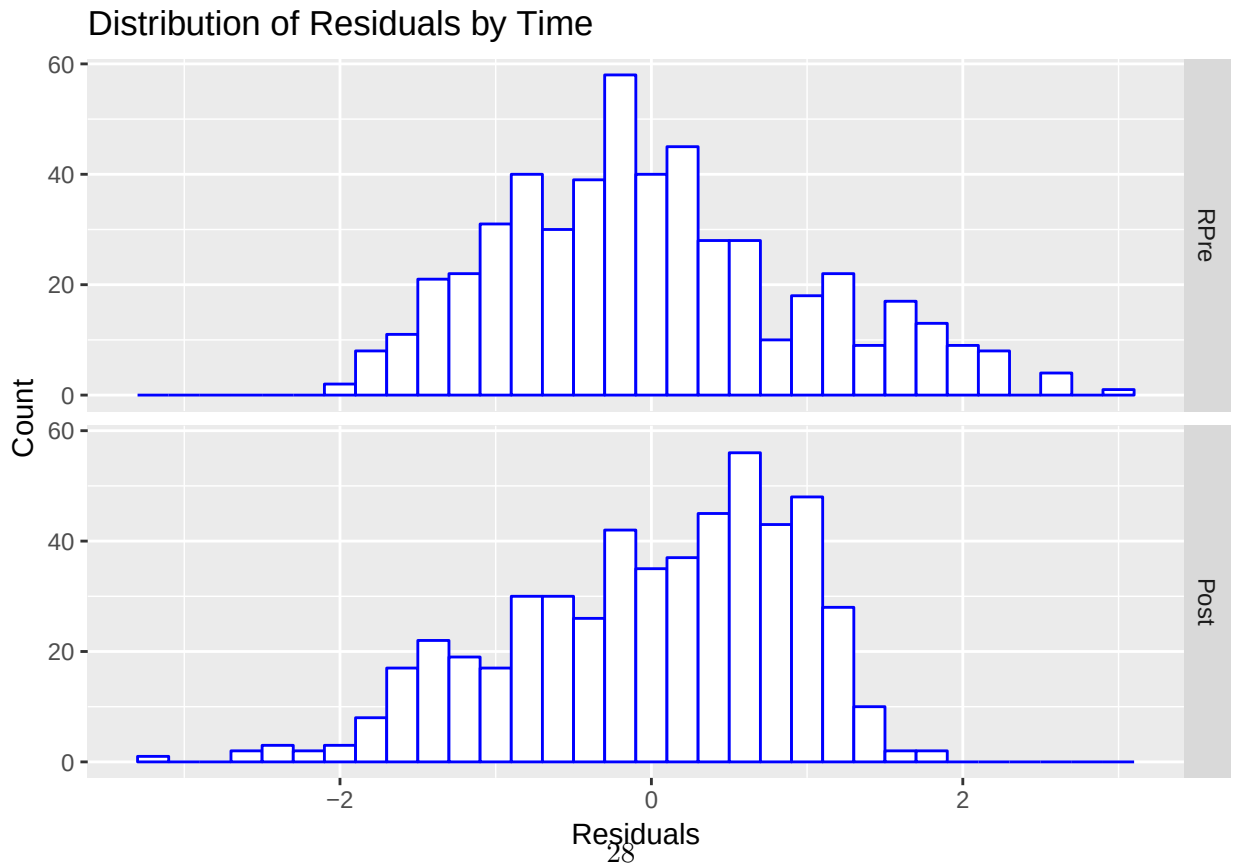


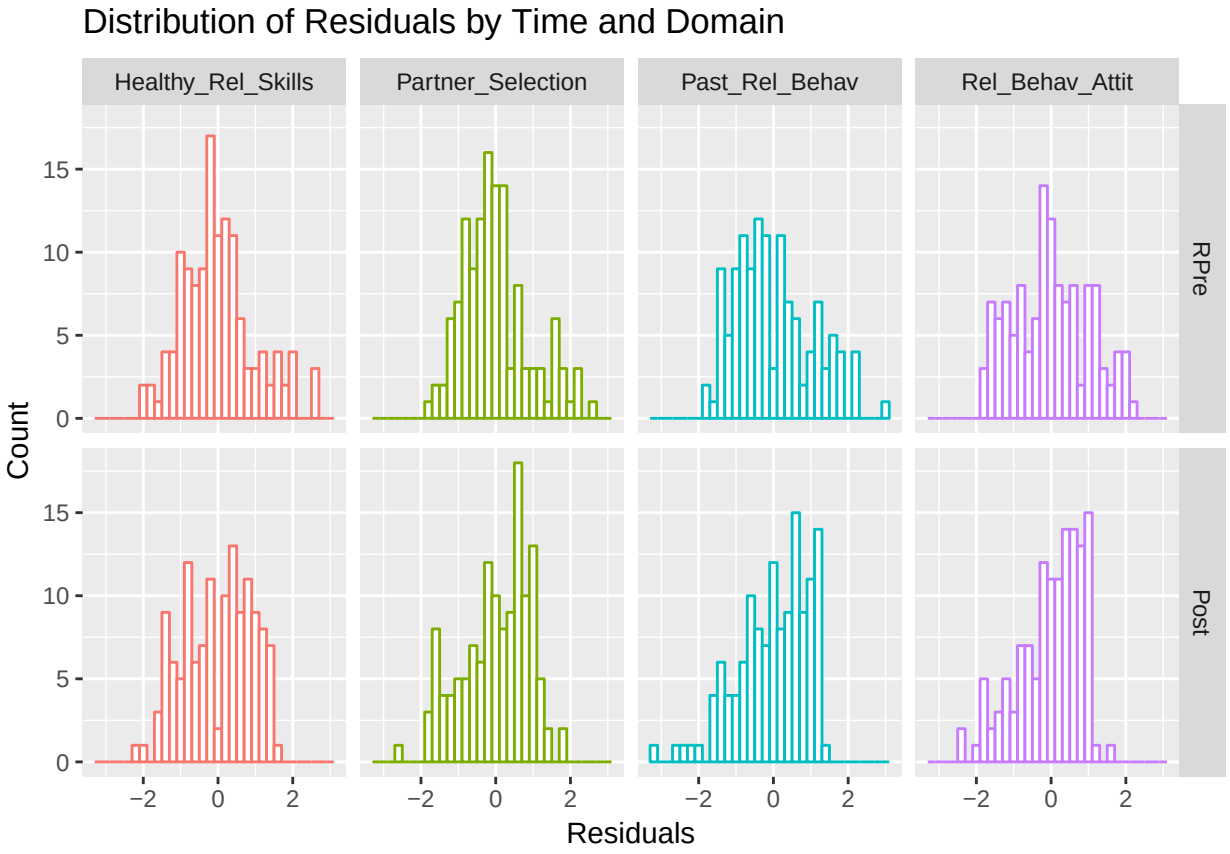

Distribution of Outcome by Time
Count
200
150
100
50
0
RPre
Post
3.0
3.5
4.0
4.5
5.0
Score


Distribution of Outcome by Time and Domain
Healthy_Rel_Skills
Partner_Selection
Past_Rel_Behav
Rel_Behav_Attit
RPre
Post
Count
0
20
40
60
3.0
3.5
4.0
4.5
5.0
Score

1.7.3 Normality of Residuals

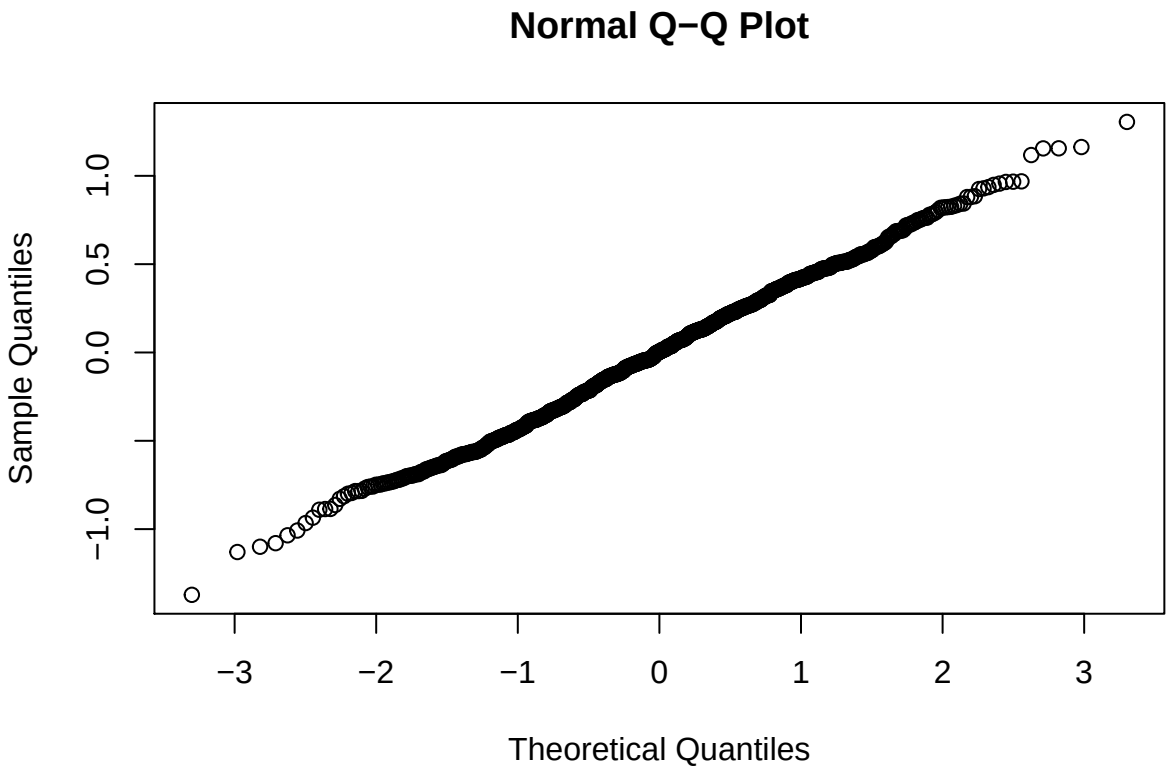





Distribution of Residuals by Time and Domain
Healthy_Rel_Skills
Partner_Selection
Past_Rel_Behav
Rel_Behav_Attit
RPre
Post
Count
Residuals
0
5
10
15
−2
0
2

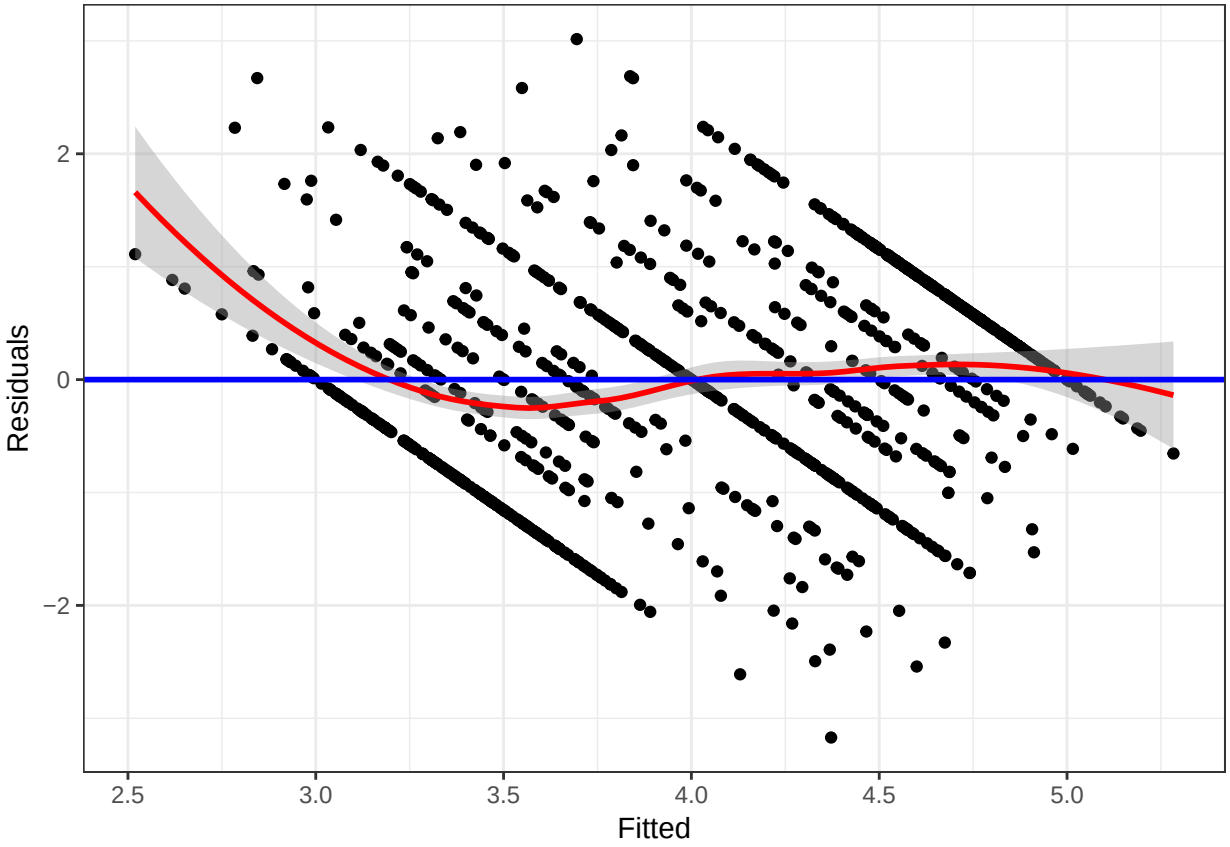
1.7.3.1 Q-Q Plot

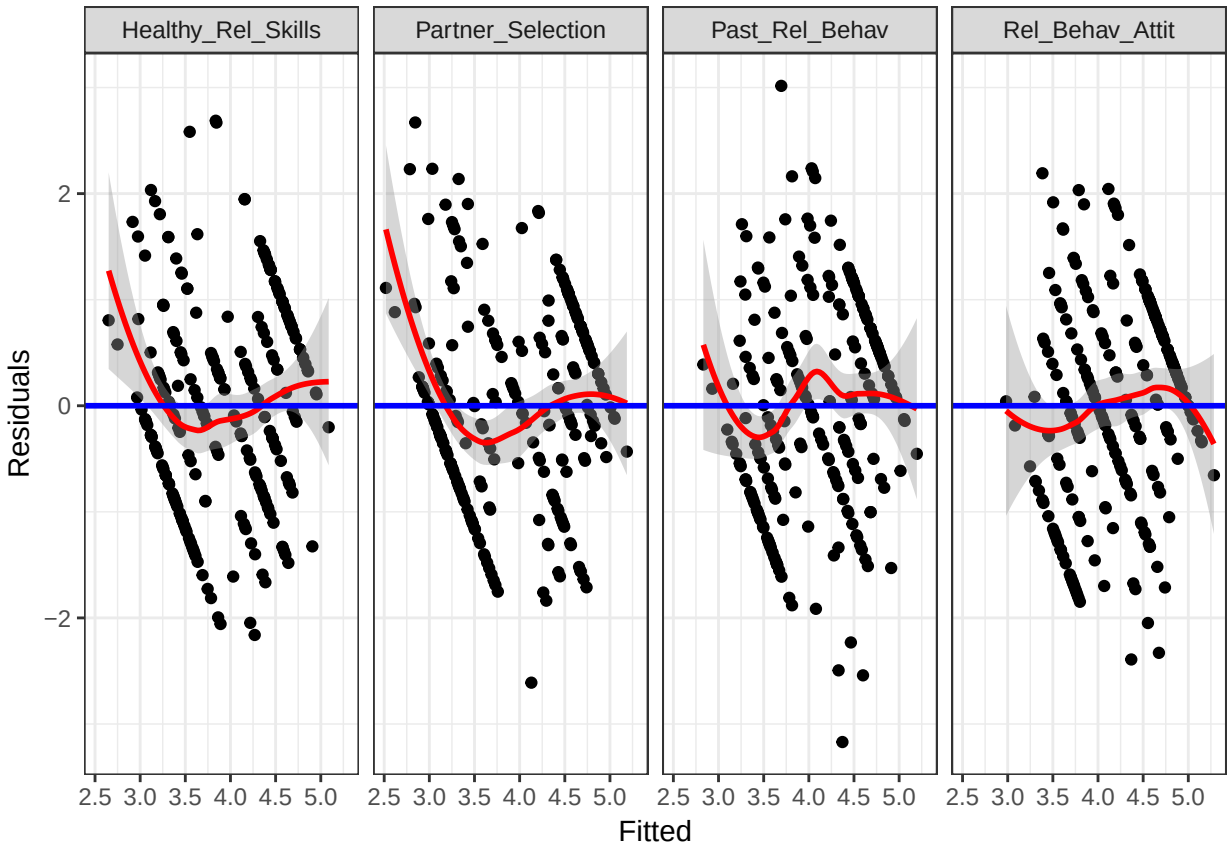
```
qqnorm(residuals(Model.8.REML))
```



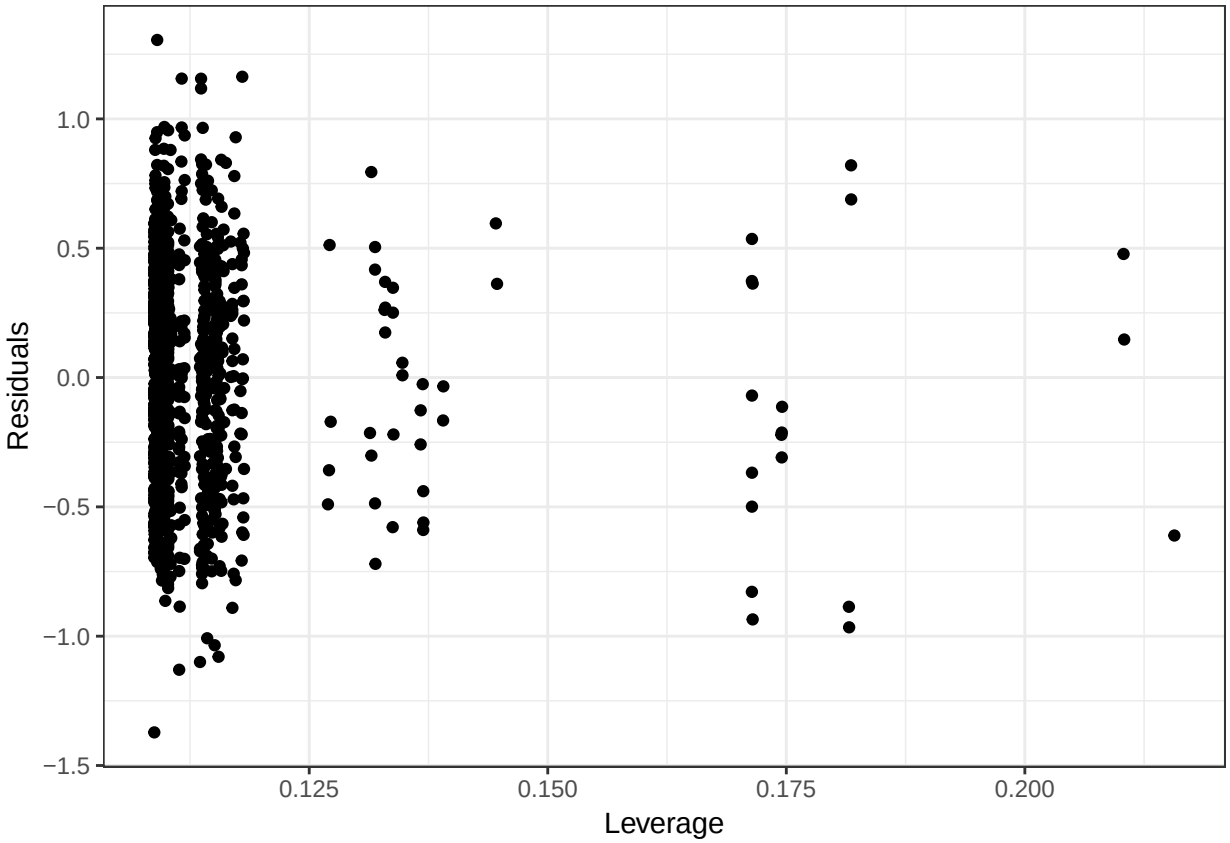
1.7.4 Assumptions of Model Form

- Underestimating those on the low end, overestimating those on the very high end.




Healthy_Rel_Skills
Partner_Selection
Past_Rel_Behav
Rel_Behav_Attit
Residuals
2
0
−2
2.5 3.0 3.5 4.0 4.5 5.0
Fitted

1.7.5 Influential Cases



1.7.5.1 Influential Cases

	Score	Ethnic_Code	Time	Domain	Prior_RshpEducation_collapsed	Number_Attended	ID
281	3.333333	Caucasian	Post	Healthy_Rel_Skills	Some/A lot	Two Sessions	102
283	4.000000	Caucasian	Post	Partner_Selection	Some/A lot	Two Sessions	102
285	4.750000	Caucasian	Post	Past_Rel_Behav	Some/A lot	Two Sessions	102
287	5.000000	Caucasian	Post	Rel_Behav_Attit	Some/A lot	Two Sessions	102
306	4.000000	Other	RPre	Healthy_Rel_Skills	None	One Session	118
309	3.666667	Other	Post	Past_Rel_Behav	None	One Session	118
312	4.000000	Other	RPre	Rel_Behav_Attit	None	One Session	118
417	4.000000	Hispanic/Latino	Post	Healthy_Rel_Skills	Some/A lot	One Session	151
419	4.000000	Hispanic/Latino	Post	Partner_Selection	Some/A lot	One Session	151
421	4.000000	Hispanic/Latino	Post	Past_Rel_Behav	Some/A lot	One Session	151
423	4.000000	Hispanic/Latino	Post	Rel_Behav_Attit	Some/A lot	One Session	151
530	4.000000	Hispanic/Latino	RPre	Healthy_Rel_Skills	Some/A lot	Two Sessions	181
532	4.000000	Hispanic/Latino	RPre	Partner_Selection	Some/A lot	Two Sessions	181
533	3.500000	Hispanic/Latino	Post	Past_Rel_Behav	Some/A lot	Two Sessions	181
535	3.666667	Hispanic/Latino	Post	Rel_Behav_Attit	Some/A lot	Two Sessions	181
1033	4.333333	Caucasian	Post	Healthy_Rel_Skills	Some/A lot	Two Sessions	398
1035	4.000000	Caucasian	Post	Partner_Selection	Some/A lot	Two Sessions	398
1037	3.250000	Caucasian	Post	Past_Rel_Behav	Some/A lot	Two Sessions	398
1039	3.666667	Caucasian	Post	Rel_Behav_Attit	Some/A lot	Two Sessions	398

1.7.5.2 Descriptive Statistics (for Reference)

```
     Score                Ethnic_Code    Time                     Domain
 Min.   :3.000   Caucasian      :714   RPre:514   Healthy_Rel_Skills:262
 1st Qu.:3.333   Hispanic/Latino:174   Post:528   Partner_Selection :262
 Median :4.000   Other          :154              Past_Rel_Behav    :259
 Mean   :4.036                                    Rel_Behav_Attit   :259
 3rd Qu.:4.750
 Max.   :5.000

 Prior_RshpEducation_collapsed       Number_Attended       ID
 None      :519                One Session   :357    2      :  8
 Some/A lot:523                Two Sessions  :279    5      :  8
                               Three Sessions:406    10     :  8
                                                     13     :  8
                                                     21     :  8
                                                     27     :  8
                                                     (Other):994
```

1.7.5.3 Effect on Estimates of Removing High Leverage Values

	effect	change
(Intercept)	3.46411345	-0.003192397
Ethnic_CodeHispanic/Latino	-0.07391337	0.002471171
Ethnic_CodeOther	0.05164368	-0.013781361
TimePost	0.93785937	-0.009058461
DomainPartner_Selection	-0.13187984	0.002680879
DomainPast_Rel_Behav	0.18068816	0.009175808
DomainRel_Behav_Attit	0.33066473	0.008008757
Prior_RshpEducation_collapsedSome/A lot	0.19234419	0.013501659
Number_AttendedTwo Sessions	-0.11115044	0.004598572
Number_AttendedThree Sessions	-0.22972517	-0.006796754
TimePost:DomainPartner_Selection	0.23145583	-0.003190442
TimePost:DomainPast_Rel_Behav	-0.07224980	0.003346076
TimePost:DomainRel_Behav_Attit	-0.13489743	-0.004039774
TimePost:Prior_RshpEducation_collapsedSome/A lot	-0.14719716	0.020890425
TimePost:Number_AttendedTwo Sessions	0.11621112	0.022039622
TimePost:Number_AttendedThree Sessions	0.27165537	-0.007937135
Ethnic_CodeHispanic/Latino:TimePost	0.13895385	0.049330397
Ethnic_CodeOther:TimePost	-0.29116414	0.017547683

	se	multiples
(Intercept)	0.07922866	0.04029347
Ethnic_CodeHispanic/Latino	0.08805606	0.02806361
Ethnic_CodeOther	0.09434596	0.14607261
TimePost	0.07627787	0.11875608
DomainPartner_Selection	0.05359839	0.05001789
DomainPast_Rel_Behav	0.05407936	0.16967301
DomainRel_Behav_Attit	0.05395083	0.14844548
Prior_RshpEducation_collapsedSome/A lot	0.06602650	0.20448849
Number_AttendedTwo Sessions	0.08348612	0.05508187
Number_AttendedThree Sessions	0.07638883	0.08897576
TimePost:DomainPartner_Selection	0.07564930	0.04217410
TimePost:DomainPast_Rel_Behav	0.07600852	0.04402238
TimePost:DomainRel_Behav_Attit	0.07594408	0.05319407
TimePost:Prior_RshpEducation_collapsedSome/A lot	0.05559342	0.37577152
TimePost:Number_AttendedTwo Sessions	0.07061533	0.31210818
TimePost:Number_AttendedThree Sessions	0.06407142	0.12387950
Ethnic_CodeHispanic/Latino:TimePost	0.07481846	0.65933457
Ethnic_CodeOther:TimePost	0.07968737	0.22020657

1.7.6 Frequencies of Outcomes Variables at Item Level

1.7.6.1 Perceived Knowledge About Relationship Skills

1.7.6.1.1 Retro-Pre

Value	Healthy Rel.	Communicate	Confl. Mng.
1	13	4	9
2	22	21	17
3	47	49	52
4	43	49	41
5	6	7	6
Valid Total	131	130	125
—	—	—	—
Missing	3	4	9
Total	134	134	134

1.7.6.1.2 Post

Value	Healthy Rel.	Communicate	Confl. Mng.
1	0	0	1
2	0	1	2
3	5	6	15
4	55	59	58
5	71	64	58
Valid Total	131	130	134
—	—	—	—
Missing	3	4	0
Total	134	134	134

1.7.6.2 Perceived Knowledge About Partner Selection

1.7.6.2.1 Retro-Pre

Value	Right Partner	Learn Partner	Pace Rel.	Warning Signs
1	18	18	19	15
2	25	26	29	29
3	56	47	47	40
4	29	37	32	41
5	2	2	3	4
Valid Total	130	130	130	129
—	—	—	—	—
Missing	4	4	4	5
Total	134	134	134	134

1.7.6.2.2 Post

Value	Right Partner	Learn Partner	Pace Rel.	Warning Signs
1	0	1	0	0
2	2	1	1	2
3	10	5	7	3
4	54	44	46	48
5	65	81	79	79
Valid Total	131	132	133	132
—	—	—	—	—
Missing	3	2	1	2
Total	134	134	134	134

1.7.6.3 Perceived Importance of Knowledge About a Potential Partner's Relationships Patterns

1.7.6.3.1 Retro-Pre

Value	Lrn. Grow. Up	Past Rels.	Get Along Pars.	Friendships
1	7	7	6	6
2	16	19	16	21
3	45	42	41	40
4	44	41	35	36
5	14	16	27	23
Valid Total	126	125	125	126
—	—	—	—	—
Missing	8	9	9	8
Total	134	134	134	134

1.7.6.3.2 Post

Value	Lrn. Grow. Up	Past Rels.	Get Along Pars.	Friendships
1	0	2	1	2
2	0	3	0	0
3	11	5	11	6
4	46	36	41	45
5	75	87	80	79
Valid Total	132	133	133	132
—	—	—	—	—
Missing	2	1	1	2
Total	134	134	134	134

1.7.6.4 Perceived Importance of Knowledge About a Potential Partner's Relationship Behavior and Attitudes

1.7.6.4.1 Retro-Pre

Value	Fights	Feelings Hurt	Right and Wrong
1	8	5	2
2	13	15	9
3	35	31	34
4	47	56	57
5	24	19	25
Valid Total	127	126	127
—	—	—	—
Missing	7	8	7
Total	134	134	134

1.7.6.4.2 Post

Value	Fights	Feelings Hurt	Right and Wrong
1	2	1	0
2	2	0	1
3	8	5	6
4	35	37	30
5	84	89	95
Valid Total	131	132	132
—	—	—	—
Missing	3	2	2
Total	134	134	134

1.7.7 Frequencies of Change in Outcomes Variables at Scale Level

- Collapsing Categories for Display of Frequencies, but not for Analyses

Value	Rel. Skills	Prtnr. Sel.	Past Rel. Beh.	Rel. Beh. Att.
[-1,0]	15	12	17	23
(0,1]	51	36	55	64
(1,2]	43	45	34	26
(2,3]	12	20	16	9
(3,4]	7	16	3	3
Valid Total	128	129	125	125
—	—	—	—	—
Missing	1	0	4	4
Total	129	129	129	129

1.8 Final Model

1.8.1 Testing Significance of Predictors

1.8.1.1 Final Model Estimates

```
Linear mixed model fit by maximum likelihood  ['lmerMod']
Formula:
Score ~ Ethnic_Code + Time + Domain + Time:Domain + Prior_RshpEducation_collapsed +
    Number_Attended + Time:Prior_RshpEducation_collapsed + Time:Number_Attended +
    Time:Ethnic_Code + (1 | ID)
   Data: PICK_clean_longlong2

     AIC      BIC   logLik deviance df.resid
    1438     1537     -699     1398     1022

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.195 -0.703  0.011  0.661  3.037

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0826   0.287
 Residual             0.1848   0.430
Number of obs: 1042, groups:  ID, 134

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4641     0.0778
Ethnic_CodeHispanic/Latino                       -0.0737     0.0863
Ethnic_CodeOther                                  0.0516     0.0925
TimePost                                          0.9379     0.0758
DomainPartner_Selection                          -0.1319     0.0532
DomainPast_Rel_Behav                              0.1807     0.0537
DomainRel_Behav_Attit                             0.3307     0.0536
Prior_RshpEducation_collapsedSome/A lot           0.1926     0.0647
Number_AttendedTwo Sessions                      -0.1110     0.0818
Number_AttendedThree Sessions                    -0.2298     0.0749
TimePost:DomainPartner_Selection                  0.2314     0.0751
TimePost:DomainPast_Rel_Behav                    -0.0723     0.0755
TimePost:DomainRel_Behav_Attit                   -0.1349     0.0754
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1474     0.0552
TimePost:Number_AttendedTwo Sessions              0.1161     0.0701
TimePost:Number_AttendedThree Sessions            0.2718     0.0636
Ethnic_CodeHispanic/Latino:TimePost               0.1388     0.0743
Ethnic_CodeOther:TimePost                        -0.2911     0.0792
                                                t value
(Intercept)                                       44.51
```

```
Ethnic_CodeHispanic/Latino                            -0.85
Ethnic_CodeOther                                       0.56
TimePost                                              12.38
DomainPartner_Selection                               -2.48
DomainPast_Rel_Behav                                   3.36
DomainRel_Behav_Attit                                  6.17
Prior_RshpEducation_collapsedSome/A lot                2.98
Number_AttendedTwo Sessions                           -1.36
Number_AttendedThree Sessions                         -3.07
TimePost:DomainPartner_Selection                       3.08
TimePost:DomainPast_Rel_Behav                         -0.96
TimePost:DomainRel_Behav_Attit                        -1.79
TimePost:Prior_RshpEducation_collapsedSome/A lot      -2.67
TimePost:Number_AttendedTwo Sessions                   1.65
TimePost:Number_AttendedThree Sessions                 4.27
Ethnic_CodeHispanic/Latino:TimePost                    1.87
Ethnic_CodeOther:TimePost                             -3.68

Correlation matrix not shown by default, as p = 18 > 12.
Use print(summary(Model.9.ML), correlation=TRUE)  or
     vcov(summary(Model.9.ML))   if you need it
```

1.8.1.1.1 Time X Race/Ethnicity

The effect of Time varied by Race/Ethnicity ($\chi^2 = 20.593$, $df = 2$, $p < .001$).

1.8.1.1.2 Time X Dosage

The effect of Time varied by Dosage ($\chi^2 = 18.273$, $df = 2$, $p < .001$).

1.8.1.1.3 Time X Prior Exposure

The effect of Time varied by Prior Exposure ($\chi^2 = 7.101$, $df = 1$, $p = .008$).

1.8.1.1.4 Time X Domain

The effect of Time varied by Domain ($\chi^2 = 26.656$, $df = 3$, $p < .001$).

1.8.1.2 Determining Significant Differences at Retro-Pre- and Post-Program Assessments

- Easier way to do this than by switching out reference groups? Possibly.

1.8.1.3 Determining Significance of Simple Slopes

- Easier way to do this than by switching out reference groups? Possibly.

1.8.1.4 Refitting Final Model with REML

```
Linear mixed model fit by REML ['lmerMod']
Formula:
Score ~ Ethnic_Code + Time + Domain + Time:Domain + Prior_RshpEducation_collapsed +
    Number_Attended + Time:Prior_RshpEducation_collapsed + Time:Number_Attended +
    Time:Ethnic_Code + (1 | ID)
   Data: PICK_clean_longlong2

REML criterion at convergence: 1469.7

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.170 -0.694  0.009  0.655  3.016

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0873   0.295
 Residual             0.1873   0.433
Number of obs: 1042, groups:  ID, 134

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4641     0.0792
Ethnic_CodeHispanic/Latino                       -0.0739     0.0881
Ethnic_CodeOther                                  0.0516     0.0943
TimePost                                          0.9379     0.0763
DomainPartner_Selection                          -0.1319     0.0536
DomainPast_Rel_Behav                              0.1807     0.0541
DomainRel_Behav_Attit                             0.3307     0.0540
Prior_RshpEducation_collapsedSome/A lot           0.1923     0.0660
Number_AttendedTwo Sessions                      -0.1112     0.0835
Number_AttendedThree Sessions                    -0.2297     0.0764
TimePost:DomainPartner_Selection                  0.2315     0.0756
TimePost:DomainPast_Rel_Behav                    -0.0722     0.0760
TimePost:DomainRel_Behav_Attit                   -0.1349     0.0759
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1472     0.0556
TimePost:Number_AttendedTwo Sessions              0.1162     0.0706
TimePost:Number_AttendedThree Sessions            0.2717     0.0641
Ethnic_CodeHispanic/Latino:TimePost               0.1390     0.0748
Ethnic_CodeOther:TimePost                        -0.2912     0.0797
                                                t value
(Intercept)                                       43.72
Ethnic_CodeHispanic/Latino                        -0.84
Ethnic_CodeOther                                   0.55
TimePost                                          12.30
DomainPartner_Selection                           -2.46
DomainPast_Rel_Behav                               3.34
```

```
DomainRel_Behav_Attit                                6.13
Prior_RshpEducation_collapsedSome/A lot              2.91
Number_AttendedTwo Sessions                         -1.33
Number_AttendedThree Sessions                       -3.01
TimePost:DomainPartner_Selection                     3.06
TimePost:DomainPast_Rel_Behav                       -0.95
TimePost:DomainRel_Behav_Attit                      -1.78
TimePost:Prior_RshpEducation_collapsedSome/A lot    -2.65
TimePost:Number_AttendedTwo Sessions                 1.65
TimePost:Number_AttendedThree Sessions               4.24
Ethnic_CodeHispanic/Latino:TimePost                  1.86
Ethnic_CodeOther:TimePost                           -3.65

Correlation matrix not shown by default, as p = 18 > 12.
Use print(summary(Model.9.RE), correlation=TRUE)  or
     vcov(summary(Model.9.RE))   if you need it
```

	Model 1	Model 2	Model 3
(Intercept)	3.55 ***	3.45 ***	3.49 ***
	(0.04)	(0.05)	(0.08)
Ethnic_CodeHispanic/Latino	-0.02	-0.02	-0.00
	(0.08)	(0.08)	(0.08)
Ethnic_CodeOther	-0.10	-0.10	-0.09
	(0.08)	(0.08)	(0.08)
TimePost	0.99 ***	0.98 ***	0.88 ***
	(0.03)	(0.05)	(0.07)
DomainPartner_Selection		-0.13 *	-0.13 *
		(0.05)	(0.05)
DomainPast_Rel_Behav		0.18 **	0.18 ***
		(0.06)	(0.05)
DomainRel_Behav_Attit		0.33 ***	0.33 ***
		(0.06)	(0.05)
TimePost:DomainPartner_Selection		0.23 **	0.23 **
		(0.08)	(0.08)
TimePost:DomainPast_Rel_Behav		-0.07	-0.07
		(0.08)	(0.08)
TimePost:DomainRel_Behav_Attit		-0.14	-0.14
		(0.08)	(0.08)
Prior_RshpEducation_collapsedSome/A lot			0.18 **
			(0.06)
Number_AttendedTwo Sessions			-0.13
			(0.08)
Number_AttendedThree Sessions			-0.25 ***
			(0.07)
TimePost:Prior_RshpEducation_collapsedSome/A lot			-0.13 *
			(0.05)
TimePost:Number_AttendedTwo Sessions			0.16 *
			(0.07)
TimePost:Number_AttendedThree Sessions			0.31 ***
			(0.06)
AIC	1555.94	1478.22	1454.58
BIC	1585.63	1537.61	1543.66
Log Likelihood	-771.97	-727.11	-709.29
Num. obs.	1042	1042	1042
Num. groups: ID	134	134	134
Var: ID (Intercept)	0.08	0.09	0.08
Var: Residual	0.22	0.20	0.19

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

	Model 1	Model 2
(Intercept)	3.46 ***	3.46 ***
	(0.08)	(0.08)
Ethnic_CodeHispanic/Latino	-0.07	-0.07
	(0.09)	(0.09)
Ethnic_CodeOther	0.05	0.05
	(0.09)	(0.09)
TimePost	0.94 ***	0.94 ***
	(0.08)	(0.08)
DomainPartner_Selection	-0.13 *	-0.13 *
	(0.05)	(0.05)
DomainPast_Rel_Behav	0.18 ***	0.18 ***
	(0.05)	(0.05)
DomainRel_Behav_Attit	0.33 ***	0.33 ***
	(0.05)	(0.05)
Prior_RshpEducation_collapsedSome/A lot	0.19 **	0.19 **
	(0.06)	(0.07)
Number_AttendedTwo Sessions	-0.11	-0.11
	(0.08)	(0.08)
Number_AttendedThree Sessions	-0.23 **	-0.23 **
	(0.07)	(0.08)
TimePost:DomainPartner_Selection	0.23 **	0.23 **
	(0.08)	(0.08)
TimePost:DomainPast_Rel_Behav	-0.07	-0.07
	(0.08)	(0.08)
TimePost:DomainRel_Behav_Attit	-0.13	-0.13
	(0.08)	(0.08)
TimePost:Prior_RshpEducation_collapsedSome/A lot	-0.15 **	-0.15 **
	(0.06)	(0.06)
TimePost:Number_AttendedTwo Sessions	0.12	0.12
	(0.07)	(0.07)
TimePost:Number_AttendedThree Sessions	0.27 ***	0.27 ***
	(0.06)	(0.06)
Ethnic_CodeHispanic/Latino:TimePost	0.14	0.14
	(0.07)	(0.07)
Ethnic_CodeOther:TimePost	-0.29 ***	-0.29 ***
	(0.08)	(0.08)
AIC	1437.99	1509.73
BIC	1536.97	1608.71
Log Likelihood	-698.99	-734.87
Num. obs.	1042	1042
Num. groups: ID	134	134
Var: ID (Intercept)	0.08	0.09
Var: Residual	0.18	0.19

```
==============================================================================
*** p < 0.001, ** p < 0.01, * p < 0.05
```

1.8.2 Testing Signifigance of Regression Coefficients

1.8.2.1 Kenward-Roger method via lmerTest

```
Type III Analysis of Variance Table with Kenward-Roger's method
                                   Sum Sq Mean Sq NumDF  DenDF  F value
Ethnic_Code                         0.231   0.116     2 128.71   0.6170
Time                              142.533 142.533     1 904.51 760.9890
Domain                             13.531   4.510     3 896.79  24.0805
Prior_RshpEducation_collapsed       0.743   0.743     1 127.56   3.9666
Number_Attended                     0.346   0.173     2 127.79   0.9235
Time:Domain                         4.998   1.666     3 897.92   8.8946
Time:Prior_RshpEducation_collapsed  1.313   1.313     1 902.87   7.0097
Time:Number_Attended                3.407   1.703     2 904.40   9.0942
Ethnic_Code:Time                    3.855   1.927     2 903.80  10.2903
                                    Pr(>F)
Ethnic_Code                      0.5411690
Time                             < 2.2e-16 ***
Domain                           5.415e-15 ***
Prior_RshpEducation_collapsed    0.0485485 *
Number_Attended                  0.3997464
Time:Domain                      8.215e-06 ***
Time:Prior_RshpEducation_collapsed 0.0082480 **
Time:Number_Attended             0.0001229 ***
Ethnic_Code:Time                 3.812e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Linear mixed model fit by REML. t-tests use Kenward-Roger's method [
lmerModLmerTest]
Formula:
Score ~ Ethnic_Code + Time + Domain + Time:Domain + Prior_RshpEducation_collapsed +
    Number_Attended + Time:Prior_RshpEducation_collapsed + Time:Number_Attended +
    Time:Ethnic_Code + (1 | ID)
   Data: PICK_clean_longlong2

REML criterion at convergence: 1469.7

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.1702 -0.6944  0.0092  0.6553  3.0157

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.08731  0.2955
 Residual             0.18730  0.4328
Number of obs: 1042, groups:  ID, 134

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                      3.46411    0.07923
Ethnic_CodeHispanic/Latino                      -0.07391    0.08806
Ethnic_CodeOther                                 0.05164    0.09435
TimePost                                         0.93786    0.07628
DomainPartner_Selection                         -0.13188    0.05360
DomainPast_Rel_Behav                             0.18069    0.05408
DomainRel_Behav_Attit                            0.33066    0.05395
Prior_RshpEducation_collapsedSome/A lot          0.19234    0.06603
Number_AttendedTwo Sessions                     -0.11115    0.08349
Number_AttendedThree Sessions                   -0.22973    0.07639
TimePost:DomainPartner_Selection                 0.23146    0.07565
TimePost:DomainPast_Rel_Behav                   -0.07225    0.07601
TimePost:DomainRel_Behav_Attit                  -0.13490    0.07595
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.14720    0.05560
TimePost:Number_AttendedTwo Sessions             0.11621    0.07062
TimePost:Number_AttendedThree Sessions           0.27166    0.06407
Ethnic_CodeHispanic/Latino:TimePost              0.13895    0.07483
Ethnic_CodeOther:TimePost                       -0.29116    0.07969
                                                      df t value
(Intercept)                                   265.84217  43.722
Ethnic_CodeHispanic/Latino                    194.33165  -0.839
Ethnic_CodeOther                              186.68898   0.547
TimePost                                      898.25756  12.295
DomainPartner_Selection                       896.87565  -2.461
DomainPast_Rel_Behav                          898.23665   3.341
DomainRel_Behav_Attit                         897.53641   6.129
```

```
Prior_RshpEducation_collapsedSome/A lot          189.72154   2.913
Number_AttendedTwo Sessions                      193.54653  -1.331
Number_AttendedThree Sessions                    187.28890  -3.007
TimePost:DomainPartner_Selection                 896.63426   3.060
TimePost:DomainPast_Rel_Behav                    899.22787  -0.951
TimePost:DomainRel_Behav_Attit                   897.85725  -1.776
TimePost:Prior_RshpEducation_collapsedSome/A lot 902.86575  -2.648
TimePost:Number_AttendedTwo Sessions             908.33608   1.646
TimePost:Number_AttendedThree Sessions           899.70442   4.240
Ethnic_CodeHispanic/Latino:TimePost              909.40770   1.857
Ethnic_CodeOther:TimePost                        897.96842  -3.654
                                                 Pr(>|t|)
(Intercept)                                       < 2e-16 ***
Ethnic_CodeHispanic/Latino                       0.402320
Ethnic_CodeOther                                 0.584774
TimePost                                          < 2e-16 ***
DomainPartner_Selection                          0.014062 *
DomainPast_Rel_Behav                             0.000869 ***
DomainRel_Behav_Attit                            1.32e-09 ***
Prior_RshpEducation_collapsedSome/A lot          0.004009 **
Number_AttendedTwo Sessions                      0.184667
Number_AttendedThree Sessions                    0.002998 **
TimePost:DomainPartner_Selection                 0.002282 **
TimePost:DomainPast_Rel_Behav                    0.342101
TimePost:DomainRel_Behav_Attit                   0.076031 .
TimePost:Prior_RshpEducation_collapsedSome/A lot 0.008248 **
TimePost:Number_AttendedTwo Sessions             0.100208
TimePost:Number_AttendedThree Sessions           2.47e-05 ***
Ethnic_CodeHispanic/Latino:TimePost              0.063634 .
Ethnic_CodeOther:TimePost                        0.000273 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
     vcov(x)     if you need it
```

2 Comparing Models

Table 12: Table continues below

Predictor	Orig. Mod. Est.	Orig. p
(Intercept)	3.264	0.000
Age_Decades	0.038	0.215
Ethnic_CodeHispanic/Latino	-0.053	0.572
Ethnic_CodeOther	0.072	0.458
Education_3catSome college	-0.060	0.443
Education_3catTech./College/Grad Degree	-0.058	0.453
FinancialWorry_catOften	0.088	0.321
FinancialWorry_catAlmost all the time	0.058	0.474
GenderFemale	0.064	0.425
Divorced_DichotomousDivorced	-0.057	0.397
TimePost	0.938	0.000
DomainPartner_Selection	-0.132	0.014
DomainPast_Rel_Behav	0.181	0.001
DomainRel_Behav_Attit	0.331	0.000
Prior_RshpEducation_collapsedSome/A lot	0.200	0.004
Number_AttendedTwo Sessions	-0.111	0.200
Number_AttendedThree Sessions	-0.222	0.006
TimePost:DomainPartner_Selection	0.232	0.002
TimePost:DomainPast_Rel_Behav	-0.073	0.340
TimePost:DomainRel_Behav_Attit	-0.136	0.074
TimePost:Prior_RshpEducation_collapsedSome/A lot	-0.147	0.008
TimePost:Number_AttendedTwo Sessions	0.115	0.103
TimePost:Number_AttendedThree Sessions	0.272	0.000
Ethnic_CodeHispanic/Latino:TimePost	0.139	0.063
Ethnic_CodeOther:TimePost	-0.291	0.000

Trim. Mod. Est.	Trim. p	Diff. Est.	Diff. p
3.464	0.000	0.200	-0.000
NA	NA	NA	NA
-0.074	0.402	-0.021	-0.170
0.052	0.585	-0.020	0.127
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
0.938	0.000	0.000	-0.000
-0.132	0.014	0.000	0.000
0.181	0.001	-0.000	0.000

Trim. Mod. Est.	Trim. p	Diff. Est.	Diff. p
0.331	0.000	-0.001	0.000
0.192	0.004	-0.008	0.000
-0.111	0.185	-0.000	-0.016
-0.230	0.003	-0.008	-0.003
0.231	0.002	-0.000	0.000
-0.072	0.342	0.000	0.002
-0.135	0.076	0.001	0.002
-0.147	0.008	-0.000	-0.000
0.116	0.100	0.001	-0.003
0.272	0.000	-0.000	0.000
0.139	0.064	-0.000	0.000
-0.291	0.000	-0.000	-0.000

3 Textual Summary

3.1 Methods

Needs to be updated to discuss removal of non-significant predictors

To evaluate the program quantitatively, we examined the impact of the program (i.e., post vs. retrospective pre-program assessments) on the four outcomes (Skills, Partner Selection, Relationship Patterns, Behavior and Attitudes) described above. We used a linear mixed effects model instead of a repeated measures MANOVA in order to assess interactions between multiple covariates, both continuous and categorical. Furthermore, mixed effects models do not assume homogeneity of variance. Specifically, we used a random intercept multilevel regression model (RI MLM) in which scores on the four outcomes at two assessments (retrospective-pre and post-program) were nested within participant.

First, we tested whether the program (i.e., post vs. retrospective pre-program assessment) had a significant effect on the four outcomes (all main effects were tested simultaneously) even after controlling for demographic covariates. In other words, did participants experience the hypothesized gains on the four outcomes? Second, we tested whether the effect of the program differed for each outcome by including interactions with outcome level. Did participants gain more on some outcomes than for others? Third, we tested whether the effect of the program varied by dosage and prior exposure to relationship education by including interactions with dosage and prior exposure. Did participants gain more if they attended more courses or had not previously received relationship eduation? Finally, we examined whether the effect of the program varied by age, race/ethnicity, education level, financial worry, gender, and divorce history by adding additional interactions one-at-a-time. Significant interactions were retained in the final model. To reduce the risk of Type I error in detecting the effects of demographic variables, a Bonferroni correction was used. Significance of predictors was tested using the likelihood ratio test following recommendations of Hox, Moerbeek, & van de Schoot (2018). Analyses were conducted using the lme4 package (Bates, Machler, Boker, & Walker, 2015) in R version 3.5.0 (R Core Team, 2018) and RStudio version 1.1.453 (RStudio Team, 2018). 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 above to the measurement section.

3.2 Results

A series of nested multilevel regression models (RI MLM) were compared and indicated that, on average, participants gained in knowledge and skills ($\beta = 0.99$, $\chi^2 = 753.075$, $df = 1$, $p < .001$). The effect of the program varied by outcome ($\chi^2 = 25.555$, $df = 3$, $p < .001$), prior exposure to relationship education ($\chi^2 = 5.246$, $df = 1$, $p = .022$), dosage ($\chi^2 = 23.481$, $df = 2$, $p < .001$), and race/ethnicity ($\chi^2 = 20.593$, $df = 2$, $p < .001$)

The average gains in knowledge and skills for each outcome were as follows. Significance of regression coefficients was tested using the lmerTest package (Kuznetsova, Brockhoff, & Christensen, 2017) using Kenward-Roger's method. Each covariate was held at its reference group – i.e., briefly, in

terms of significant covariates: a Caucasian participant who attended only one session and had not previously received relationship education: Skills, $\beta = 0.938$, $t = 12.295$, $df = 898.258$, $p < .001$; Partner Selection, $\beta = 1.169$, $t = 15.294$, $df = 897.819$, $p < .001$; Relationship Patterns, $\beta = 0.866$, $t = 11.286$, $df = 898.494$, $p < .001$; and Behavior and Attitudes, $\beta = 0.803$, $t = 10.468$, $df = 898.951$, $p < .001$. The program had a significant effect on all outcomes even after controlling for age, ethnicity, prior relationship education, the number of classes attended (dosage), education level, financial worry, gender, and divorce history.

Our analyses also tested whether the effect of the program varied by prior experience with relationship education, dosage, and (using a Bonferroni correction) demographic covariates. All interactions are shown in Figure 1. Participants who had previously received relationship education through courses, counseling, workshops, etc. gained less than those who had not (β = -0.147, t = -2.648, df = 902.222, p = .008). Gains were greater for participants who attended three sessions compared to only one ($\beta = 0.272$, $t = 4.240$, $df = 899.046$, $p < .001$). Gains did not differ for participants who attended two sessions compared to only one ($\beta = 0.116$, $t = 1.646$, $df = 907.717$, $p = .100$).

The only demographic covariate that significantly moderated the effect of the program was race/ethnicity. There was no difference in the effect of the program for participants who identified as Hispanic/Latino than for participants who identified as Caucasian ($\beta = 0.139$, $t = 1.857$, $df = 908.794$, $p = .064$). However, the program had a diminished effect for participants who identified as another race/ethnicity than for participants who identified as Caucasian (β = -0.291, t = -3.654, df = 897.302, $p < .001$).

3.3 Limitations

- "What he/she learned from his/her family when growing up" appears to load with the item, "How he/she fights when angry", "How he/she reacts when my feelings are hurt", and "What he/she believes about right and wrong" instead of the factors it is currently associated with.
- If not already included, the extremely high level of skewness ("ceiling effect") at the item level for most items at post should be acknowledged. The residuals of the model look fine, indicating that the skewness at the construct level is not an issue. However, this doesn't negate the skewness at the item level and that it limits how much information the measure gives us and how much growth indivduals could experience.
- Might consider reporting congeneric reliabilty, which is more appropriate for skewed data, in addiiton to Cronbach's alpha.

3.4 References

Bates, D., Machler, M., Boker, B., & Walker, S. (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software, 67*(1), 1 - 48. doi: 10.18637/jss.v067.i01

Hox, J. J., Moerbeek, M., & van de Schoot, R. (2018). *Multilevel analysis: Techniques and applications.* New York: Routledge.

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software, 82*(13). https://doi.org/10.18637/jss.v082.i13

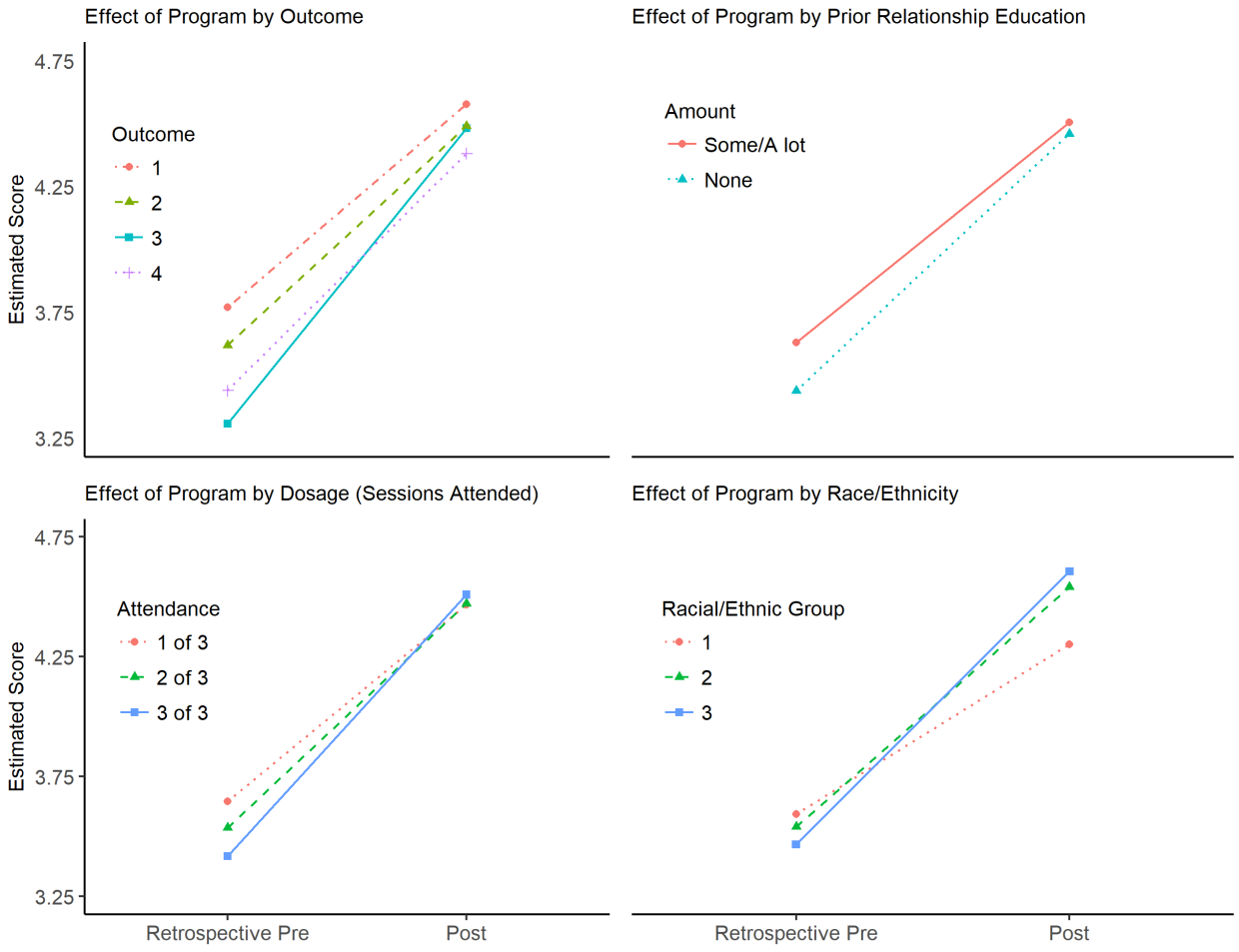
R Core Team (2018). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. URL: http://www.R-project.org/.

RStudio Team (2018). *RStudio: Integrated Development for R.* RStudio, Inc., Boston, MA. URL: http://www.rstudio.com/.

3.4.1 Notes on Results Section

- Make sure methods section says "Another race" rather than "Other"

3.4.2 Figure 1. Effect of Program by Outcome, Prior Relationship Education, Dosage, and Race/Ethnicity



Note. Outcome 1: Relationship Behavior and Attitudes, Outcome 2: Past Relationship Behavior, Outcome 3: Partner Selection, Outcome 4: Healthy Relationship Skills, Racial/Ethnic Group 1: Another Race/Ethnicity, Racial/Ethnic Group 2: Caucasian, and Racial/Ethnic Group 3: Hispanic/Latino.