PICK Pilot Mixed Methods Evaluation

Revised Quantitative Analyses and Results: Dropping Non-Significant Predictors and Using all Available Data

19 July 2018

Contents

0.1 Continuous Outcomes: Means and Standard Deviations. Also Testing for Difference in Analytic Sample vs. Full Sample.

```
Warning in chisq.test(d$split, d[[i]]): Chi-squared approximation may be
incorrect

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incorrect

Warning in chisq.test(d$split, d[[i]]): Chi-squared approximation may be
incorrect
```

	In Analysis Sample4		
	FALSE	TRUE	P-Value
	n = 23	n = 165	
Age_Decades			0.127
	4.16 (1.31)	3.67 (1.22)	
Age_Groups			0.128
18-30	4 (17.4%)	63 (38.2%)	
31-40	3 (13%)	37 (22.4%)	
41-50	7 (30.4%)	34 (20.6%)	
51+	6 (26.1%)	26 (15.8%)	
NA	3 (13%)	5 (3%)	
Ethnic_Code			0.851
Caucasian	10 (43.5%)	113 (68.5%)	
Hispanic/Latino	3 (13%)	29 (17.6%)	
Other	3 (13%)	23 (13.9%)	
NA	7 (30.4%)	0 (0%)	
Education_3cat			0.691
High school graduate/GED/No degree	7 (30.4%)	67 (40.6%)	
Some college	6 (26.1%)	35 (21.2%)	
Tech./College/Grad Degree	8 (34.8%)	56 (33.9%)	
NA	2 (8.7%)	7 (4.2%)	
Income_10K			0.723

	1.96 (2.07)	1.78 (1.73)	
Gender			0.806
Male	3 (13%)	29 (17.6%)	
Female	20 (87%)	136 (82.4%)	
NA	0 (0%)	0 (0%)	
Divorced_Dichotomous			0.396
Never Divorced	7 (30.4%)	70 (42.4%)	
Divorced	13 (56.5%)	76 (46.1%)	
NA	3 (13%)	19 (11.5%)	
FinancialWorry_cat			0.729
Never, Once in a While, Hardly Ever	4 (17.4%)	36 (21.8%)	
Often	9 (39.1%)	53 (32.1%)	
Almost all the time	9 (39.1%)	74 (44.8%)	
NA	1 (4.3%)	2 (1.2%)	
Prior_RshpEducation_collapsed			0.924
None	9 (39.1%)	80 (48.5%)	
Some/A lot	8 (34.8%)	85 (51.5%)	
NA	6 (26.1%)	0 (0%)	
Number_Attended			0.029
One Session	12 (52.2%)	55 (33.3%)	
Two Sessions	1 (4.3%)	44 (26.7%)	
Three Sessions	7 (30.4%)	66 (40%)	
NA	3 (13%)	0 (0%)	
Dosage			0.849
Partial	13 (56.5%)	99 (60%)	
Full	7 (30.4%)	66 (40%)	
NA	3 (13%)	0 (0%)	
Healthy_Rel_Skills_Before			0.431
	3.43 (1.17)	3.17 (0.87)	
Partner_Selection_Before			0.563
	3.12 (1.43)	2.88 (0.97)	
Past_Rel_Behav_Before			0.627
	3.62 (1.36)	3.42 (0.91)	
Rel_Behav_Attit_Before			0.746
	3.54 (1.33)	3.66 (0.84)	
Healthy_Rel_Skills			0.855
	4.42 (0.67)	4.46 (0.54)	
Partner_Selection			0.926
	4.56 (0.63)	4.54 (0.54)	
Past_Rel_Behav			0.768
	4.45 (1.04)	4.53 (0.57)	
Rel_Behav_Attit			0.492
	4.42 (1.05)	4.62 (0.55)	
In Analysis Sample4			<.001
FALSE	23 (100%)	0 (0%)	
TRUE	0 (0%)	165 (100%)	
NA	0 (0%)	0 (0%)	

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): 0.285892
```

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): 0.310606
```

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 ($\chi^2 = 3.261$, $df = 2$, $p = .196$).

1.3.1.2 Effect of Time Controlling for Demographics

The effect of Time was significant ($\chi^2 = 907.791$, $df = 1$, $p < .001$), 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_longlong4

     AIC      BIC   logLik deviance df.resid
  1800.7   1862.5   -888.4   1776.7     1262

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9190 -0.6774  0.0039  0.6726  3.0135

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0861   0.294
 Residual             0.1950   0.442
Number of obs: 1274, groups:  ID, 165

Fixed effects:
                                 Estimate Std. Error t value
(Intercept)                       3.47998    0.04547   76.53
Ethnic_CodeHispanic/Latino       -0.00617    0.06986   -0.09
Ethnic_CodeOther                 -0.11968    0.07653   -1.56
TimePost                          0.99732    0.04949   20.15
DomainPartner_Selection          -0.12045    0.04962   -2.43
DomainPast_Rel_Behav              0.19209    0.05010    3.83
DomainRel_Behav_Attit             0.36133    0.04991    7.24
TimePost:DomainPartner_Selection  0.21166    0.06984    3.03
TimePost:DomainPast_Rel_Behav    -0.10045    0.07019   -1.43
TimePost:DomainRel_Behav_Attit   -0.18653    0.07003   -2.66

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 -0.310
Ethnc_CdOth -0.287  0.185
TimePost    -0.550 -0.001  0.007
DmnPrtnr_Sl -0.544  0.000  0.003  0.500
DmnPst_Rl_B -0.539  0.001  0.002  0.496  0.494
DmnRl_Bhv_A -0.541  0.001 -0.001  0.497  0.495  0.493
TmPst:DmP_S  0.387  0.000 -0.004 -0.706 -0.710 -0.351 -0.352
```

```
TmPs:DP_R_B  0.386 -0.001 -0.005 -0.704 -0.353 -0.714 -0.352  0.498
TmPs:DR_B_A  0.386 -0.001  0.000 -0.705 -0.353 -0.352 -0.713  0.499
            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 ($\chi^2 = 79.192$, $df = 3$, $p < .001$), indicating that the domains (averaged jointly across Retrospective Pre and Post) different significantly.

1.4.1.2 Effect of Time X Domain

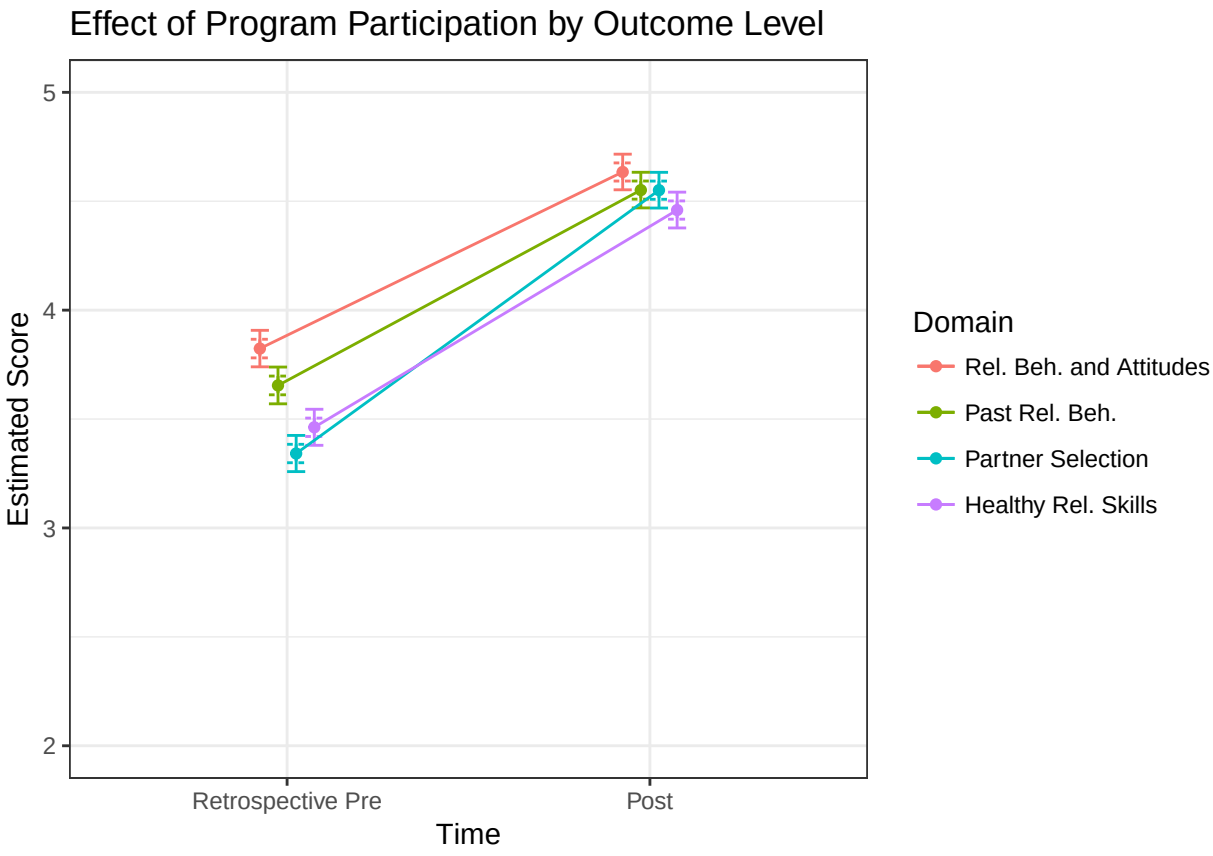
The effect of Time varied significantly by outcome level ($\chi^2 = 35.407$, $df = 3$, $p < .001$), indicating that the average effect of program participation varied by outcome.

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 ($\chi^2 = 114.599$, $df = 6$, $p < .001$).

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  3.434002 0.04178231 402.40 3.351863 3.516141  1
 Healthy_Rel_Skills 3.447218 0.04173459 401.54 3.365173 3.529264  1
 Past_Rel_Behav     3.587619 0.04192189 407.39 3.505209 3.670029   2
 Rel_Behav_Attit    3.713000 0.04185235 405.21 3.630725 3.795275    3

Time = Post:
 Domain               emmean         SE     df lower.CL upper.CL .group
 Partner_Selection  4.413165 0.04168124 400.25 4.331223 4.495106  1
 Healthy_Rel_Skills 4.426381 0.04167957 401.02 4.344443 4.508319  1
 Past_Rel_Behav     4.566782 0.04165126 400.02 4.484899 4.648664   2
 Rel_Behav_Attit    4.692163 0.04163115 399.51 4.610319 4.774006    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	1.00	20.15	—	—	—	—	—	—
2. Partner Sel.	1.21	24.44	0.21	3.03	—	—	—	—
3. Past Rel. Beh.	0.90	17.99	-0.10	-1.43	-0.31	-4.45	—	—
4. Rel. Beh. Att.	0.81	16.32	-0.19	-2.66	-0.40	-5.69	-0.09	-1.23

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 ($\chi^2 = 7.321$, $df = 3$, $p = .062$).

1.5.1.2 Effect of Time X Prior Exposure

The include of Time varied significantly by Prior Exposure ($\chi^2 = 10.178$, $df = 1$, $p = .001$).

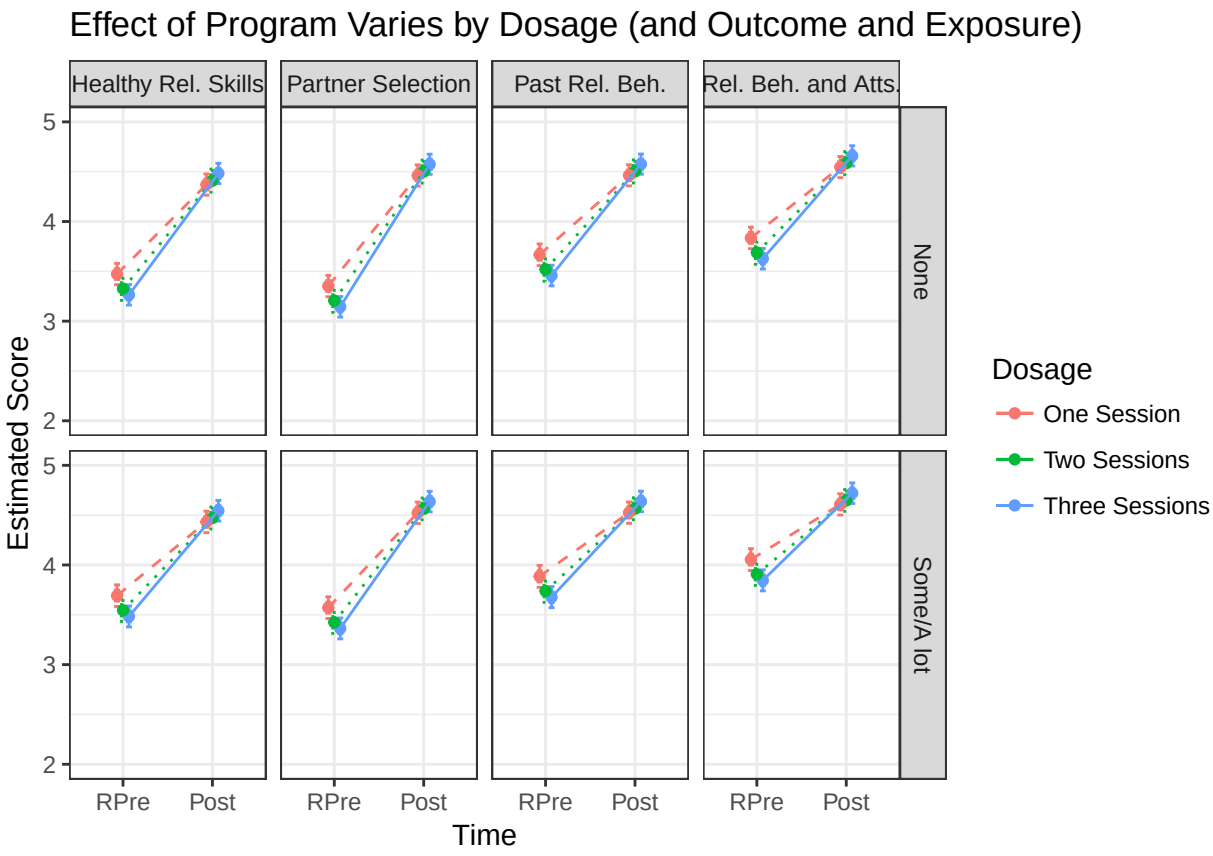
1.5.1.3 Effect of Time X Dosage

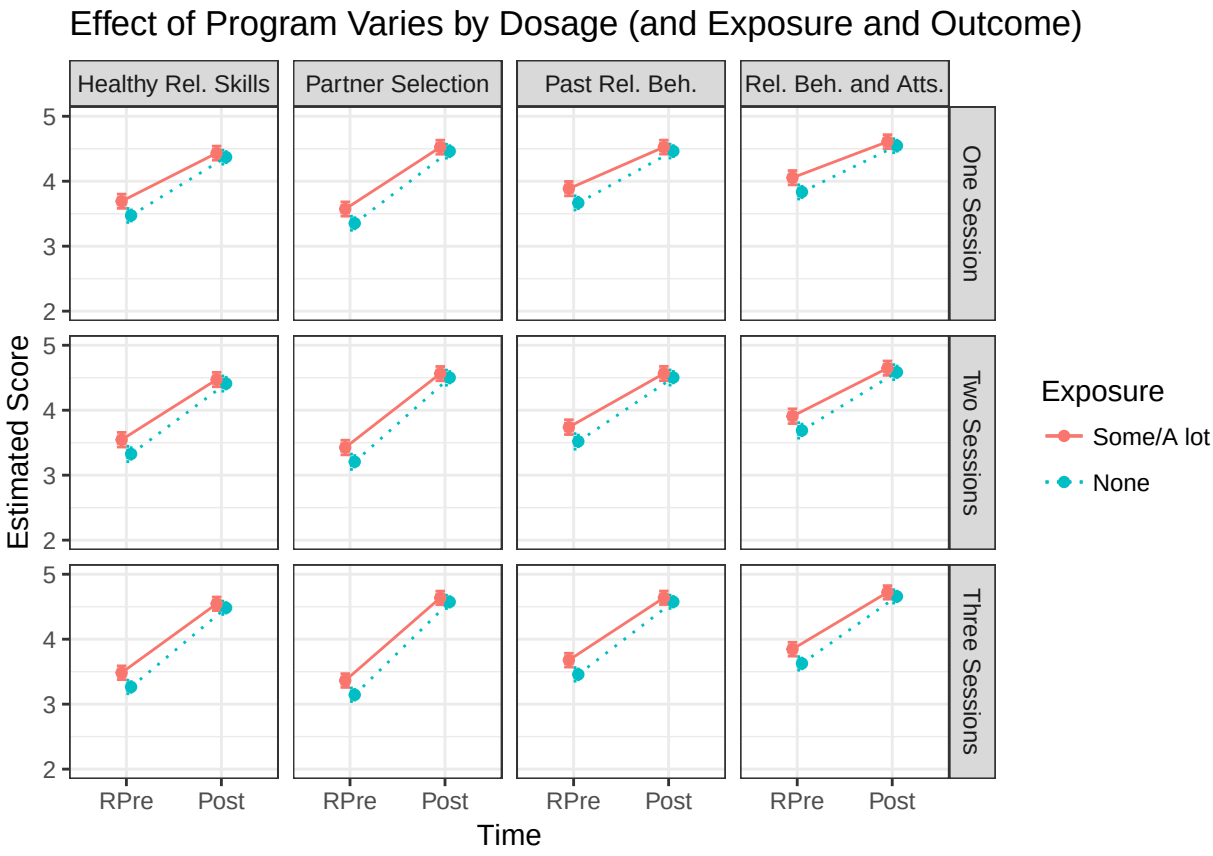
The effect of Time varied by Dosage ($\chi^2 = 31.158$, $df = 2$, $p < .001$).

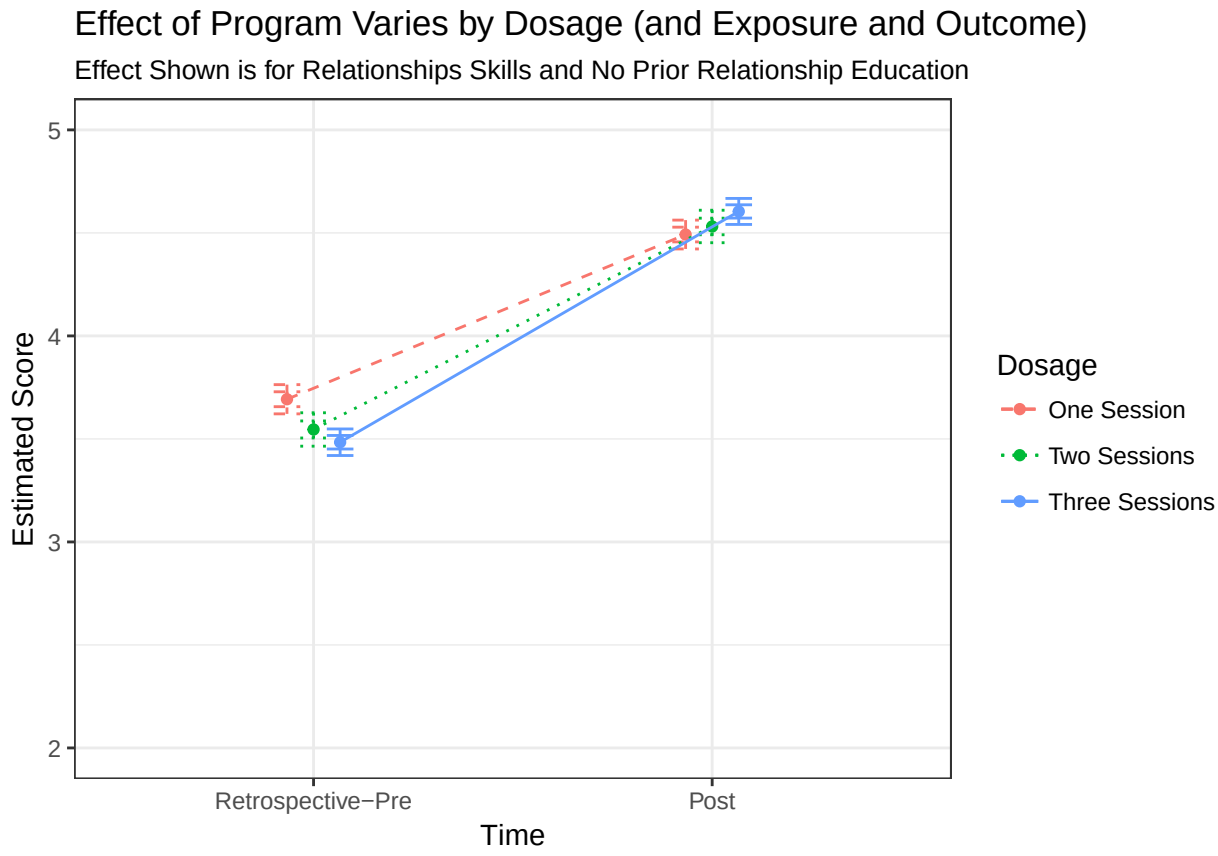
1.5.1.4 Effect of Time X Prior Exposure and Time X Dosage

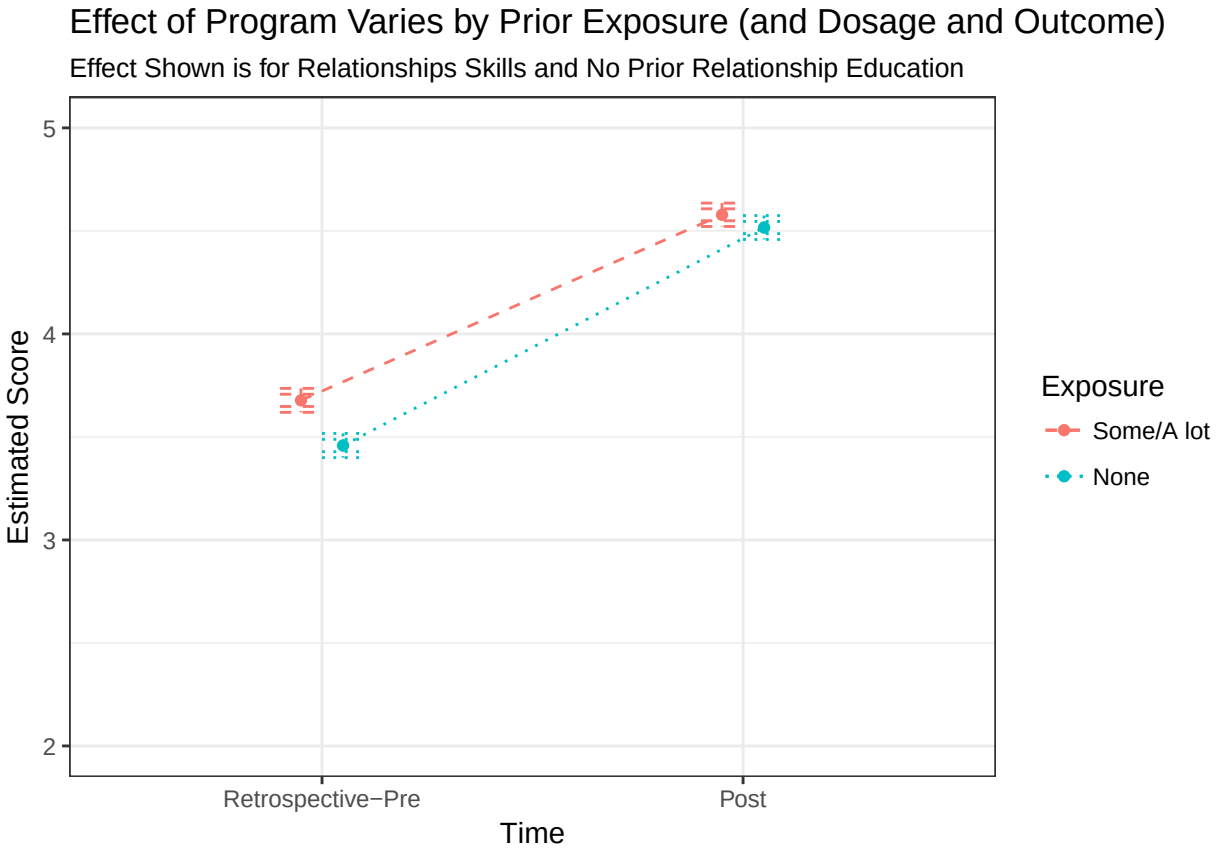
The addition of prior exposure, dosage, and their respective interactions with time as predictors significantly improved model fit ($\chi^2 = 47.956$, $df = 6$, $p < .001$).

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                           3.450083 0.04382412 247.50 3.363767
 Some/A lot                     3.669283 0.04827098 231.70 3.574177
 upper.CL .group
 3.536399  1
 3.764389   2

Time = Post:
 Prior_RshpEducation_collapsed   emmean         SE     df lower.CL
 None                           4.497854 0.04362142 243.57 4.411931
 Some/A lot                     4.559712 0.04783467 225.31 4.465451
 upper.CL .group
 4.583778  1
 4.653972  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  3.469455 0.05181313 234.06 3.367375 3.571534  1
 Two Sessions    3.531428 0.05926277 254.93 3.414721 3.648135  12
 One Session     3.678166 0.05240629 250.12 3.574952 3.781380   2

Time = Post:
 Number_Attended   emmean         SE     df lower.CL upper.CL .group
 One Session     4.478372 0.05205762 244.61 4.375834 4.580911  1
 Two Sessions    4.517496 0.05862242 246.56 4.402032 4.632961  1
 Three Sessions  4.590480 0.05132981 227.12 4.489337 4.691624  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.	0.898	14.053	—	—	—	—
2. Att. 2 Sess.	1.084	15.436	0.186	2.884	—	—
3. Att. 3 Sess.	1.219	19.773	0.321	5.616	0.135	2.182

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 ($\chi^2 = 31.710$, $df = 2$, $p < .001$).

1.7 Diagnostics

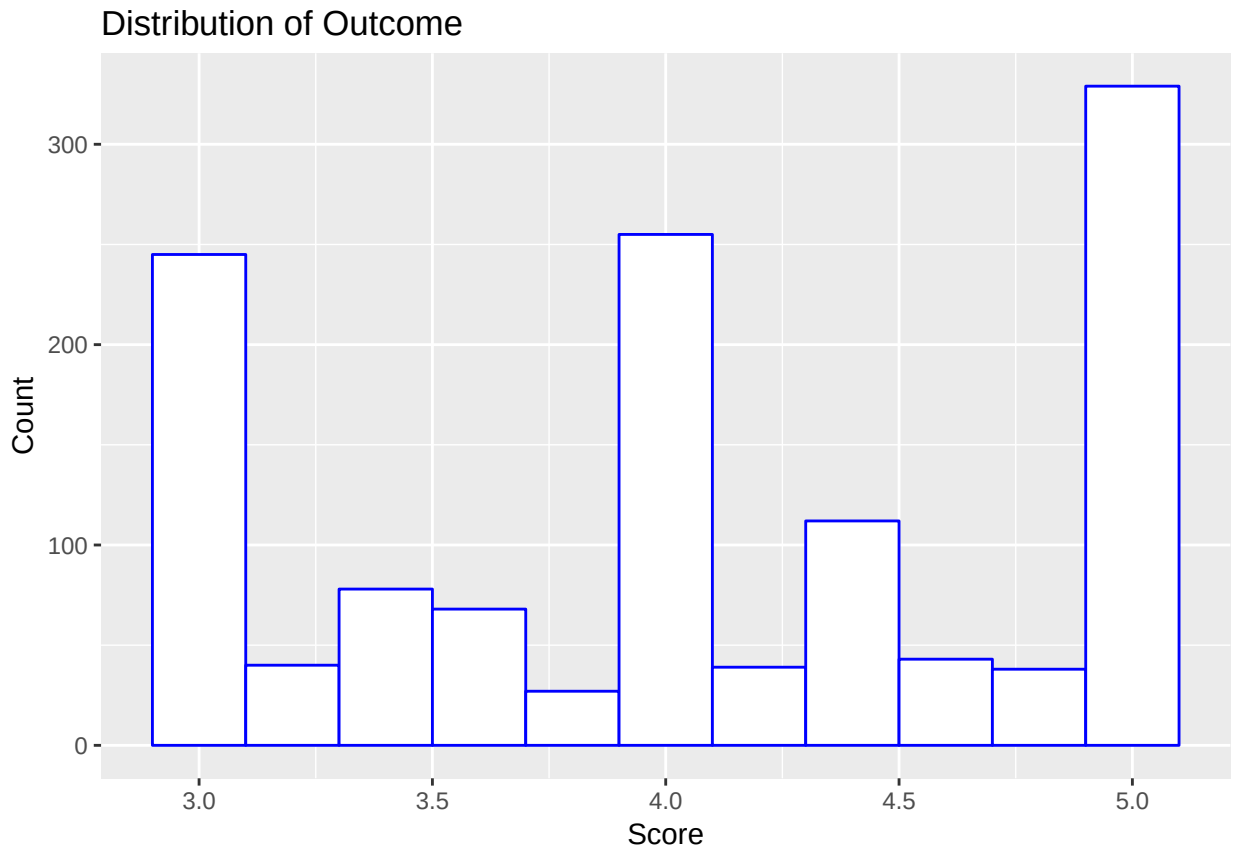
1.7.1 The model

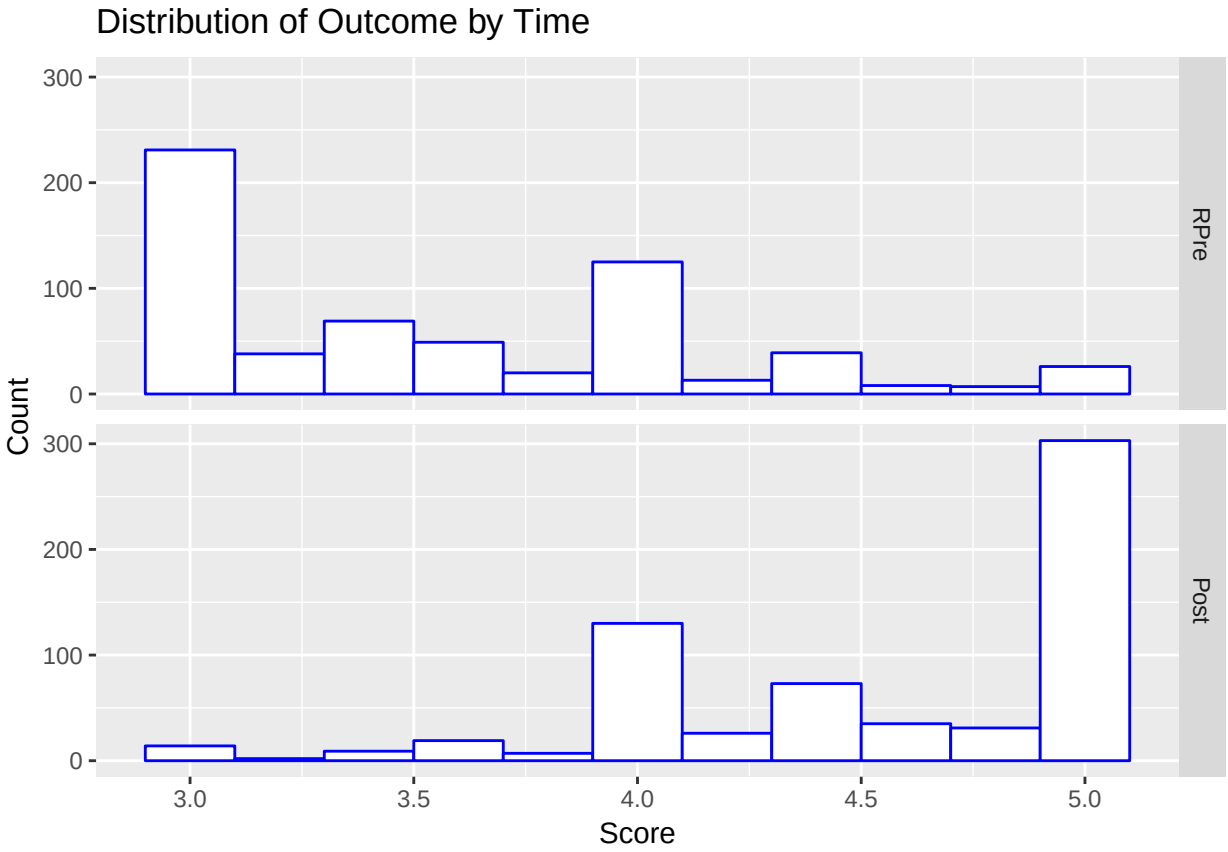
```
Linear mixed model fit by REML ['lmerMod']
Formula:
Score ~ Ethnic_Code + Time + Domain + Time:Domain + Prior_RshpEducation_collapsed +
    Number_Attended + Time:Prior_RshpEducation_collapsed + Time:Number_Attended +
    Time:Ethnic_Code + (1 | ID)
   Data: PICK_clean_longlong4

REML criterion at convergence: 1772.6

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.199 -0.696  0.024  0.657  2.960

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0849   0.291
 Residual             0.1851   0.430
Number of obs: 1274, groups:  ID, 165

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4579     0.0709
Ethnic_CodeHispanic/Latino                       -0.0836     0.0784
Ethnic_CodeOther                                  0.0635     0.0867
TimePost                                          0.9428     0.0686
DomainPartner_Selection                          -0.1196     0.0483
DomainPast_Rel_Behav                              0.1932     0.0488
DomainRel_Behav_Attit                             0.3612     0.0486
Prior_RshpEducation_collapsedSome/A lot           0.2307     0.0594
Number_AttendedTwo Sessions                      -0.1240     0.0755
Number_AttendedThree Sessions                    -0.1905     0.0678
TimePost:DomainPartner_Selection                  0.2120     0.0680
TimePost:DomainPast_Rel_Behav                    -0.0984     0.0684
TimePost:DomainRel_Behav_Attit                   -0.1844     0.0682
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1809     0.0503
TimePost:Number_AttendedTwo Sessions              0.1459     0.0643
TimePost:Number_AttendedThree Sessions            0.2863     0.0573
Ethnic_CodeHispanic/Latino:TimePost               0.1948     0.0670
Ethnic_CodeOther:TimePost                        -0.3023     0.0735
                                                t value
(Intercept)                                       48.80
Ethnic_CodeHispanic/Latino                        -1.07
Ethnic_CodeOther                                   0.73
```

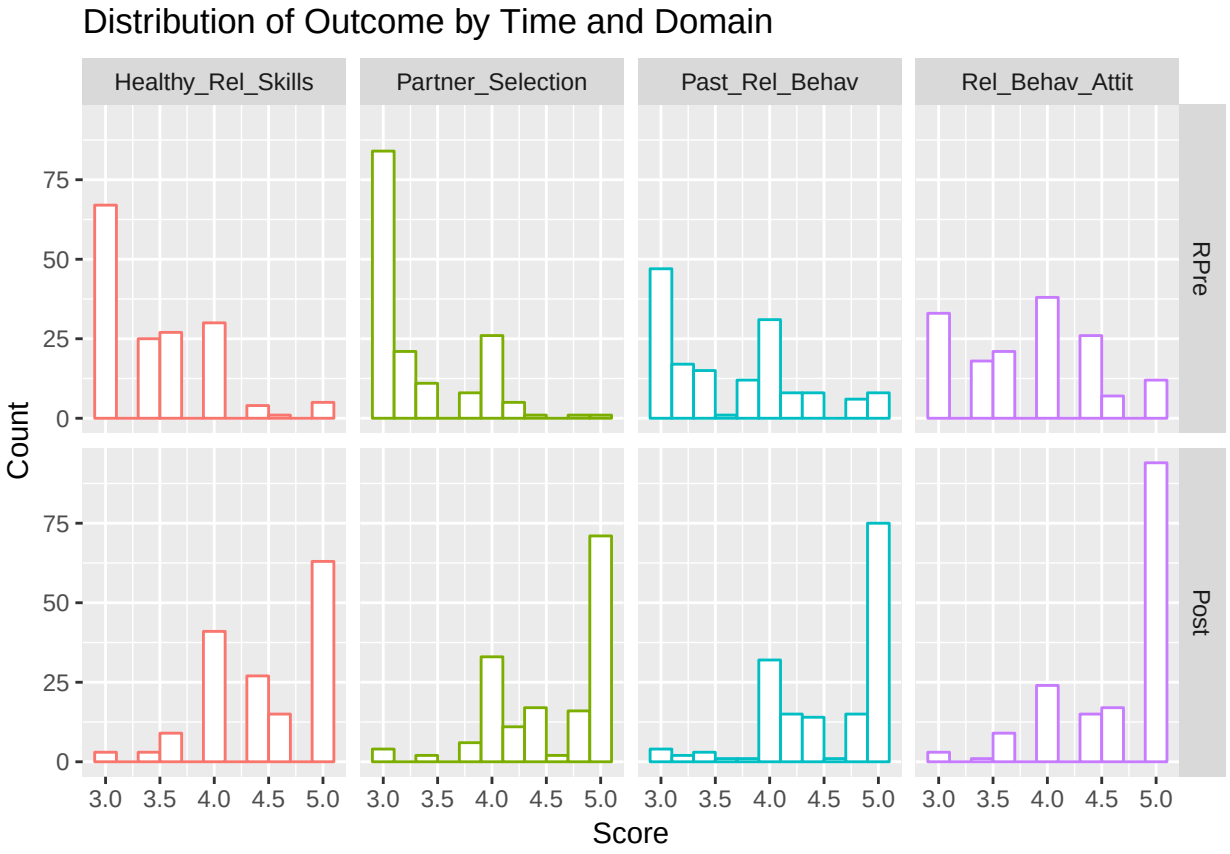
```
TimePost                                            13.75
DomainPartner_Selection                             -2.47
DomainPast_Rel_Behav                                 3.96
DomainRel_Behav_Attit                                7.43
Prior_RshpEducation_collapsedSome/A lot              3.88
Number_AttendedTwo Sessions                         -1.64
Number_AttendedThree Sessions                       -2.81
TimePost:DomainPartner_Selection                     3.12
TimePost:DomainPast_Rel_Behav                       -1.44
TimePost:DomainRel_Behav_Attit                      -2.70
TimePost:Prior_RshpEducation_collapsedSome/A lot    -3.60
TimePost:Number_AttendedTwo Sessions                 2.27
TimePost:Number_AttendedThree Sessions               4.99
Ethnic_CodeHispanic/Latino:TimePost                  2.91
Ethnic_CodeOther:TimePost                           -4.11

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

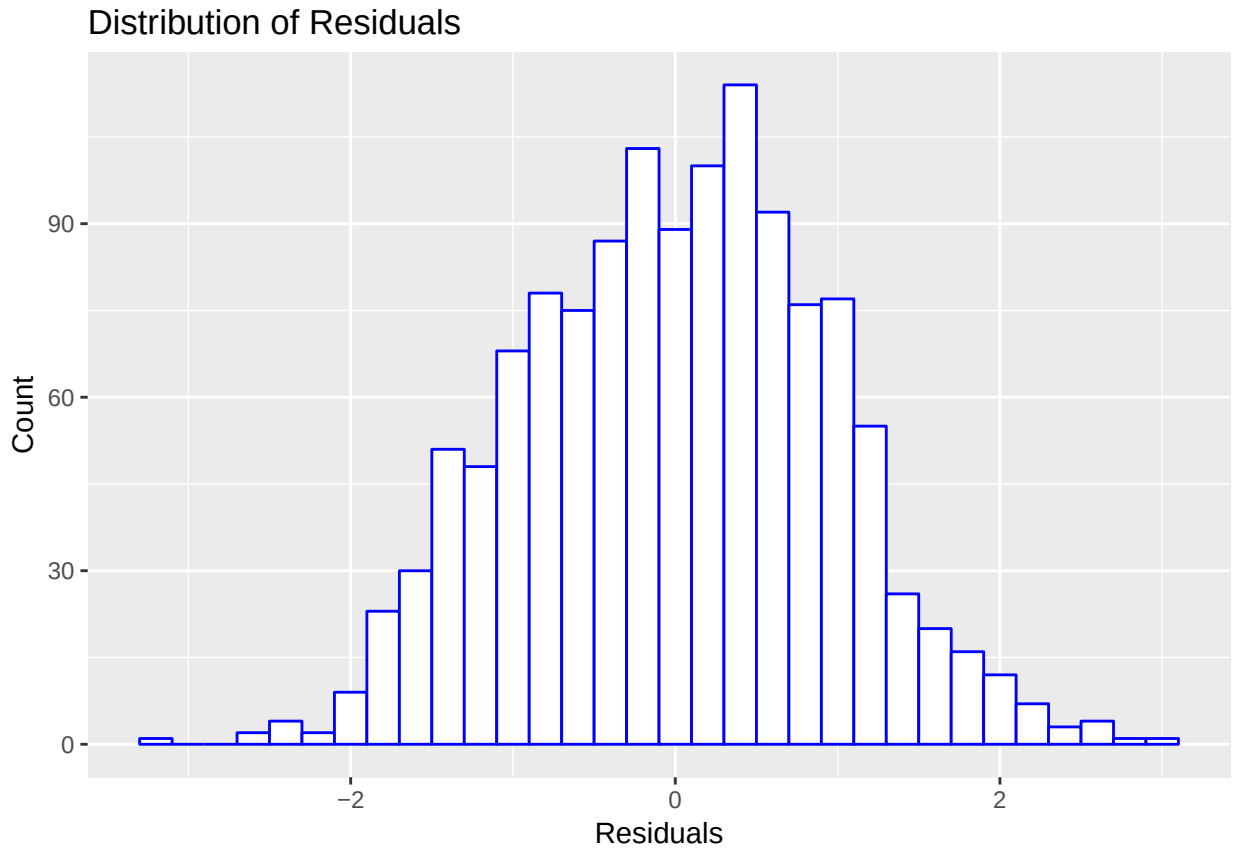
- Not an assumption, but could indicate need for a different link function.

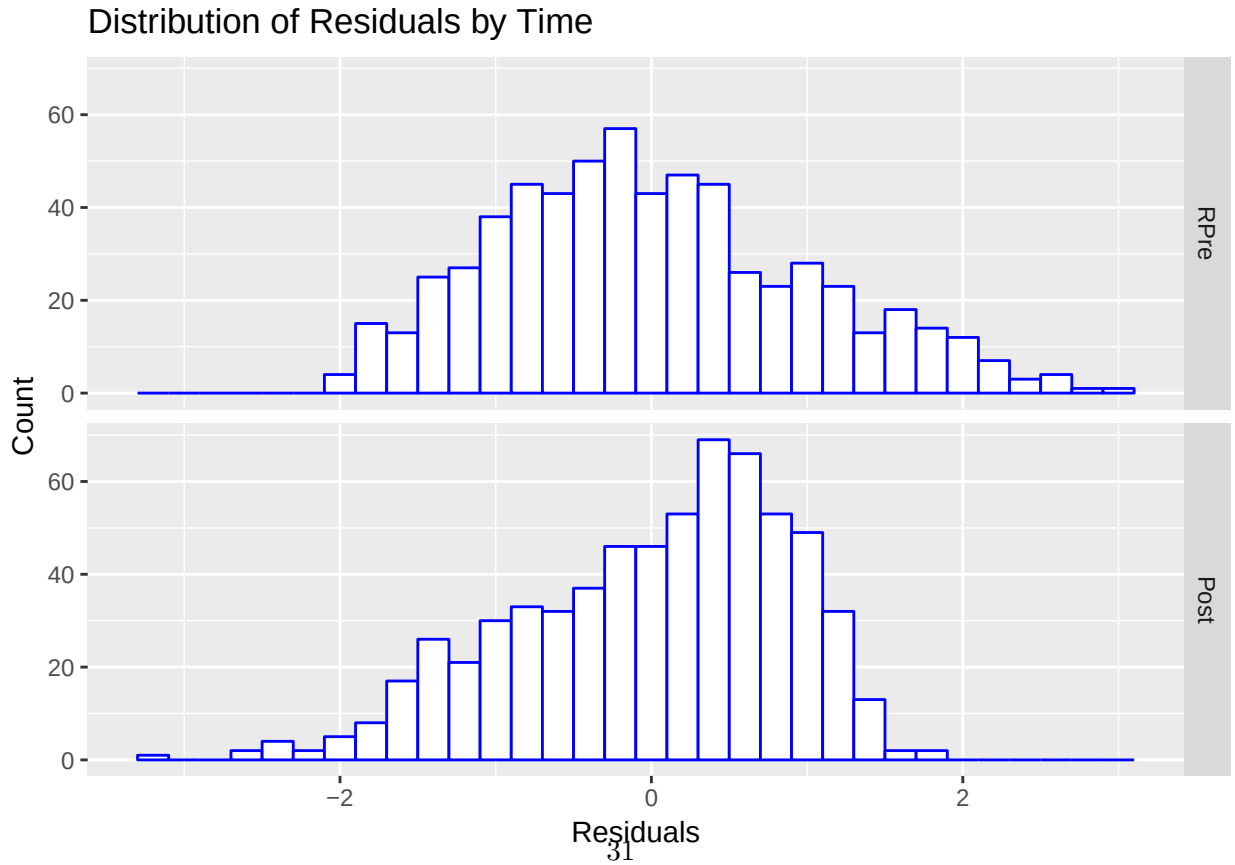


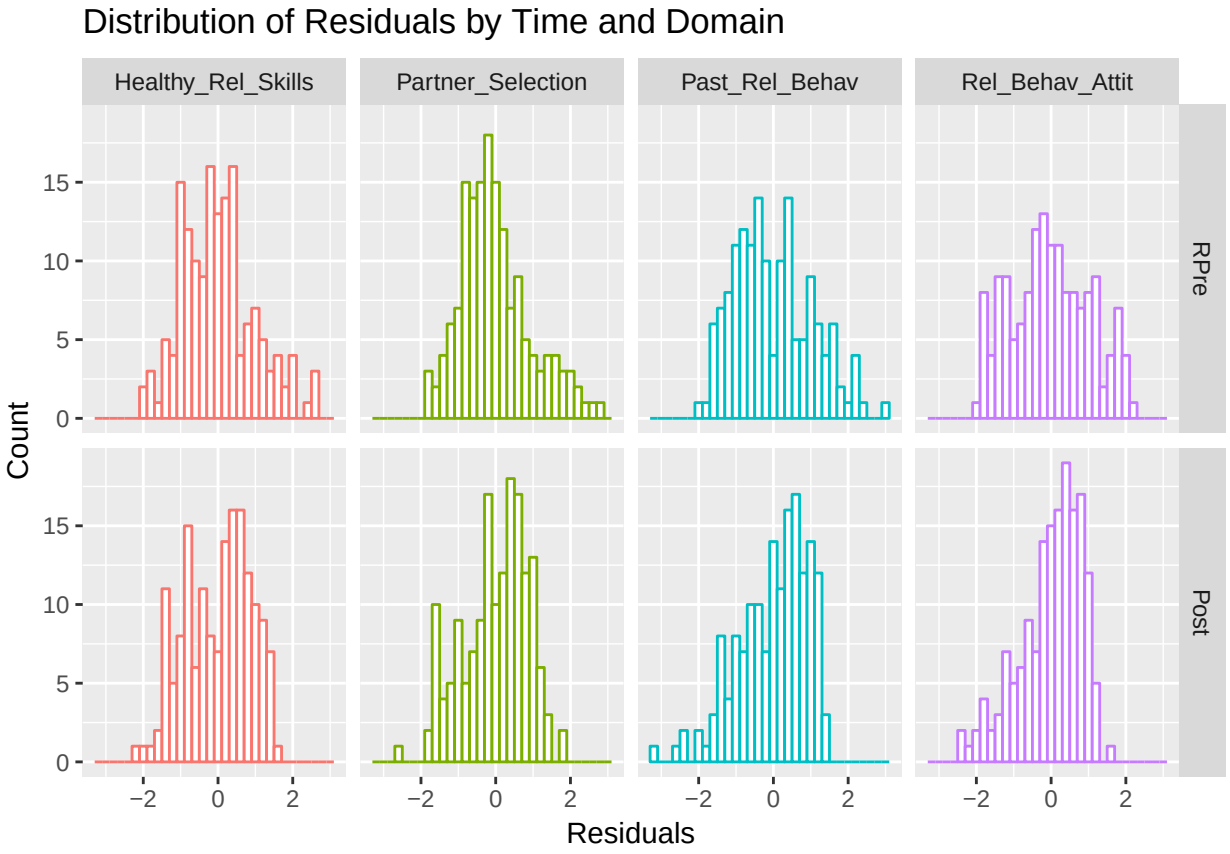

Distribution of Outcome by Time
Count
300
200
100
0
RPre
Post
3.0
3.5
4.0
4.5
5.0
Score


Distribution of Outcome by Time and Domain
Healthy_Rel_Skills
Partner_Selection
Past_Rel_Behav
Rel_Behav_Attit
RPre
Post
Count
0
25
50
75
3.0
3.5
4.0
4.5
5.0
Score

1.7.3 Normality of Residuals

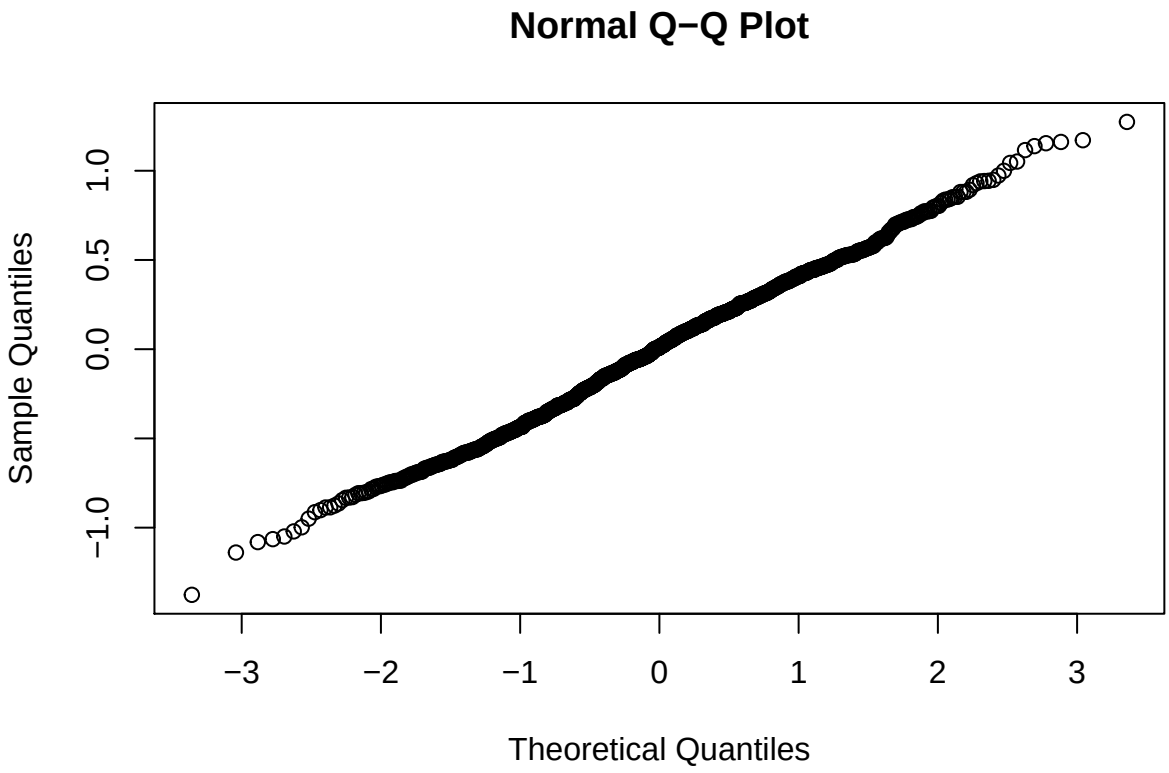





Distribution of Residuals by Time and Domain
Healthy_Rel_Skills
Partner_Selection
Past_Rel_Behav
Rel_Behav_Attit
RPre
Post
Count
Residuals
0
5
10
15
−2
0
2

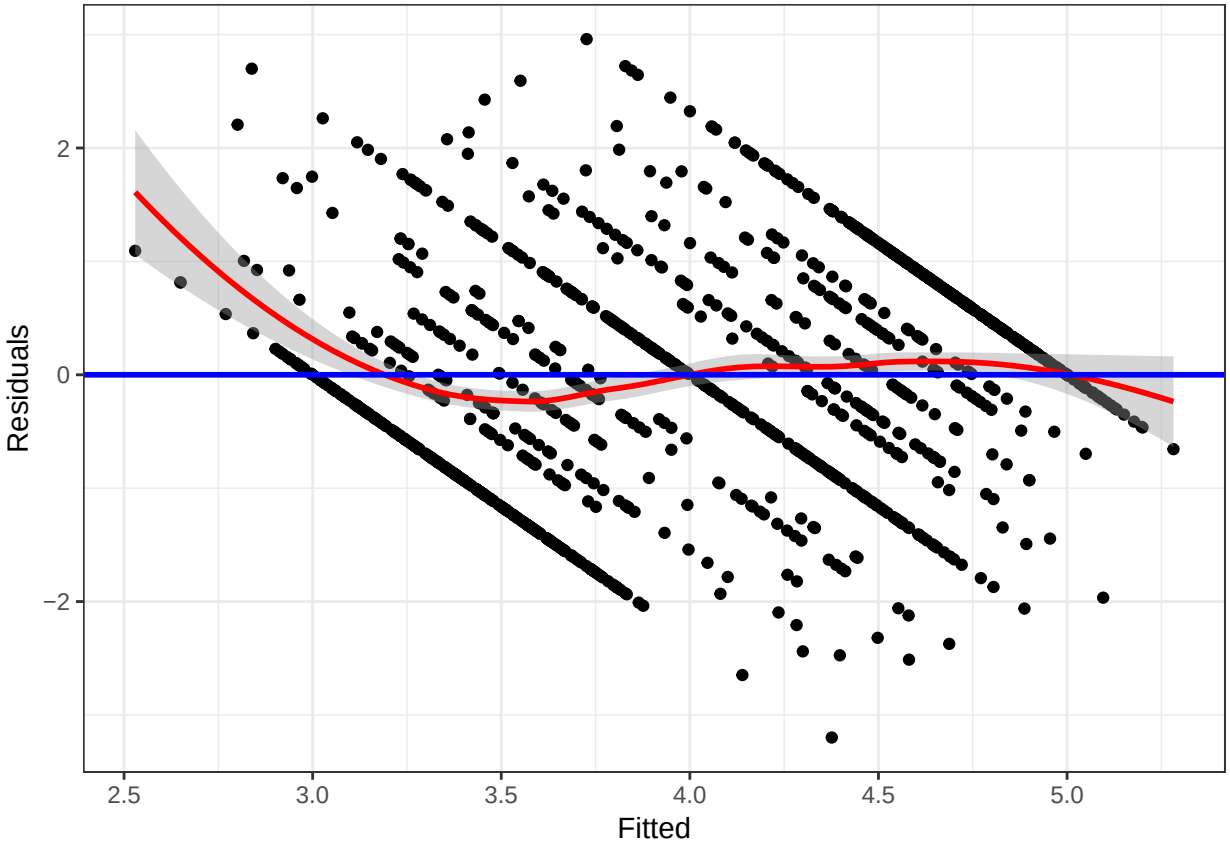
1.7.3.1 Q-Q Plot

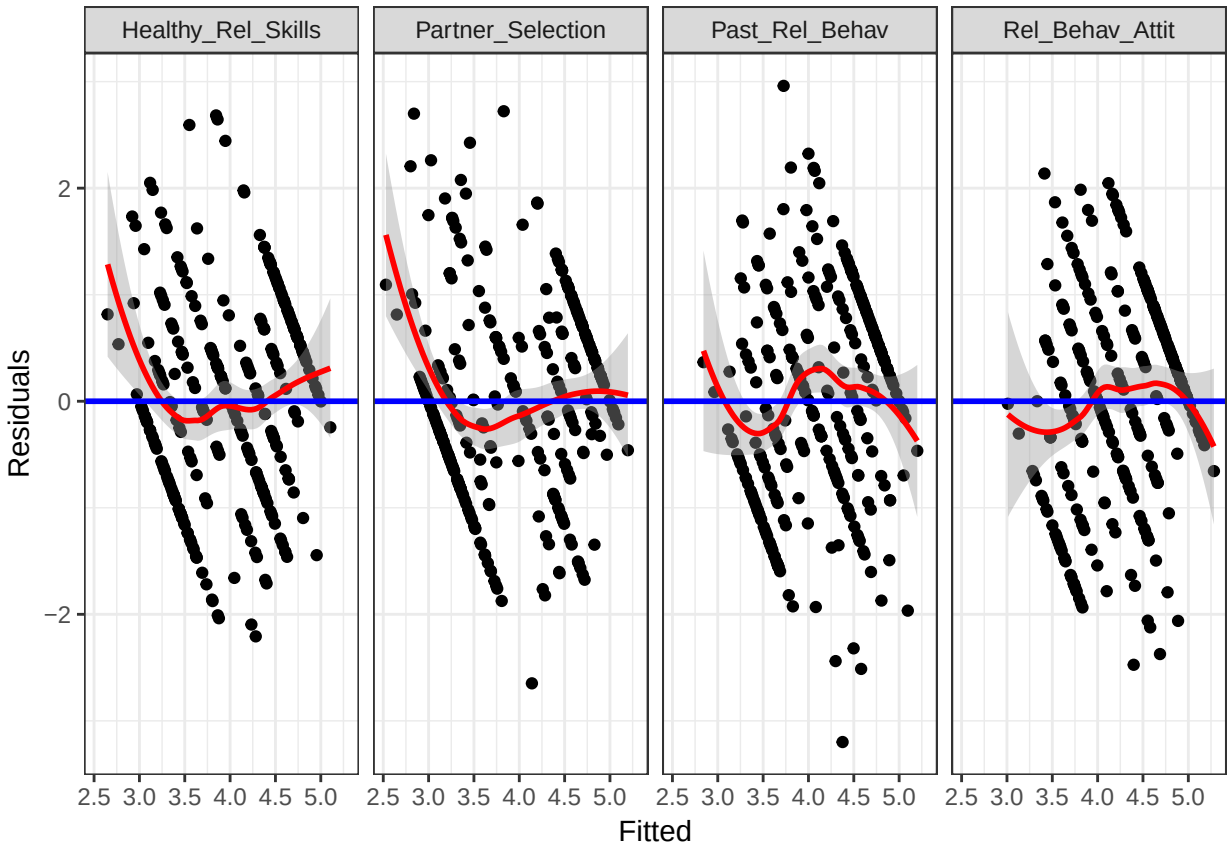
```
qqnorm(residuals(Model.8.REML))
```



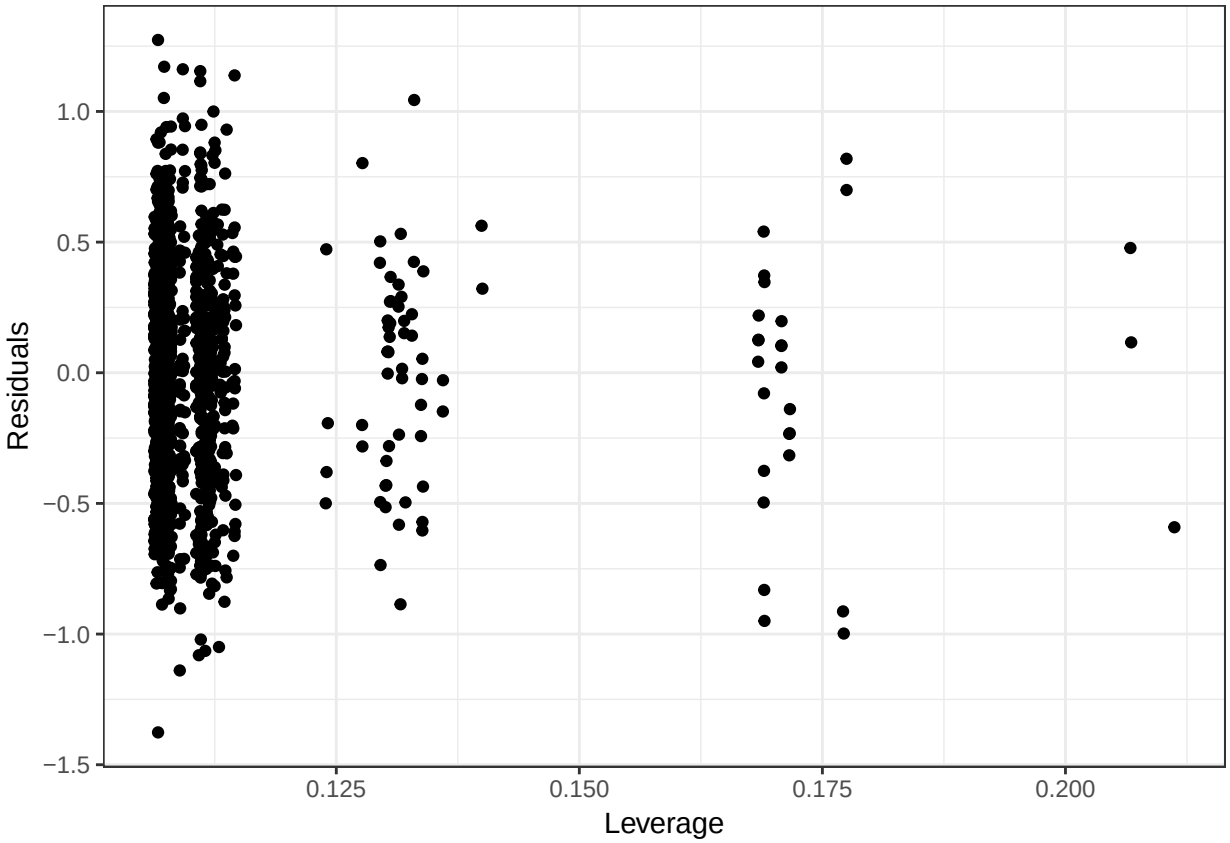
1.7.4 Assumptions of Model Form

- 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
81	5.000000	Caucasian	Post	Healthy_Rel_Skills	Some/A lot	Three Sessions	31
83	5.000000	Caucasian	Post	Partner_Selection	Some/A lot	Three Sessions	31
85	5.000000	Caucasian	Post	Past_Rel_Behav	Some/A lot	Three Sessions	31
87	5.000000	Caucasian	Post	Rel_Behav_Attit	Some/A lot	Three Sessions	31
329	3.333333	Caucasian	Post	Healthy_Rel_Skills	Some/A lot	Two Sessions	102
331	4.000000	Caucasian	Post	Partner_Selection	Some/A lot	Two Sessions	102
333	4.750000	Caucasian	Post	Past_Rel_Behav	Some/A lot	Two Sessions	102
335	5.000000	Caucasian	Post	Rel_Behav_Attit	Some/A lot	Two Sessions	102
354	4.000000	Other	RPre	Healthy_Rel_Skills	None	One Session	118
357	3.666667	Other	Post	Past_Rel_Behav	None	One Session	118
360	4.000000	Other	RPre	Rel_Behav_Attit	None	One Session	118
481	4.000000	Hispanic/Latino	Post	Healthy_Rel_Skills	Some/A lot	One Session	151
483	4.000000	Hispanic/Latino	Post	Partner_Selection	Some/A lot	One Session	151
485	4.000000	Hispanic/Latino	Post	Past_Rel_Behav	Some/A lot	One Session	151
487	4.000000	Hispanic/Latino	Post	Rel_Behav_Attit	Some/A lot	One Session	151
610	4.000000	Hispanic/Latino	RPre	Healthy_Rel_Skills	Some/A lot	Two Sessions	181
612	4.000000	Hispanic/Latino	RPre	Partner_Selection	Some/A lot	Two Sessions	181
613	3.500000	Hispanic/Latino	Post	Past_Rel_Behav			
615	3.666667	Hispanic/Latino	Post	Rel_Behav_Attit			
953	5.000000	Hispanic/Latino	Post	Healthy_Rel_Skills			
955	5.000000	Hispanic/Latino	Post	Partner_Selection			
957	5.000000	Hispanic/Latino	Post	Past_Rel_Behav			
959	5.000000	Hispanic/Latino	Post	Rel_Behav_Attit			
1249	4.333333	Caucasian	Post	Healthy_Rel_Skills			
1251	4.000000	Caucasian	Post	Partner_Selection			
1253	3.250000	Caucasian	Post	Past_Rel_Behav			
1255	3.666667	Caucasian	Post	Rel_Behav_Attit			

```
613                  Some/A lot    Two Sessions 181
615                  Some/A lot    Two Sessions 181
953                        None  Three Sessions 317
955                        None  Three Sessions 317
957                        None  Three Sessions 317
959                        None  Three Sessions 317
1249                 Some/A lot    Two Sessions 398
1251                 Some/A lot    Two Sessions 398
1253                 Some/A lot    Two Sessions 398
1255                 Some/A lot    Two Sessions 398
```

1.7.5.2 Descriptive Statistics (for Reference)

```
     Score                Ethnic_Code    Time                     Domain
 Min.   :3.000   Caucasian      :878   RPre:625   Healthy_Rel_Skills:320
 1st Qu.:3.333   Hispanic/Latino:218   Post:649   Partner_Selection :320
 Median :4.000   Other          :178              Past_Rel_Behav    :316
 Mean   :4.070                                    Rel_Behav_Attit   :318
 3rd Qu.:5.000
 Max.   :5.000

 Prior_RshpEducation_collapsed       Number_Attended       ID
 None      :627                One Session   :425    2      :   8
 Some/A lot:647                Two Sessions  :331    5      :   8
                               Three Sessions:518    10     :   8
                                                     11     :   8
                                                     13     :   8
                                                     21     :   8
                                                     (Other):1226
```

1.7.5.3 Effect on Estimates of Removing High Leverage Values

	effect	change
(Intercept)	3.45788373	-0.001384929
Ethnic_CodeHispanic/Latino	-0.08358884	-0.002651090
Ethnic_CodeOther	0.06349420	-0.009828367
TimePost	0.94276582	-0.007455398
DomainPartner_Selection	-0.11958304	0.002279431
DomainPast_Rel_Behav	0.19319136	0.007655066
DomainRel_Behav_Attit	0.36118831	0.006903901
Prior_RshpEducation_collapsedSome/A lot	0.23065674	0.010294667
Number_AttendedTwo Sessions	-0.12397016	0.004378265
Number_AttendedThree Sessions	-0.19047567	-0.013196029
TimePost:DomainPartner_Selection	0.21204089	-0.001631016
TimePost:DomainPast_Rel_Behav	-0.09839664	0.003684094
TimePost:DomainRel_Behav_Attit	-0.18436640	-0.001704186
TimePost:Prior_RshpEducation_collapsedSome/A lot	-0.18093292	0.017937744
TimePost:Number_AttendedTwo Sessions	0.14590277	0.017969660
TimePost:Number_AttendedThree Sessions	0.28625017	-0.011687561
Ethnic_CodeHispanic/Latino:TimePost	0.19478182	0.037182729
Ethnic_CodeOther:TimePost	-0.30226786	0.015352818

	se	multiples
(Intercept)	0.07086350	0.01954361
Ethnic_CodeHispanic/Latino	0.07842094	0.03380589
Ethnic_CodeOther	0.08668950	0.11337436
TimePost	0.06856896	0.10872847
DomainPartner_Selection	0.04834564	0.04714863
DomainPast_Rel_Behav	0.04881038	0.15683275
DomainRel_Behav_Attit	0.04862490	0.14198284
Prior_RshpEducation_collapsedSome/A lot	0.05938622	0.17335109
Number_AttendedTwo Sessions	0.07550079	0.05798965
Number_AttendedThree Sessions	0.06777999	0.19468915
TimePost:DomainPartner_Selection	0.06804832	0.02396849
TimePost:DomainPast_Rel_Behav	0.06839138	0.05386781
TimePost:DomainRel_Behav_Attit	0.06823400	0.02497561
TimePost:Prior_RshpEducation_collapsedSome/A lot	0.05031439	0.35651318
TimePost:Number_AttendedTwo Sessions	0.06427577	0.27957131
TimePost:Number_AttendedThree Sessions	0.05733654	0.20384139
Ethnic_CodeHispanic/Latino:TimePost	0.06701025	0.55488118
Ethnic_CodeOther:TimePost	0.07353062	0.20879489

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_longlong4

     AIC      BIC   logLik deviance df.resid
  1737.1   1840.1   -848.5   1697.1     1254

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.220 -0.702  0.025  0.660  2.977

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0812   0.285
 Residual             0.1831   0.428
Number of obs: 1274, groups:  ID, 165

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4579     0.0698
Ethnic_CodeHispanic/Latino                       -0.0835     0.0772
Ethnic_CodeOther                                  0.0635     0.0853
TimePost                                          0.9427     0.0682
DomainPartner_Selection                          -0.1196     0.0481
DomainPast_Rel_Behav                              0.1932     0.0485
DomainRel_Behav_Attit                             0.3612     0.0484
Prior_RshpEducation_collapsedSome/A lot           0.2308     0.0584
Number_AttendedTwo Sessions                      -0.1239     0.0743
Number_AttendedThree Sessions                    -0.1906     0.0667
TimePost:DomainPartner_Selection                  0.2120     0.0677
TimePost:DomainPast_Rel_Behav                    -0.0984     0.0680
TimePost:DomainRel_Behav_Attit                   -0.1844     0.0679
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1811     0.0500
TimePost:Number_AttendedTwo Sessions              0.1459     0.0639
TimePost:Number_AttendedThree Sessions            0.2864     0.0570
Ethnic_CodeHispanic/Latino:TimePost               0.1948     0.0666
Ethnic_CodeOther:TimePost                        -0.3022     0.0731
                                                t value
(Intercept)                                       49.51
```

```
Ethnic_CodeHispanic/Latino                          -1.08
Ethnic_CodeOther                                     0.74
TimePost                                            13.82
DomainPartner_Selection                             -2.49
DomainPast_Rel_Behav                                 3.98
DomainRel_Behav_Attit                                7.47
Prior_RshpEducation_collapsedSome/A lot              3.95
Number_AttendedTwo Sessions                         -1.67
Number_AttendedThree Sessions                       -2.86
TimePost:DomainPartner_Selection                     3.13
TimePost:DomainPast_Rel_Behav                       -1.45
TimePost:DomainRel_Behav_Attit                      -2.72
TimePost:Prior_RshpEducation_collapsedSome/A lot    -3.62
TimePost:Number_AttendedTwo Sessions                 2.28
TimePost:Number_AttendedThree Sessions               5.02
Ethnic_CodeHispanic/Latino:TimePost                  2.92
Ethnic_CodeOther:TimePost                           -4.13

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 ($\chi^2 = 31.710$, $df = 2$, $p < .001$).

1.8.1.1.2 Time X Dosage

The effect of Time varied by Dosage ($\chi^2 = 25.013$, $df = 2$, $p < .001$).

1.8.1.1.3 Time X Prior Exposure

The effect of Time varied by Prior Exposure ($\chi^2 = 13.025$, $df = 1$, $p < .001$).

1.8.1.1.4 Time X Domain

The effect of Time varied by Domain ($\chi^2 = 37.306$, $df = 3$, $p < .001$).

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_longlong4

REML criterion at convergence: 1772.6

Scaled residuals:
   Min     1Q Median     3Q    Max
-3.199 -0.696  0.024  0.657  2.960

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.0849   0.291
 Residual             0.1851   0.430
Number of obs: 1274, groups:  ID, 165

Fixed effects:
                                                Estimate Std. Error
(Intercept)                                       3.4579     0.0709
Ethnic_CodeHispanic/Latino                       -0.0836     0.0784
Ethnic_CodeOther                                  0.0635     0.0867
TimePost                                          0.9428     0.0686
DomainPartner_Selection                          -0.1196     0.0483
DomainPast_Rel_Behav                              0.1932     0.0488
DomainRel_Behav_Attit                             0.3612     0.0486
Prior_RshpEducation_collapsedSome/A lot           0.2307     0.0594
Number_AttendedTwo Sessions                      -0.1240     0.0755
Number_AttendedThree Sessions                    -0.1905     0.0678
TimePost:DomainPartner_Selection                  0.2120     0.0680
TimePost:DomainPast_Rel_Behav                    -0.0984     0.0684
TimePost:DomainRel_Behav_Attit                   -0.1844     0.0682
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.1809     0.0503
TimePost:Number_AttendedTwo Sessions              0.1459     0.0643
TimePost:Number_AttendedThree Sessions            0.2863     0.0573
Ethnic_CodeHispanic/Latino:TimePost               0.1948     0.0670
Ethnic_CodeOther:TimePost                        -0.3023     0.0735
                                                t value
(Intercept)                                       48.80
Ethnic_CodeHispanic/Latino                        -1.07
Ethnic_CodeOther                                   0.73
TimePost                                          13.75
DomainPartner_Selection                           -2.47
DomainPast_Rel_Behav                               3.96
```

```
DomainRel_Behav_Attit                                7.43
Prior_RshpEducation_collapsedSome/A lot              3.88
Number_AttendedTwo Sessions                         -1.64
Number_AttendedThree Sessions                       -2.81
TimePost:DomainPartner_Selection                     3.12
TimePost:DomainPast_Rel_Behav                       -1.44
TimePost:DomainRel_Behav_Attit                      -2.70
TimePost:Prior_RshpEducation_collapsedSome/A lot    -3.60
TimePost:Number_AttendedTwo Sessions                 2.27
TimePost:Number_AttendedThree Sessions               4.99
Ethnic_CodeHispanic/Latino:TimePost                  2.91
Ethnic_CodeOther:TimePost                           -4.11

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)	3.59 ***	3.48 ***	3.48 ***
	(0.03)	(0.05)	(0.07)
Ethnic_CodeHispanic/Latino	-0.01	-0.01	0.02
	(0.07)	(0.07)	(0.07)
Ethnic_CodeOther	-0.12	-0.12	-0.09
	(0.08)	(0.08)	(0.08)
TimePost	0.98 ***	1.00 ***	0.90 ***
	(0.03)	(0.05)	(0.06)
DomainPartner_Selection		-0.12 *	-0.12 *
		(0.05)	(0.05)
DomainPast_Rel_Behav		0.19 ***	0.19 ***
		(0.05)	(0.05)
DomainRel_Behav_Attit		0.36 ***	0.36 ***
		(0.05)	(0.05)
TimePost:DomainPartner_Selection		0.21 **	0.21 **
		(0.07)	(0.07)
TimePost:DomainPast_Rel_Behav		-0.10	-0.10
		(0.07)	(0.07)
TimePost:DomainRel_Behav_Attit		-0.19 **	-0.19 **
		(0.07)	(0.07)
Prior_RshpEducation_collapsedSome/A lot			0.22 ***
			(0.06)
Number_AttendedTwo Sessions			-0.15 *
			(0.07)
Number_AttendedThree Sessions			-0.21 **
			(0.07)
TimePost:Prior_RshpEducation_collapsedSome/A lot			-0.16 **
			(0.05)
TimePost:Number_AttendedTwo Sessions			0.19 **
			(0.06)
TimePost:Number_AttendedThree Sessions			0.32 ***
			(0.06)
AIC	1903.35	1800.75	1764.79
BIC	1934.25	1862.55	1857.49
Log Likelihood	-945.67	-888.37	-864.40
Num. obs.	1274	1274	1274
Num. groups: ID	165	165	165
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 ***
	(0.07)	(0.07)
Ethnic_CodeHispanic/Latino	-0.08	-0.08
	(0.08)	(0.08)
Ethnic_CodeOther	0.06	0.06
	(0.09)	(0.09)
TimePost	0.94 ***	0.94 ***
	(0.07)	(0.07)
DomainPartner_Selection	-0.12 *	-0.12 *
	(0.05)	(0.05)
DomainPast_Rel_Behav	0.19 ***	0.19 ***
	(0.05)	(0.05)
DomainRel_Behav_Attit	0.36 ***	0.36 ***
	(0.05)	(0.05)
Prior_RshpEducation_collapsedSome/A lot	0.23 ***	0.23 ***
	(0.06)	(0.06)
Number_AttendedTwo Sessions	-0.12	-0.12
	(0.07)	(0.08)
Number_AttendedThree Sessions	-0.19 **	-0.19 **
	(0.07)	(0.07)
TimePost:DomainPartner_Selection	0.21 **	0.21 **
	(0.07)	(0.07)
TimePost:DomainPast_Rel_Behav	-0.10	-0.10
	(0.07)	(0.07)
TimePost:DomainRel_Behav_Attit	-0.18 **	-0.18 **
	(0.07)	(0.07)
TimePost:Prior_RshpEducation_collapsedSome/A lot	-0.18 ***	-0.18 ***
	(0.05)	(0.05)
TimePost:Number_AttendedTwo Sessions	0.15 *	0.15 *
	(0.06)	(0.06)
TimePost:Number_AttendedThree Sessions	0.29 ***	0.29 ***
	(0.06)	(0.06)
Ethnic_CodeHispanic/Latino:TimePost	0.19 **	0.19 **
	(0.07)	(0.07)
Ethnic_CodeOther:TimePost	-0.30 ***	-0.30 ***
	(0.07)	(0.07)
AIC	1737.08	1812.60
BIC	1840.08	1915.59
Log Likelihood	-848.54	-886.30
Num. obs.	1274	1274
Num. groups: ID	165	165
Var: ID (Intercept)	0.08	0.08
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                          0.266   0.133     2  159.48   0.7194
Time                               168.704 168.704     1 1110.14 911.3639
Domain                              16.968   5.656     3 1098.47  30.5549
Prior_RshpEducation_collapsed        1.271   1.271     1  158.16   6.8666
Number_Attended                      0.145   0.072     2  158.83   0.3909
Time:Domain                          6.944   2.315     3 1099.31  12.5035
Time:Prior_RshpEducation_collapsed   2.394   2.394     1 1107.57  12.9300
Time:Number_Attended                 4.621   2.310     2 1110.30  12.4805
Ethnic_Code:Time                     5.892   2.946     2 1109.94  15.9138
                                     Pr(>F)
Ethnic_Code                       0.4886221
Time                              < 2.2e-16 ***
Domain                            < 2.2e-16 ***
Prior_RshpEducation_collapsed     0.0096382 **
Number_Attended                   0.6770676
Time:Domain                       4.827e-08 ***
Time:Prior_RshpEducation_collapsed 0.0003376 ***
Time:Number_Attended              4.363e-06 ***
Ethnic_Code:Time                  1.534e-07 ***
---
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_longlong4

REML criterion at convergence: 1772.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.1989 -0.6959  0.0242  0.6574  2.9602

Random effects:
 Groups   Name        Variance Std.Dev.
 ID       (Intercept) 0.08493  0.2914
 Residual             0.18511  0.4302
Number of obs: 1274, groups:  ID, 165

Fixed effects:
                                                 Estimate Std. Error
(Intercept)                                       3.45788    0.07086
Ethnic_CodeHispanic/Latino                       -0.08359    0.07843
Ethnic_CodeOther                                  0.06349    0.08669
TimePost                                          0.94277    0.06857
DomainPartner_Selection                          -0.11958    0.04835
DomainPast_Rel_Behav                              0.19319    0.04881
DomainRel_Behav_Attit                             0.36119    0.04863
Prior_RshpEducation_collapsedSome/A lot           0.23066    0.05939
Number_AttendedTwo Sessions                      -0.12397    0.07551
Number_AttendedThree Sessions                    -0.19048    0.06778
TimePost:DomainPartner_Selection                  0.21204    0.06805
TimePost:DomainPast_Rel_Behav                    -0.09840    0.06839
TimePost:DomainRel_Behav_Attit                   -0.18437    0.06823
TimePost:Prior_RshpEducation_collapsedSome/A lot -0.18093    0.05032
TimePost:Number_AttendedTwo Sessions              0.14590    0.06428
TimePost:Number_AttendedThree Sessions            0.28625    0.05734
Ethnic_CodeHispanic/Latino:TimePost               0.19478    0.06702
Ethnic_CodeOther:TimePost                        -0.30227    0.07353
                                                       df t value
(Intercept)                                     331.71630  48.796
Ethnic_CodeHispanic/Latino                      245.88774  -1.066
Ethnic_CodeOther                                231.75318   0.732
TimePost                                       1100.08241  13.749
DomainPartner_Selection                        1097.96800  -2.473
DomainPast_Rel_Behav                           1100.23443   3.958
DomainRel_Behav_Attit                          1099.23977   7.428
```

```
Prior_RshpEducation_collapsedSome/A lot           237.07875   3.884
Number_AttendedTwo Sessions                       241.45907  -1.642
Number_AttendedThree Sessions                     235.97735  -2.810
TimePost:DomainPartner_Selection                 1097.72298   3.116
TimePost:DomainPast_Rel_Behav                    1100.78320  -1.439
TimePost:DomainRel_Behav_Attit                   1099.39447  -2.702
TimePost:Prior_RshpEducation_collapsedSome/A lot 1107.56526  -3.596
TimePost:Number_AttendedTwo Sessions             1111.87076   2.270
TimePost:Number_AttendedThree Sessions           1106.71004   4.992
Ethnic_CodeHispanic/Latino:TimePost              1120.04723   2.906
Ethnic_CodeOther:TimePost                        1099.41611  -4.111
                                                 Pr(>|t|)
(Intercept)                                       < 2e-16 ***
Ethnic_CodeHispanic/Latino                       0.287559
Ethnic_CodeOther                                 0.464651
TimePost                                          < 2e-16 ***
DomainPartner_Selection                          0.013530 *
DomainPast_Rel_Behav                             8.05e-05 ***
DomainRel_Behav_Attit                            2.21e-13 ***
Prior_RshpEducation_collapsedSome/A lot          0.000133 ***
Number_AttendedTwo Sessions                      0.101917
Number_AttendedThree Sessions                    0.005368 **
TimePost:DomainPartner_Selection                 0.001881 **
TimePost:DomainPast_Rel_Behav                    0.150520
TimePost:DomainRel_Behav_Attit                   0.007000 **
TimePost:Prior_RshpEducation_collapsedSome/A lot 0.000338 ***
TimePost:Number_AttendedTwo Sessions             0.023413 *
TimePost:Number_AttendedThree Sessions           6.93e-07 ***
Ethnic_CodeHispanic/Latino:TimePost              0.003728 **
Ethnic_CodeOther:TimePost                        4.24e-05 ***
---
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

- Comparing:
  - Original Model (N = 134)
  - Trimmed Model (N = 134): Removing all non-significant predictors from the model
  - Trimmed Model (N = 165): Rerunning model with all available data. There were 31 cases gained because they were only missing on non-significant predictors.

2.1 Comparing Mixed Effects Regression Coefficients

2.1.1 Estimates

Predictor	Orig. Est. N = 134	Trimmed Est. N = 134	Trimmed Est. N = 165
Intercept	3.264	3.464	3.458
Age (Decades)	0.038	NA	NA
Hispanic/Latino	-0.053	-0.074	-0.084
Another Race/Ethnicity	0.072	0.052	0.063
Some college	-0.060	NA	NA
Tech./College/Grad Degree	-0.058	NA	NA
Fin. Wor. Often	0.088	NA	NA
Fin. Wor. Alm. all time	0.058	NA	NA
Female	0.064	NA	NA
Divorced	-0.057	NA	NA
Time (T)	0.938	0.938	0.943
Partner_Selection	-0.132	-0.132	-0.120
Past_Rel_Behav	0.181	0.181	0.193
Rel_Behav_Attit	0.331	0.331	0.361
Prior Rel. Ed	0.200	0.192	0.231
Two Sessions	-0.111	-0.111	-0.124
Three Sessions	-0.222	-0.230	-0.190
T X Partner_Selection	0.232	0.231	0.212
T X Past_Rel_Behav	-0.073	-0.072	-0.098
T X Rel_Behav_Attit	-0.136	-0.135	-0.184
T X Prior Rel. Ed.	-0.147	-0.147	-0.181
T X Two Sessions	0.115	0.116	0.146
T X Three Sessions	0.272	0.272	0.286
T X Hispanic/Latino	0.139	0.139	0.195
T X Another Race/Ethn	-0.291	-0.291	-0.302

2.1.2 Difference in Estimates

Predictor	Difference in Est.: Orig. N = 134 vs. Trimmed N = 134	Difference in Est.: Orig. N = 134 vs. Trimmed N = 165
Intercept	0.200	0.194
Age (Decades)	NA	NA
Hispanic/Latino	-0.021	-0.031
Another Race/Ethnicity	-0.020	-0.009
Some college	NA	NA
Tech./College/Grad Degree	NA	NA
Fin. Wor. Often	NA	NA
Fin. Wor. Alm. all time	NA	NA
Female	NA	NA
Divorced	NA	NA
Time (T)	0.000	0.005
Partner_Selection	0.000	0.012
Past_Rel_Behav	-0.000	0.012
Rel_Behav_Attit	-0.001	0.030
Prior Rel. Ed	-0.008	0.031
Two Sessions	-0.000	-0.013
Three Sessions	-0.008	0.032
T X Partner_Selection	-0.000	-0.020
T X Past_Rel_Behav	0.000	-0.025
T X Rel_Behav_Attit	0.001	-0.048
T X Prior Rel. Ed.	-0.000	-0.034
T X Two Sessions	0.001	0.031
T X Three Sessions	-0.000	0.014
T X Hispanic/Latino	-0.000	0.056
T X Another Race/Ethn	-0.000	-0.011

2.2 Comparing Significance

2.2.1 Significance

Predictor	Orig. p N = 134	Trimmed p N = 134	Trimmed p N = 165
Intercept	0.000	0.000	0.000
Age (Decades)	0.215	NA	NA
Hispanic/Latino	0.572	0.402	0.288
Another Race/Ethnicity	0.458	0.585	0.465
Some college	0.443	NA	NA
Tech./College/Grad Degree	0.453	NA	NA
Fin. Wor. Often	0.321	NA	NA
Fin. Wor. Alm. all time	0.474	NA	NA
Female	0.425	NA	NA
Divorced	0.397	NA	NA
Time (T)	0.000	0.000	0.000
Partner_Selection	0.014	0.014	0.014
Past_Rel_Behav	0.001	0.001	0.000
Rel_Behav_Attit	0.000	0.000	0.000
Prior Rel. Ed	0.004	0.004	0.000
Two Sessions	0.200	0.185	0.102
Three Sessions	0.006	0.003	0.005
T X Partner_Selection	0.002	0.002	0.002
T X Past_Rel_Behav	0.340	0.342	0.151
T X Rel_Behav_Attit	0.074	0.076	0.007
T X Prior Rel. Ed.	0.008	0.008	0.000
T X Two Sessions	0.103	0.100	0.023
T X Three Sessions	0.000	0.000	0.000
T X Hispanic/Latino	0.063	0.064	0.004
T X Another Race/Ethn	0.000	0.000	0.000

2.2.2 Difference in Significance

Predictor	Difference in Sig.: Orig. N = 134 vs. Trimmed N = 134	Difference in Sig.: Orig. N = 134 vs. Trimmed N = 165
Intercept	-0.000	0.000
Age (Decades)	NA	NA
Hispanic/Latino	-0.170	-0.284
Another Race/Ethnicity	0.127	0.007
Some college	NA	NA
Tech./College/Grad Degree	NA	NA
Fin. Wor. Often	NA	NA
Fin. Wor. Alm. all time	NA	NA
Female	NA	NA
Divorced	NA	NA
Time (T)	-0.000	0.000
Partner_Selection	0.000	-0.000
Past_Rel_Behav	0.000	-0.001
Rel_Behav_Attit	0.000	0.000
Prior Rel. Ed	0.000	-0.004
Two Sessions	-0.016	-0.098
Three Sessions	-0.003	-0.001
T X Partner_Selection	0.000	-0.000
T X Past_Rel_Behav	0.002	-0.189
T X Rel_Behav_Attit	0.002	-0.067
T X Prior Rel. Ed.	-0.000	-0.008
T X Two Sessions	-0.003	-0.080
T X Three Sessions	0.000	0.000
T X Hispanic/Latino	0.000	-0.059
T X Another Race/Ethn	-0.000	0.000

3 Textual Summary

3.1 Methods

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

- **Need to add discussion of removing non-significant predictors to methods 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 ($\beta = 0.98$, $\chi^2 = 907.791$, $df = 1$, $p < .001$). The effect of the program varied by outcome ($\chi^2 = 35.407$, $df = 3$, $p < .001$), prior exposure to relationship education ($\chi^2 = 10.178$, $df = 1$, $p = .001$), dosage ($\chi^2 = 31.158$, $df = 2$, $p < .001$), and race/ethnicity ($\chi^2 = 31.710$, $df = 2$, $p < .001$). **Non-signficant predictors were removed from the model. A benefit of multilevel modeling is that cases missing data on an outcome or time point can still be included in analyses; cases with missing data contribute less to model estimates. However, cases missing data for any predictor variable are excluded. By removing non-significant predictors from the model, more cases can be included in the analyses, reducing bias due to missing data. The model with only**

the significant predictors from the original model was fit using the original sample of 134 and the larger sample of 165. There were some slight differences in patterns of significance, as discussed below. Full results are available in the online supplemental material.

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, $\beta = 0.943$, $t = 13.749$, $df = 1100.082$, $p < .001$; Partner Selection, $\beta = 1.155$, $t = 16.809$, $df = 1099.636$, $p < .001$; Relationship Patterns, $\beta = 0.844$, $t = 12.252$, $df = 1100.416$, $p < .001$; and Behavior and Attitudes, $\beta = 0.758$, $t = 11.011$, $df = 1100.874$, $p < .001$. 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 = -0.181, t = -3.596, df = 1106.820, $p < .001$). Gains were greater for participants who attended three sessions compared to only one ($\beta = 0.286$, $t = 4.992$, $df = 1105.961$, $p < .001$). **Gains did not differ for participants who attended two sessions compared to only one in the original model, but did in the reduced model using the larger sample (β = 0.146, t = 2.270, df = 1111.145, p = .023)**.

The only demographic covariate that significantly moderated the effect of the program was race/ethnicity. **There was a marginally significant difference (p = .063) in the effect of the program for participants who identified as Hispanic/Latino than for participants who identified as Caucasian in the original model. The difference was significant in the reduced model using the larger sample (β = 0.195, t = 2.907, df = 1119.357, p = .004).** However, the program had a diminished effect for participants who identified as another race/ethnicity than for participants who identified as Caucasian (β = -0.302, t = -4.111, df = 1098.636, $p < .001$).

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

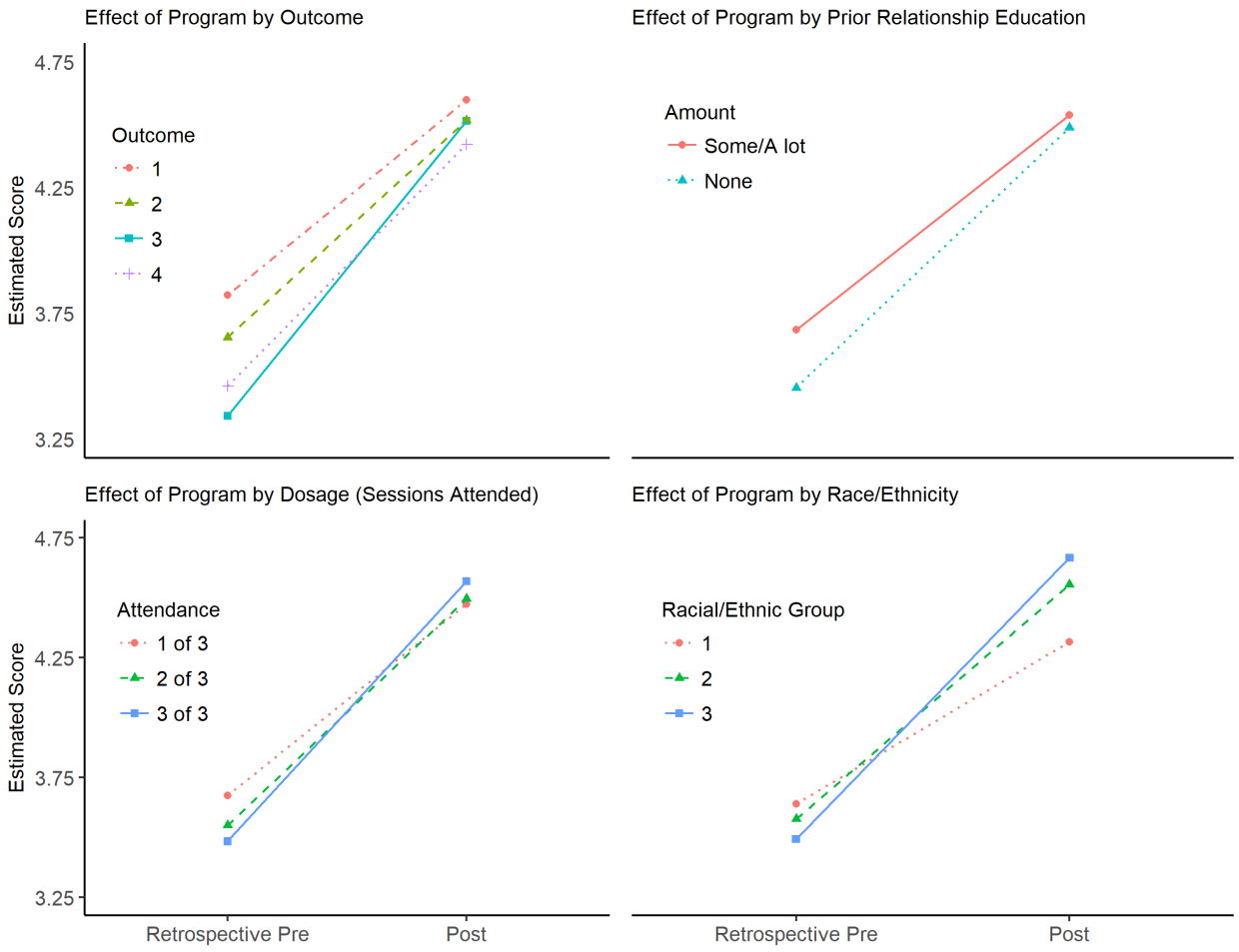
R Core Team (2018). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. URL: http://www.R-project.org/.

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.