Dyadic Analysis of FLASHE Data

This document provides syntax from SAS and MPlus to conduct an example dyadic data analysis using variables from the FLASHE dataset.

First, SAS code is presented that takes selected variables from the posted FLASHE datasets, restructures them to create a dyadic dataset, and demonstrates some of the analyses that can be done to take advantage of the dyadic features of FLASHE. We then present SAS code that creates new datasets with recoded and restructured variables and conduct a dyadic analysis of FLASHE data. For the dyadic analysis, we focus on cases (dyads) with no missing data for the selected variables. Fruit & Vegetable Consumption for the teen and Fruit & Vegetable Consumption for the parent will be used as the focal outcomes. Teen and Parent Efficacy for Fruit & Vegetable Consumption will be used as the focal predictors. Parent gender will also be examined as a moderator by making use of variables that distinguish male parent from female parent participants. The SAS code has been commented throughout to explain key data processing steps and analysis options. Finally, commented Mplus code for conducting corresponding dyadic analyses of the selected FLASHE variables is also provided. Throughout this document, output (SAS or Mplus as appropriate) and interpretations are provided.

Example Analysis of Dyadic Data Using SAS

In the following section, SAS code is provided from a file called "`create-flashe-tiny.sas`" that creates a new dataset by merging data for a handful of teen and parent FLASHE variables. We begin with data files that we previously merged for parents and teens. "FLASHE.parent_merged" is a SAS dataset containing parent data from all surveys (diet, physical activity, and demographics) that has been merged by the participant identifier (PID). Similarly, "FLASHE.teen_merged" is a dataset containing all adolescent survey data.

```
************************************************************************
FILE NAME: create-flashe-tiny.sas

This file (1) creates a SAS library called flashe, (2) reads FLASHE parent and teen
SAS datasets, (3) merges them by the dyad identifier (dyadid) to create
flashe.ptcombo, and (4) creates a small SAS dataset called flashe.flashetiny that
selects a subset of 13 variables.

Note: P or p = parent, T or t = teen.

The variable names are: dyadid TSEX PSEX PDFFRUIT TDFFRUIT PDFSALAD TDFSALAD
PDFPOTOTH TDFPOTOTH PDFVEG TDFVEG PDEFFFV TDEFFFV.

************************************************************************;

libname flashe "Insert filepath to folder containing the FLASHE datasets"; *Modify
path as needed;
run;

options fmtsearch = (flashe.formats);
run;

proc contents position data=flashe.parent_merged;
run;

proc contents position data=flashe.teen_merged;
```

```
run;

*sort by dyadid prior to merging;
proc sort data=flashe.parent_merged;
by dyadid;
run;
proc sort data=flashe.teen_merged;
by dyadid;
run;

*merging the parent and teen datasets;
data flashe.ptcombo;
merge flashe.parent_merged flashe.teen_merged;
by dyadid;
run;
*there will now be one row per dyad. If one member of the dyad has missing data, there
will still be a row for the dyad, but the variables from the missing respondent will
have missing values;

data flashe.flashetiny;
set flashe.ptcombo;
keep dyadid TSEX PSEX PDFFRUIT TDFFRUIT PDFSALAD TDFSALAD PDFPOTOTH TDFPOTOTH
      PDFVEG TDFVEG PDEFFFV TDEFFFV;
run;

title;
title Take a look at the flashetiny dataset;
proc contents position
data=flashe.flashetiny; run;

**************************************************************************
END OF FILE: create-flashe-tiny.sas
**************************************************************************;
```

The following SAS file is called "`analyze-flashe-tiny.sas`" and contains code to produce dyadic descriptive statistics, correlations, and plots for visualizing dyadic variables from the FLASHE dataset. For ease of comparing results across various analyses, a dataset is created including dyads with no missing data. The PROC MIXED code at the end of this file is used to calculate intraclass correlations (ICCs) to measure the degree of dyadic interdependence in the fruit & vegetable consumption outcome. Dyadic interdependence is a reflection of how much variability in an outcome variable reflects dyads differing from each other in average levels of the outcome (versus partners within a dyad differing from each other).

```
**************************************************************************
FILE NAME: analyze-flashe-tiny.sas

This file illustrates how descriptive dyadic analyses can be conducted on selected
FLASHE variables.

The file reads a SAS dataset called flashetiny, a subset of 13 variables.

Note: P or p = parent, T or t = teen.

The variable names are: dyadid TSEX PSEX PDFFRUIT TDFFRUIT PDFSALAD TDFSALAD PDFPOTOTH
TDFPOTOTH PDFVEG TDFVEG PDEFFFV TDEFFFV.

To see how flashetiny was created, see the file create-flashe-tiny.sas;
**************************************************************************;
```

```
libname flashe "Insert filepath to folder containing the FLASHE datasets "; *Modify
path as needed;
run;

options fmtsearch = (flashe.formats);
run;

title;
title Take a look at the dataset;
proc contents position data=flashe.flashetiny;
run;

****************************************************;
*Create temporary dataset flashetiny1;
*Compute \ recode variables prior to dyadic analyses;
****************************************************;
data flashetiny1(drop=s);
set flashe.flashetiny;

*Recoding responses of 'not ascertained' to missing;
if TSEX=-9 then TSEX = .;
if PSEX=-9 then PSEX = .;
if PDFFRUIT=-9 then PDFFRUIT = .;
if TDFFRUIT=-9 then TDFFRUIT = .;
if PDFSALAD=-9 then PDFSALAD = .;
if TDFSALAD=-9 then TDFSALAD = .;
if PDFPOTOTH=-9 then PDFPOTOTH = .;
if TDFPOTOTH=-9 then TDFPOTOTH = .;
if PDFVEG=-9 then PDFVEG = .;
if TDFVEG=-9 then TDFVEG = .;
if PDEFFFV=-9 then PDEFFFV = .;
if TDEFFFV=-9 then TDEFFFV = .;

*total fruit and vegetable consumption recoded to a range of 0-10. Recoding is not
required for the dyadic analysis but improves interpretation of the results;
pftveg=(PDFFRUIT + PDFSALAD + PDFPOTOTH + PDFVEG - 4)/2;
tftveg=(TDFFRUIT + TDFSALAD + TDFPOTOTH + TDFVEG - 4)/2;

*self-efficacy variables recoded to a range of 0-10. Recoding is not required for the
dyadic analysis but improves interpretation of the results;
pefffv=(PDEFFFV - 1)*(10/4);
tefffv=(TDEFFFV - 1)*(10/4);

cpefffv=pefffv-7.6; *centering parent efficacy on mean of
pefffv; ctefffv=tefffv-7.6; *centering teen efficacy on mean of
tefffv;
*pfem, tfem: Dummy variables: 0 = male, 1 = female. psex currently coded as 1=male,
2=female;
pfem=psex-1;
tfem=tsex-1;

*gmatch: 4 dyadic gender combinations;
gmatch=.;
if psex=1 and tsex=1 then gmatch=1; *male parent, male teen;
else if psex=1 and tsex=2 then gmatch=2; *male parent, female teen;
else if psex=2 and tsex=1 then gmatch=3; *female parent, male teen;
else if psex=2 and tsex=2 then gmatch=4; *female parent, female teen;

*jittered variables: adding random uniform noise. Jittering assists with data
visualization. For more information see Applied Regression Analysis and Generalized
Linear Models 2nd Edition by John Fox;
s = 1.5; * scale factor;
```

```
jpfruit = pdffruit + s*(ranuni(1)-0.5); *ranuni is a random number generator and
returns numbers between 0 and 1. That value is subtracted by 0.5 and multiplied by the
scale factor of 1.5, which is then added to the original variable, creating a
potential change in value from -.75 to .75 (noninclusive);
jtfruit = tdffruit +
s*(ranuni(1)-0.5); jpsalad = pdfsalad
+ s*(ranuni(1)-0.5); jtsalad =
jppototh = pdfpototh +
s*(ranuni(1)-0.5); jtpototh = tdfpototh
jpveg = pdfveg +
s*(ranuni(1)-0.5); jtveg = tdfveg
jpftveg = pftveg +
s*(ranuni(1)-0.5); jtftveg = tftveg
jpefffv=pefffv + 2*s*(ranuni(1)-0.5); *The multiplication by 2 helps with
visualization of variance between the outcome and the predictor variables, and
results in a potential change in value from -1.5 to 1.5 (noninclusive). If other
used, this value may need to be modified to enhance visualization;
jtefffv=tefffv + 2*s*(ranuni(1)-0.5); *The multiplication by 2 helps with
visualization of variance between the outcome and the predictor variables, and
results in a potential change in value from -1.5 to 1.5 (noninclusive). If other
used, this value may need to be modified to enhance visualization;

label
      pftveg = "Parent's Fruit and Veg Consumption"
      tftveg = "Teen's Fruit and Veg Consumption"
      pefffv = "Parent's Efficacy for Fruit and Veg Consumption"
      tefffv = "Teens's Efficacy for Fruit and Veg
      Consumption" jpftveg = "Parent's Fruit and Veg
      jtftveg = "Teen's Fruit and Veg Consumption (Jittered)"
      jpefffv = "Parent's Efficacy for Fruit and Veg Consumption
      (Jittered)" jtefffv = "Teens's Efficacy for Fruit and Veg Consumption
      (Jittered)" cpefffv = "Parent's Efficacy for Fruit and Veg
      ctefffv = "Teens's Efficacy for Fruit and Veg Consumption (Centered)"
      pfem = "Female Parent"
      tfem = "Female Teen"
      gmatch = "Gender Match of Parent and Teen";
      ;

* Create new formats;
proc format library=flashe;
value femf
0 = "Male"
1 = "Female";
value matchf
1 = "mpar mteen"
2 = "mpar fteen"
3 = "fpar mteen"
4 = "fpar fteen";
;
* Apply new formats to recoded variables;
format pfem femf. tfem femf. gmatch matchf.;

run;

****************************************************************************;
*Create permanent dataset (flashe.flashetiny2) with no missing data on key variables;
****************************************************************************;

data flashe.flashetiny2; *New N=1486 dyads vs original N=1869
dyads; set flashetiny1;
if pftveg ne .;
if tftveg ne .;
if pefffv ne .;
```

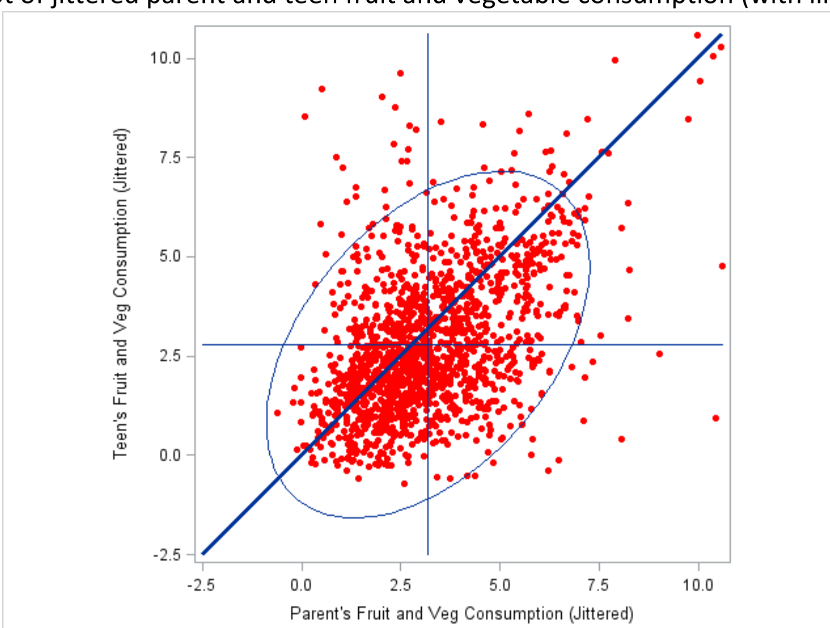
```
if tefffv ne .;
if       pfem
ne   .;   if
run; ne .;


*frequencies of parent and teen gender as well as gender pairs;
title;
title Show sample sizes in gender match categories;
proc freq data=flashe.flashetiny2;
format pfem femf. tfem femf. gmatch matchf.;
tables pfem*tfem;
tables gmatch;
run;

*correlations between parent and teen diet variables;
title;
title Correlations between parent and teen diet variables; proc
corr data=flashe.flashetiny2;
var PDFFRUIT TDFFRUIT PDFsalad TDFsalad
PDFPOTOTH TDFPOTOTH PDFVEG TDFVEG;
run;

*******************************************;
*Total fruit and vegetable consumption; *******************************************;

title;
title Pearson correlation of parent and teen total fruit and veg consumption scores;
proc corr data=flashe.flashetiny2 cov;
var pftveg tftveg;
run;
```

The correlation between parent and teen fruit and vegetable consumption is 0.488 (highlighted in the output shown below).

Pearson Correlation Coefficients, N = 1486 Prob > |r| under H0: Rho=0		
	pftveg	**tftveg**
pftveg Parent's Fruit and Veg Consumption	1.00000	0.48826 <.0001
tftveg Teen's Fruit and Veg Consumption	0.48826 <.0001	1.00000

```
title;
title "Dyadic scatterplot of jittered parent and teen F&V consumption (with line of
equality)";
proc template;
define statgraph square; *setting a square figure;
begingraph;
layout overlayequated / equatetype=square;
scatterplot x=jpftveg y=jtftveg/ MARKERATTRS = (symbol=circlefilled color = red
size=6px); *x-axis is jittered parent ftveg, y-axis is jittered teen ftveg;
lineparm x=0 y=0 slope=1/ LINEATTRS = (pattern=1 thickness=3); *adding line of
equality;
lineparm x=3.18 y = 0 slope=.; * adding vertical line at the mean value of pftveg (x-
axis variable);
lineparm y=2.78 x = 0 slope=0; *adding horizontal line at the mean of tftveg (y-axis
variable);
ellipse x=jpftveg y=jtftveg/type=predicted  alpha=0.05; *overlaying a prediction
ellipse computed with a 0.05 confidence level;
endlayout;
endgraph;
end;
run;
proc sgrender data=flashe.flashetiny2 template=square; run;
```

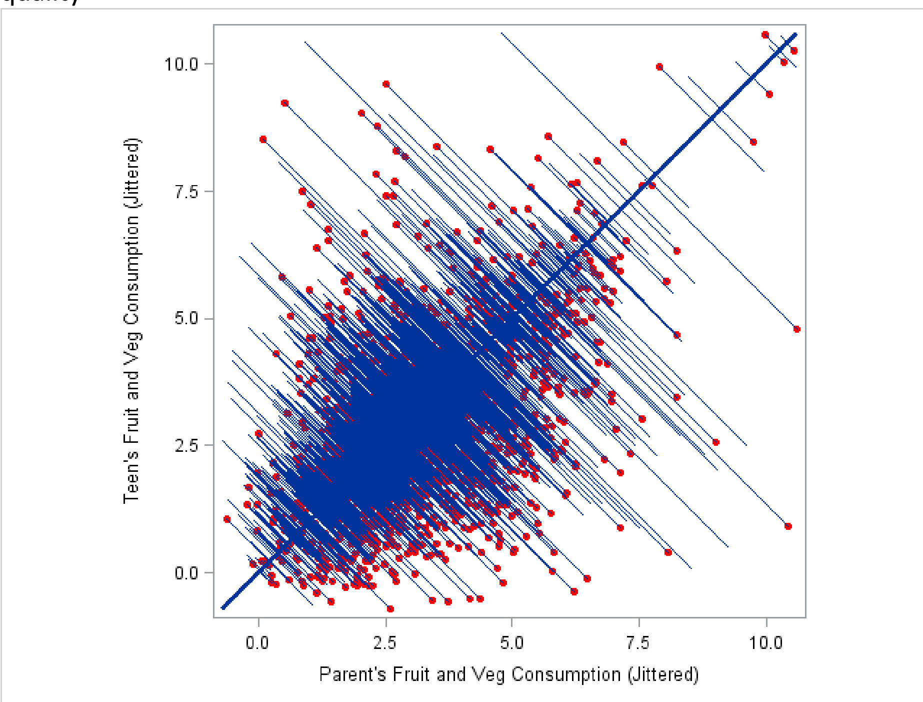
Dyadic scatterplot of jittered parent and teen fruit and vegetable consumption (with line of equality)



The ellipse shown on the graph above represents 95% of the data and the correlation between parent and teen fruit and vegetable consumption. The correlation shows to what extent the value of parent fruit and vegetable consumption predicts teen fruit and vegetable consumption.

```
title;
title "Dyadic scatterplot of jittered parent and teen F&V consumption showing
deviations from line of equality";
proc template;
define statgraph square;
begingraph;
layout overlayequated / equatetype=square;
scatterplot x=jpftveg y=jtftveg/ MARKERATTRS = (symbol=circlefilled color = red
size=6px);
vectorplot y=jtftveg x=jpftveg yorigin=jpftveg xorigin=jtftveg/ LINEATTRS = (pattern=1
thickness=1)arrowheads=false; *specifying the deviations between parent and teen F&V
consumption;
lineparm x=0 y=0 slope=1/ LINEATTRS = (pattern=1 thickness=3);*adding line of
equality;
endlayout;
endgraph;
end;
run;
proc sgrender data=flashe.flashetiny2 template=square; run;
```

Dyadic scatterplot of jittered parent and teen fruit and vegetable consumption showing deviations from line of equality



The above graph shows a visualization of the ICC. The more the values are aligned on the 45° line, the higher the ICC. This graph shows how similar parent and teen fruit and vegetable consumption values are to each other. The more similar they are, the higher the ICC. In this example, the Pearson correlation and ICC values are very close, but in some instances, they can be quite different (please see Robinson, WS. The geometric interpretation of agreement. Am Sociol Rev. 1959;24:338-45, for more information on the ICC compared to the Pearson correlation). While the above visualization represents the ICC, the technical description and calculation is included later in this guide.

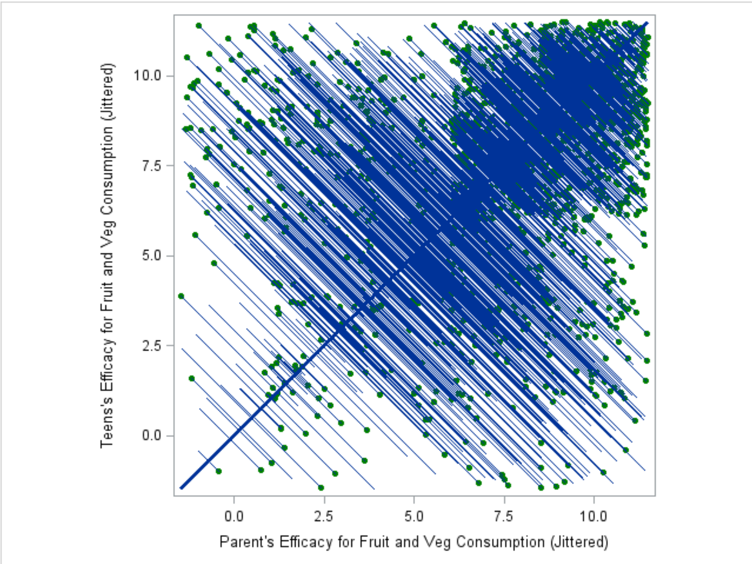
```
*******************************************;
*Efficacy for Fruit & Vegetable consumption;
*******************************************;
```

```
title;
title Correlation of parent and teen efficacy for F&V consumption;
proc corr data=flashe.flashetiny2 cov;
var pefffv tefffv;
run;
```

Pearson Correlation Coefficients, N = 1486 Prob > |r| under H0: Rho=0		
	pefffv	**tefffv**
Pefffv Parent's Efficacy for Fruit and Veg Consumption	1.00000	0.20668 <.0001
Tefffv Teens's Efficacy for Fruit and Veg Consumption	0.20668 <.0001	1.00000

```
title;
title "Dyadic scatterplot of jittered parent and teen efficacy for F&V consumption
      showing deviations from line of equality"; run;
proc template;
define statgraph square;
begingraph;
layout overlayequated / equatetype=square;
scatterplot x=jpefffv y=jtefffv/ MARKERATTRS = (symbol=circlefilled color = green
size=6px);
vectorplot y=jtefffv x=jpefffv yorigin=jpefffv xorigin=jtefffv/ LINEATTRS = (pattern=1
thickness=1)arrowheads=false;
lineparm x=0 y=0 slope=1/ LINEATTRS = (pattern=1 thickness=3);
endlayout;
endgraph;
end;
run;
proc sgrender data=flashe.flashetiny2 template=square; run;
```

Dyadic scatterplot of jittered parent and teen efficacy for fruit and vegetable consumption showing deviations from the line of equality



This graph shows the similarity between parent and teen self-efficacy values. The closer these values are to each other, the higher the ICC will be.

```
********************************************************************;
*Create temporary stacked dataset (with each dyad having two rows of data: one for
parent and one for teen) for calculating ICCs in PROC MIXED;
********************************************************************;

data tline; *creating a teen dataset;
set flashe.flashetiny2;
p=0; t=1; *These variables will be used in the stacked dataset to indicate teen values
of F&V;
ftveg=tftveg; *Renaming the teen F&V variable. Parent and teen variables need to have
the same name to create the stacked dataset;
keep dyadid p t ftveg; *Keep only the variables needed to calculate the ICC;
run;
```

Take a look at the tline dataset. Below are the first 6 observations of the tline dataset. We can see that p=0 and t=1 for all observations because this is the teen dataset. The values for ftveg are the teen values.

Obs	DYADID	p	t	ftveg
1	3	0	1	4.5
2	4	0	1	1.5
3	5	0	1	7.0
4	7	0	1	3.5
5	11	0	1	3.0
6	12	0	1	2.5

```
data pline;*creating a parent dataset;
set flashe.flashetiny2;
p=1; t=0; *These variables will be used in the stacked dataset to indicate parent
values of F&V;
ftveg=pftveg; *Renaming the parent F&V variable. Parent and teen variables need to
have the same name to create the stacked dataset;
keep dyadid p t ftveg; *Keep only the variables needed to calculate the ICC;
run;
```

Take a look at the pline dataset. Below are the first 6 observations of the pline dataset. We can see that p=1 and t=0 for all observations because this is the parent dataset. The values for ftveg are the parent values.

Obs	DYADID	p	t	ftveg
1	3	1	0	5.0
2	4	1	0	2.5
3	5	1	0	5.5
4	7	1	0	5.0
5	11	1	0	2.0
6	12	1	0	2.0

```
data stacktp;
set tline pline;
run;
*Datastep will stack the pline and tline datasets into one dataset;

proc sort data=stacktp; *sorting by
dyadid; by dyadid;
run;
```

Take a look at the stacktp dataset. Now we have stacked and sorted the combined datasets (tline and pline). Below are the first 12 observations from the new stacktp dataset, sorted by DYADID. In the first row p=0 and t=1, indicating that this row contains the teen value for ftveg (i.e., 4.5). Looking back at the print out for the tline dataset, we see that 4.5 is the value that was in the teen only dataset for this dyadid. In the next row, p=1 and t=0, indicating that this row contains the parent value for ftveg (i.e., 5.0). This value also matches what is shown above in the parent only dataset for this dyadid. The stacked dataset will be used to calculate ICCs and to perform an Actor-Partner Interdependence Model in the next section.

Obs	DYADID	p	t	ftveg
1	3	0	1	4.5
2	3	1	0	5.0
3	4	0	1	1.5
4	4	1	0	2.5
5	5	0	1	7.0
6	5	1	0	5.5
7	7	0	1	3.5
8	7	1	0	5.0
9	11	0	1	3.0
10	11	1	0	2.0
11	12	0	1	2.5
12	12	1	0	2.0

```
*intraclass correlation run for ftveg;
proc mixed data=stacktp covtest;
class dyadid;
model ftveg=/solution; *intercept only model displays fixed-effects parameter
estimates;
random intercept/subject=dyadid; *define random effects and identifying nested
respondents by dyadid;
run;
*Calculate ICC from ratio of dyadid variance to sum of (dyadid + residual) variance;
```

Covariance Parameter Estimates					
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr > Z**
Intercept	**DYADID**	1.3283	0.08147	16.30	<.0001
Residual		1.5167	0.05564	27.26	<.0001

Calculation of the ICC: 1.3283/(1.3283+1.5167) = 0.467

```
*parent and teen means model for ftveg;
proc mixed data=stacktp covtest;
class dyadid p;
model ftveg=p/solution; *ICC of F&V between parent and teen dyads;
random intercept/subject=dyadid;
lsmeans p /cl; *Output provides mean F&V consumption for parents and teens (p=1
for parent, p=0 for teen);
run;
```

Mean fruit and vegetable consumption for parents (p=1) and teens (p=0) are highlighted below

Least Squares Means									
Effect	**p**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
p	**0**	2.7843	0.04345	1485	64.07	<.0001	0.05	2.6991	2.8696
p	**1**	3.1814	0.04345	1485	73.21	<.0001	0.05	3.0961	3.2666

```
**************************************************************************
END OF FILE: analyze-flashe-tiny.sas
**************************************************************************;
```

The following SAS file is called "`analyze-actor-partner-flashe-tiny2`" and contains code for alternative ways of calculating the ICC as well as code for estimating an Actor-Partner Interdependence Model (APIM; Kenny, Kashy, & Cook, 2006). The APIM allows for the examination of potential actor and partner effects of efficacy for eating fruits & vegetables predicting fruit and vegetable consumption. Applied to this context, a teen actor effect reflects whether teen efficacy influences teen fruit & vegetable consumption while a teen partner effect reflects whether a teen efficacy influences parent fruit & vegetable consumption. The same model also produces a corresponding parent actor effect and parent partner effect. Actor and partner effects are estimated simultaneously. At the end of this file is code for examining the APIM separately by parent gender.

```
********************************************************************************
FILE NAME: analyze-actor-partner-flashe-tiny2.sas

Actor-Partner Interdependence Model for F&V Efficacy Predicting F&V Consumption

This file illustrates how to perform dyadic analyses (Actor-Partner Interdependence
Model) on selected FLASHE variables.

Note: P or p = parent, T or t = teen.

The file reads a SAS dataset called flashetiny2, a dataset with 34 variables and a
complete set of cases (dyads) from the FLASHE survey.
********************************************************************************;
```

```
libname flashe " Insert filepath to folder containing the FLASHE datasets "; *Modify
path as needed;
run;

options fmtsearch = (flashe.formats);
run;


********************************************************************;
*Create permanent stacked dataset for actor partner analyses in MIXED

A new dataset needs to be created where the teen and the parent
can be modeled as the actor and the partner.

We start by creating two separate data sets. The first dataset uses
the teen as the "actor." The second dataset uses the parent as the
"actor." The abbreviation, “fv”, refers to fruit & vegetable.
********************************************************************;

*Note cefffv = own efficacy for fv (centered on mean of 7.6),
      coefffv = partner's efficacy for fv (centered on mean of 7.6)

*Create a teen dataset (N=1486);
data tline;
set flashe.flashetiny2;
p=0; t=1; *These variables will be used in the stacked dataset to indicate which
variables are from the teen perspective;

*Renaming the teen F&V and efficacy variables. Parent and teen variables need to have
the same name to create the stacked dataset. In the dataset tline, variables starting
with "o" indicate a parent variable;
ftveg=tftveg; *teen F&V;
oftveg=pftveg; *parent F&V;
cefffv=ctefffv; *teen centered efficacy;
coefffv=cpefffv; *parent centered efficacy;
keep dyadid p t ftveg oftveg cefffv coefffv; *Keep only the variables needed for the
dyadic analysis;
run;

*Create a parent dataset (N=1486);
data pline;
set flashe.flashetiny2;
p=1; t=0; *These variables will be used in the stacked dataset to indicate which
variables are from the parent perspective;

*Renaming the parent F&V and efficacy variables. Parent and teen variables need to
have the same name to create the stacked dataset. In the dataset pline, variables
starting with "o" indicate a teen variable;
ftveg=pftveg; *parent F&V;
oftveg=tftveg; *teen F&V;
cefffv=cpefffv; *parent centered efficacy;
coefffv=ctefffv; *teen centered efficacy;
keep dyadid p t ftveg oftveg cefffv coefffv; *Keep only the variables needed for the
dyadic analysis;
run;

*Data step will stack teen and parent datasets (tline and pline)(N=2972);
data stacktp;
set tline pline;
run;
```

```
*Need to add parent and teen gender to the dataset stacktp for analyses examining
actor and partner effects by gender;
*To add gender, we will create ftinygender, a dataset with dyad identifier, parent
gender and teen gender. This dataset then needs to be merged with the stacked dataset
(stacktp);
data ftinygender;
set flashe.flashetiny2;
keep dyadid pfem tfem; *keeping dyadid identifier, parent and teen gender variables;
run;

*sort both datasets to be merged by dyadid;
proc sort data=stacktp;
by dyadid;
run;

proc sort
data=ftinygender; by
dyadid;
run;
*Create a permanent dyadic analysis dataset by merging the stacked dataset (stacktp)
with the gender only dataset (ftinygender);
data flashe.stacktp;
merge stacktp ftinygender;
by dyadid;
label
       p = "Parent = 1, Teen =
       0" t = "Parent = 0, Teen
       ftveg = "Actor's Fruit and Veg Consumption"
       oftveg = "Partner's Fruit and Veg Consumption"

       cefffv = "Actor's Efficacy for Fruit and Veg Consumption (Centered)"
       coefffv = "Partner's Efficacy for Fruit and Veg Consumption (Centered)"
       pfem = "Female Parent = 1, Male Parent = 0"
       tfem = "Female Teen = 1, Male Teen = 0"
       ;

run;
*values from ftinygender will be included for each row with the same dyad identifier;

*Sort by Parent Gender, Teen Gender, Dyadid, Parent v. Teen. This is not required,
but allows for better visualization for the output. The dataset will now be sorted
in ascending order by parent gender, then teen gender, then dyad ID, and lastly by
the parent level of the dyad indicator.;
proc sort data=flashe.stacktp;
by pfem tfem dyadid p;
run;

title;run;title "Show structure of stacktp dataset";
run; proc contents order=varnum data=flashe.stacktp;
run;


********************************************************;
*intraclass correlation run for ftveg;
********************************************************;

*proc corr using the stacked dataset;
title;
title "Intraclass Correlation for F&V Consumption Using Stacked Dataset"; run;
proc corr data=flashe.stacktp cov;
var ftveg oftveg;
run;
```

Above, we used PROC MIXED to calculate the ICC. Another way to calculate the ICC is to use PROC CORR with the stacked dataset. The ICC between parent and teen fruit and vegetable consumption is 0.467 (highlighted in the output shown below).

Pearson Correlation Coefficients, N = 2972 Prob > |r| under H0: Rho=0		
	ftveg	**oftveg**
Ftveg Actor's Fruit and Veg Consumption	1.00000	0.46664 <.0001
oftveg Partner's Fruit and Veg Consumption	0.46664 <.0001	1.00000

```
title;
title "Intraclass Correlation for Efficacy Using Stacked Dataset"; run;
proc corr data=flashe.stacktp cov;
var efffv oefffv;
run;
```

Pearson Correlation Coefficients, N = 2972 Prob > |r| under H0: Rho=0		
	efffv	**oefffv**
efffv Actor's Efficacy for Fruit and Veg Consumption	1.00000	0.20587 <.0001
oefffv Partner's Efficacy for Fruit and Veg Consumption	0.20587 <.0001	1.00000

```
*Using PROC MIXED to calculate a negative ICC. In some instances, the ICC will be
negative, which will be evident during the data visualization steps above. When the
ICC is negative, an alternative syntax needs to be used to estimate the ICC using PROC
MIXED. Below is the original PROC MIXED syntax (for a positive ICC) to use as a
comparison to the PROC MIXED syntax for calculating a negative ICC which follows;
title;
title "Intraclass Correlation for F&V Consumption using PROC MIXED" ;run;
proc mixed data=flashe.stacktp covtest;
class dyadid;
model ftveg=/solution;
random intercept/subject=dyadid;
run;
*need to calculate ICC from ratio of dyadid variance to sum of (dyadid + residual)
variance;
*this ICC matches the one calculated above using proc corr for ftveg and oftveg.
```

Covariance Parameter Estimates					
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr > Z**
Intercept	**DYADID**	1.3283	0.08147	16.30	<.0001
Residual		1.5167	0.05564	27.26	<.0001

Calculation of the ICC: 1.3283/(1.3283+1.5167) = 0.467

```
* Below is the proc mixed version that allows for negative intraclass correlations;
title;
title "Intraclass Correlation for F&V Consumption using PROC MIXED: Unbiased
Version";run;
proc mixed data=flashe.stacktp covtest;
class dyadid;
model ftveg=/solution;
repeated /subject=dyadid type=cs; *using repeated instead of random and specifying
type=cs allows for estimation of a negative ICC;
run;
* need to calculate from ratio of dyadid variance to sum of (dyadid + residual)
variance;
```

Covariance Parameter Estimates					
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**
CS	**DYADID**	1.3283	0.08147	16.30	<.0001
Residual		1.5167	0.05564	27.26	<.0001

Calculation of the ICC: 1.3283/(1.3283+1.5167) = 0.467

```
*Pearson correlation run for ftveg using proc mixed;
*need to standardize the UN(2,1) covariance parameter to calculate ICC;
title;
title "Pearson Correlation for F&V Consumption using PROC MIXED"; run;
proc mixed data=flashe.stacktp covtest;
class dyadid p t;
model ftveg=p/noint solution;
repeated t/subject=dyadid type=un; *type=un specifies an unstandardized covariance
matrix;
run;
*need to calculate the correlation from ratio of UN(2,1) variance to the square root
of the product of (UN(1,1)*UN(2,2)) variances
For ftveg, the equation is: 1.3673 /(squareroot(2.6262*2.9859));
```

Covariance Parameter Estimates					
Cov Parm	**Subject**	**Estimate**	**Standard Error**	**Z Value**	**Pr Z**
UN(1,1)	**DYADID**	2.6262	0.09638	27.25	<.0001
UN(2,1)	**DYADID**	1.3673	0.08087	16.91	<.0001
UN(2,2)	**DYADID**	2.9859	0.1096	27.25	<.0001

Calculation of correlation: 1.3673 /(√(2.6262*2.9859)) = 0.488

```
******************************************************************************;
*Actor-Partner Analyses for Efficacy-->F&V Consumption in PROC MIXED;
******************************************************************************;
title;
title "Actor-partner Analyses for Efficacy-->F&V Consumption in PROC MIXED"; run;
proc mixed data=flashe.stacktp covtest method=ml;
class dyadid t;
model ftveg=p cefffv p*cefffv coefffv p*coefffv/solution cl;
repeated t/subject=dyadid type=un; *t is used to indicate which line in the dataset
represents the teen and which represents the parent;
run;
```

```
*See output section "Solution for Fixed Effects" for parameter estimates of parent and
  teen actor and partner effects.
Intercept = mean F&V consumption for teens.
p = additional mean F&V consumption for parents.
cefffv = teen actor effect (i.e., effect of teen self-efficacy on teen F&V
         consumption).
p*cefffv = additional actor effect of self-efficacy for parent F&V consumption.
coefffv = the parent partner effect (i.e. effect of parent self-efficacy on teen F&V
          consumption).
p*coefffv = the additional partner effect of self-efficacy for parent F&V consumption.

p + Intercept = mean F&V consumption for parents.
cefffv + p*cefffv = parent actor effect (i.e. effect of parent self-efficacy on parent
                                   F&V consumption).
coefffv + p*coefffv = teen partner effect (i.e. effect of teen self-efficacy on parent
                       F&V consumption).;
```

Solution for Fixed Effects								
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Intercept	2.7844	0.04019	1485	69.29	<.0001	0.05	2.7056	2.8632
p	0.4029	0.04180	1485	9.64	<.0001	0.05	0.3209	0.4849
cefffv	0.2581	0.01506	1485	17.14	<.0001	0.05	0.2286	0.2877
p*cefffv	-0.09036	0.02116	1485	-4.27	<.0001	0.05	-0.1319	-0.04886
coefffv	0.06289	0.01385	1485	4.54	<.0001	0.05	0.03573	0.09006
p*coefffv	0.01301	0.02112	1485	0.62	0.5380	0.05	-0.02842	0.05444

Calculating mean F&V consumption for parents: 2.7844 + 0.4029 = 3.1873

Calculating parent actor effect of self-efficacy for fruit and vegetable consumption: 0.2581 + (-0.09036) = 0.16774

Calculating teen partner effect of self-efficacy for fruit and vegetable consumption: 0.06289 + 0.01301 = 0.0759

```
*Creating separate APIM models by gender of the parent;
*need to sort by parent gender to use the by statement below;
proc sort data=flashe.stacktp;
by pfem dyadid t p;
run;

title2 "Separate APIM analyses by gender of parent";
proc mixed data=flashe.stacktp covtest method=ml;
class dyadid t;
model ftveg=p cefffv p*cefffv coefffv p*coefffv/solution
cl; repeated t/subject=dyadid type=un;
by pfem;
run;
*Output can be interpreted as before, separate effect estimates are provided for each
level of parent gender;
```

For male parents

Solution for Fixed Effects								
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Intercept	2.9564	0.08102	377	36.49	<.0001	0.05	2.7971	3.1157
p	0.1343	0.08243	377	1.63	0.1042	0.05	-0.02783	0.2963
cefffv	0.3051	0.03347	377	9.11	<.0001	0.05	0.2393	0.3709
p*cefffv	-0.1444	0.04531	377	-3.19	0.0016	0.05	-0.2335	-0.05531
coefffv	0.02095	0.02854	377	0.73	0.4634	0.05	-0.03517	0.07707
p*coefffv	0.07904	0.04502	377	1.76	0.0800	0.05	-0.00948	0.1676

For female parents

Solution for Fixed Effects								
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Intercept	2.7230	0.04612	1107	59.04	<.0001	0.05	2.6325	2.8135
p	0.4953	0.04823	1107	10.27	<.0001	0.05	0.4007	0.5899
cefffv	0.2436	0.01678	1107	14.52	<.0001	0.05	0.2107	0.2766
p*cefffv	-0.07355	0.02390	1107	-3.08	0.0021	0.05	-0.1204	-0.02666
coefffv	0.07511	0.01575	1107	4.77	<.0001	0.05	0.04420	0.1060
p*coefffv	-0.00438	0.02388	1107	-0.18	0.8545	0.05	-0.05124	0.04248

```
*Actor-partner model for ftveg as a function of efficacy;
*to look at effects by parent gender, the parent gender variable pfem needs to be
added to the model;
title2;run;
title2 Include gender of parent as a dummy variable in the model;
title3;run;
title3 "Estimate Intercepts, Actor and Partner Effects for each Parent Gender and
Parents Vs. Teens ";
proc mixed data=flashe.stacktp covtest method=ml;
class dyadid t;
model ftveg=pfem p cefffv coefffv
                    pfem*p pfem*cefffv pfem*coefffv p*cefffv  p*coefffv
                    pfem*p*cefffv pfem*p*coefffv/solution cl; *APIM model with
original terms, pfem added and new interactions with pfem added to each original
term; repeated t/subject=dyadid type=un;

*Use the estimate statement to obtain estimates and tests of effects of interest. Each
term from the model statement is included in each estimate statement;

*First, we estimate intercepts, actor, and partner effects separately for male and
female parents;

*male parent estimates. These six estimates match those calculated using the
stratified model;
estimate "Male Parent Dyads: Teen Intercept" intercept 1 pfem 0 p 0 cefffv 0 coefffv 0
            pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 0 pfem*p*cefffv
            0 pfem*p*coefffv 0 /cl;
estimate "Male Parent Dyads: Teen Actor Effect" intercept 0 pfem 0 p 0 cefffv 1
            coefffv 0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 0
pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Male Parent Dyads: Parent Partner Effect" intercept 0 pfem 0 p 0 cefffv 0
            coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 0
            pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
```

```
estimate "Male Parent Dyads: Parent Intercept" intercept 1 pfem 0 p 1 cefffv 0 coefffv
            0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 0
            pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Male Parent Dyads: Parent Actor Effect" intercept 0 pfem 0 p 0 cefffv 1
            coefffv 0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 1  p*coefffv 0
            pfem*p*cefffv 0 pfem*p*coefffv 0 /cl;
estimate "Male Parent Dyads: Teen Partner Effect" intercept 0 pfem 0 p 0 cefffv 0
            coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 1
            pfem*p*cefffv 0 pfem*p*coefffv 0/ cl;

*female parent estimates. These six estimates match those calculated using the
stratified model;
estimate "Female Parent Dyads: Teen Intercept" intercept 1 pfem 1 p 0 cefffv 0 coefffv
            0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0 p*coefffv 0
            pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Teen Actor Effect" intercept 0 pfem 0 p 0 cefffv 1
            coefffv 0 pfem*p 0 pfem*cefffv 1 pfem*coefffv 0 p*cefffv 0  p*coefffv 0
pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Parent Partner Effect" intercept 0 pfem 0 p 0 cefffv 0
            coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 1 p*cefffv 0  p*coefffv
            0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Parent Intercept" intercept 1 pfem 1 p 1 cefffv 0
            coefffv 0 pfem*p 1 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0  p*coefffv
0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Parent Actor Effect" intercept 0 pfem 0 p 0 cefffv 1
            coefffv 0 pfem*p 0 pfem*cefffv 1 pfem*coefffv 0 p*cefffv 1 p*coefffv
            0 pfem*p*cefffv 1 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Teen Partner Effect" intercept 0 pfem 0 p 0 cefffv 0
            coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 1 p*cefffv 0  p*coefffv 1
            pfem*p*cefffv 0 pfem*p*coefffv 1/cl;

*In addition to the estimates calculated using the stratified model, we can also
assess the teen and parent actor and partner effects, the overall actor effects, and
the overall partner effects separately for male and female parents;

*for male parents;
estimate "Male Parent Dyads: Teen Actor and Partner Effects" intercept 0 pfem 0 p 0
            cefffv 1 coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0
            p*coefffv 1 pfem*p*cefffv 0 pfem*p*coefffv 0/cl; *we are adding the effect
            estimates of the teen actor and partner effects to determine the total
            teen effect;
estimate "Male Parent Dyads: Parent Actor and Partner Effects" intercept 0 pfem 0 p 0
            cefffv 1 coefffv 1 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 1
            p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv 0 /cl; *we are adding the
            effect estimates of the parent actor and partner effects to determine
the total parent effect;
estimate "Male Parent Dyads: Parent and Teen Actor Effects" intercept 0 pfem 0 p 0
            cefffv 2 coefffv 0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 1
            p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl; *we are adding the effect
            estimates of the teen actor and parent actor effects to determine
            the total actor effect. The estimate for cefffv needs to be counted
            because it is used to estimate the actor effect for both parents and
            teens;
estimate "Male Parent Dyads: Parent and Teen Partner Effects" intercept 0 pfem 0 p 0
            cefffv 0 coefffv 2 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0 p*cefffv 0
            p*coefffv 1 pfem*p*cefffv 0 pfem*p*coefffv 0/cl; *we are adding the effect
            estimates of the teen partner and parent partner effects to determine the
            total partner effect. The estimate for coefffv needs to be counted twice
            because it is used to estimate the partner effect for both parents and
            teens;

*for female parents;
```

```
estimate "Female Parent Dyads: Parent Actor and Partner Effects" intercept 0 pfem 0 p
            0 cefffv 1 coefffv 1 pfem*p 0 pfem*cefffv 1 pfem*coefffv 1 p*cefffv 1
            p*coefffv 0 pfem*p*cefffv 1 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Teen Actor and Partner Effects" intercept 0 pfem 0 p 0
            cefffv 1 coefffv 1 pfem*p 0 pfem*cefffv 1 pfem*coefffv 1 p*cefffv 0
            p*coefffv 1 pfem*p*cefffv 0 pfem*p*coefffv 1/cl;
estimate "Female Parent Dyads: Parent and Teen Actor Effects" intercept 0 pfem 0 p 0
            cefffv 2 coefffv 0 pfem*p 0 pfem*cefffv 2 pfem*coefffv 0 p*cefffv 1
            p*coefffv 0 pfem*p*cefffv 1 pfem*p*coefffv 0/cl;
estimate "Female Parent Dyads: Parent and Teen Partner Effects" intercept 0 pfem 0 p 0
            cefffv 0 coefffv 2 pfem*p 0 pfem*cefffv 0 pfem*coefffv 2 p*cefffv 0
            p*coefffv 1 pfem*p*cefffv 0 pfem*p*coefffv 1/cl;

*Lastly, we can contrast the size of these effects for male and female parent dyads,
and determine if the differences are statistically significant;
*teen effects;
estimate "Are teen intercepts larger for female than male parent dyads?" intercept 0
            pfem 1 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 0 pfem*coefffv 0
            p*cefffv 0 p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Are teen actor effects larger for female than male parent dyads?" intercept
      0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 1 pfem*coefffv 0
          p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
  estimate "Are teen partner effects larger for female than male parent dyads?"
            intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 0
            pfem*coefffv 1 p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv
            1/cl;
estimate "Are teen (actor and partner) effects larger for female than male parent
            dyads?" intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 1
            pfem*coefffv 1 p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv
            1/cl;
*parent effects;
estimate "Are parent intercepts larger for female than male parent dyads?" intercept 0
            pfem 1 p 0 cefffv 0 coefffv 0 pfem*p 1 pfem*cefffv 0 pfem*coefffv 0
            p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv 0/cl;
estimate "Are parent actor effects larger for female than male parent dyads?"
            intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 1
            pfem*coefffv 0 p*cefffv 0 p*coefffv 0 pfem*p*cefffv 1 pfem*p*coefffv 0/cl;
estimate "Are parent partner effects larger for female than male parent dyads?"
            intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 0
            pfem*coefffv 1 p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv
            0/cl;
estimate "Are parent (actor and partner) effects larger for female than male parent
            dyads?" intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 1
            pfem*coefffv 1 p*cefffv 0 p*coefffv 0 pfem*p*cefffv 1 pfem*p*coefffv 0/cl;
*actor effects;
estimate "Are (parent and teen) actor effects larger for female than male parent
            dyads?" intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 2
            pfem*coefffv 0 p*cefffv 0  p*coefffv 0 pfem*p*cefffv 1 pfem*p*coefffv
            0/cl;
*partner effects;
estimate "Are (parent and teen) partner effects larger for female than male parent
            dyads?" intercept 0 pfem 0 p 0 cefffv 0 coefffv 0 pfem*p 0 pfem*cefffv 0
            pfem*coefffv 2 p*cefffv 0  p*coefffv 0 pfem*p*cefffv 0 pfem*p*coefffv
            1/cl;
```

The “Solution for Fixed Effects” table shows the estimates for each term included in the model statement

Solution for Fixed Effects								
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Intercept	2.9564	0.07973	1484	37.08	<.0001	0.05	2.8000	3.1128
pfem	-0.2334	0.09224	1484	-2.53	0.0115	0.05	-0.4143	-0.05243
p	0.1343	0.08279	1484	1.62	0.1051	0.05	-0.02814	0.2966
cefffv	0.3051	0.03294	1484	9.26	<.0001	0.05	0.2405	0.3697
coefffv	0.02095	0.02809	1484	0.75	0.4559	0.05	-0.03415	0.07604
pfem*p	0.3610	0.09578	1484	3.77	0.0002	0.05	0.1732	0.5489
pfem*cefffv	-0.06146	0.03701	1484	-1.66	0.0970	0.05	-0.1341	0.01114
pfem*coefffv	0.05417	0.03225	1484	1.68	0.0932	0.05	-0.00909	0.1174
p*cefffv	-0.1444	0.04503	1484	-3.21	0.0014	0.05	-0.2327	-0.05608
p*coefffv	0.07904	0.04490	1484	1.76	0.0786	0.05	-0.00904	0.1671
pfem*p*cefffv	0.07086	0.05100	1484	1.39	0.1649	0.05	-0.02918	0.1709
pfem*p*coefffv	-0.08342	0.05087	1484	-1.64	0.1013	0.05	-0.1832	0.01637

The result of each estimate statement is included in the “Estimates” table. We will now go through this table.

Estimates								
Label	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Male Parent Dyads: Teen Intercept	2.9564	0.07973	1484	37.08	<.0001	0.05	2.8000	3.1128
Male Parent Dyads: Teen Actor Effect	0.3051	0.03294	1484	9.26	<.0001	0.05	0.2405	0.3697
Male Parent Dyads: Parent Partner Effect	0.02095	0.02809	1484	0.75	0.4559	0.05	-0.03415	0.07604
Male Parent Dyads: Parent Intercept	3.0906	0.07815	1484	39.55	<.0001	0.05	2.9373	3.2439
Male Parent Dyads: Parent Actor Effect	0.1607	0.02753	1484	5.84	<.0001	0.05	0.1067	0.2147
Male Parent Dyads: Teen Partner Effect	0.09998	0.03229	1484	3.10	0.0020	0.05	0.03665	0.1633
Female Parent Dyads: Teen Intercept	2.7230	0.04638	1484	58.71	<.0001	0.05	2.6320	2.8140
Female Parent Dyads: Teen Actor Effect	0.2436	0.01687	1484	14.44	<.0001	0.05	0.2105	0.2767
Female Parent Dyads: Parent Partner Effect	0.07511	0.01584	1484	4.74	<.0001	0.05	0.04404	0.1062

Estimates								
Label	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Female Parent Dyads: Parent Intercept	3.2183	0.04546	1484	70.79	<.0001	0.05	3.1291	3.3075
Female Parent Dyads: Parent Actor Effect	0.1701	0.01553	1484	10.95	<.0001	0.05	0.1396	0.2005
Female Parent Dyads: Teen Partner Effect	0.07073	0.01654	1484	4.28	<.0001	0.05	0.03829	0.1032

The above estimates are all identical to the results of the stratified model looking at effects by parent gender.

Below we can consider the total teen, parent, actor, and partner effects by parent gender:

Male Parent Dyads: Teen Actor and Partner Effects	0.4051	0.05554	1484	7.29	<.0001	0.05	0.2961	0.5140

Among male parents: Total impact of teen self-efficacy on F&V consumption

Male Parent Dyads: Parent Actor and Partner Effects	0.1816	0.04736	1484	3.83	0.0001	0.05	0.08872	0.2745

Among male parents: Total impact of parent self-efficacy on F&V consumption

Male Parent Dyads: Parent and Teen Actor Effects	0.4658	0.04072	1484	11.44	<.0001	0.05	0.3859	0.5456

Among male parents: Total actor effect on F&V consumption

Male Parent Dyads: Parent and Teen Partner Effects	0.1209	0.04057	1484	2.98	0.0029	0.05	0.04134	0.2005

Among male parents: Total partner effect on F&V consumption

Female Parent Dyads: Parent Actor and Partner Effects	0.2452	0.02672	1484	9.18	<.0001	0.05	0.1928	0.2976

Among female parents: Total impact of parent self-efficacy on F&V consumption

Female Parent Dyads: Teen Actor and Partner Effects	0.3144	0.02845	1484	11.05	<.0001	0.05	0.2586	0.3702

Among female parents: Total impact of teen self-efficacy on F&V consumption

Estimates								
Label	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Female Parent Dyads: Parent and Teen Actor Effects	0.4137	0.02188	1484	18.91	<.0001	0.05	0.3708	0.4566

Among female parents: Total actor effect on F&V consumption

Female Parent Dyads: Parent and Teen Partner Effects	0.1458	0.02185	1484	6.68	<.0001	0.05	0.1030	0.1887

Among female parents: Total partner effect on F&V consumption

We can also use the estimates statement to test specific questions:

Are teen intercepts larger for female than male parent dyads?	-0.2334	0.09224	1484	-2.53	0.0115	0.05	-0.4143	-0.05243

Interpretation: Mean F&V consumption for teens is significantly lower for female compared to male parent dyads

Are teen actor effects larger for female than male parent dyads?	-0.06146	0.03701	1484	-1.66	0.0970	0.05	-0.1341	0.01114

Interpretation: There is no difference in teen actor effects for male and female parent dyads

Are teen partner effects larger for female than male parent dyads?	-0.02925	0.03628	1484	-0.81	0.4201	0.05	-0.1004	0.04190

Interpretation: There is no difference in teen partner effects for male and female parent dyads

Are teen (actor and partner) effects larger for female than male parent dyads?	-0.09071	0.06241	1484	-1.45	0.1463	0.05	-0.2131	0.03170

Interpretation: There is no difference in teen effects for male and female parent dyads

Are parent intercepts larger for female than male parent dyads?	0.1277	0.09041	1484	1.41	0.1581	0.05	-0.04968	0.3050

Interpretation: Mean parent F&V consumption does not differ between male and female parent dyads

Are parent actor effects larger for female than male parent dyads?	0.009405	0.03161	1484	0.30	0.7661	0.05	-0.05260	0.07141

Interpretation: There is no difference in parent actor effects for male and female parent dyads

Estimates								
Label	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**
Are parent partner effects larger for female than male parent dyads?	0.05417	0.03225	1484	1.68	0.0932	0.05	-0.00909	0.1174

Interpretation: There is no difference in parent partner effects for male and female parent dyads

Are parent (actor and partner) effects larger for female than male parent dyads?	0.06357	0.05438	1484	1.17	0.2426	0.05	-0.04309	0.1702

Interpretation: There is no difference in parent effects for male and female parent dyads

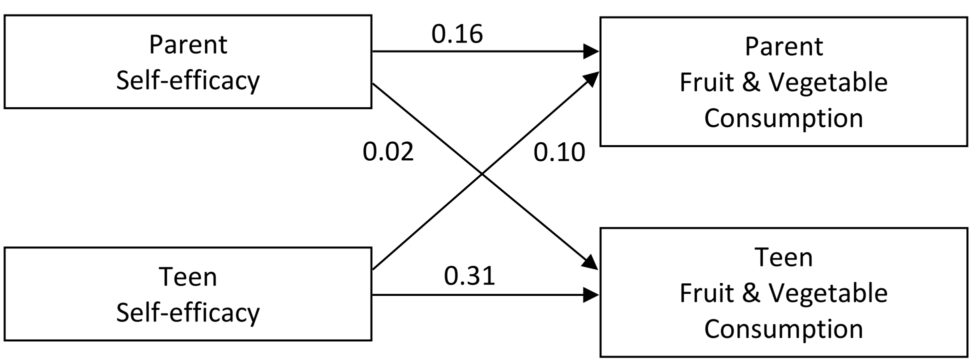
Are (parent and teen) actor effects larger for female than male parent dyads?	-0.05205	0.04622	1484	-1.13	0.2603	0.05	-0.1427	0.03862

Interpretation: There is no difference in actor effects for male and female parent dyads

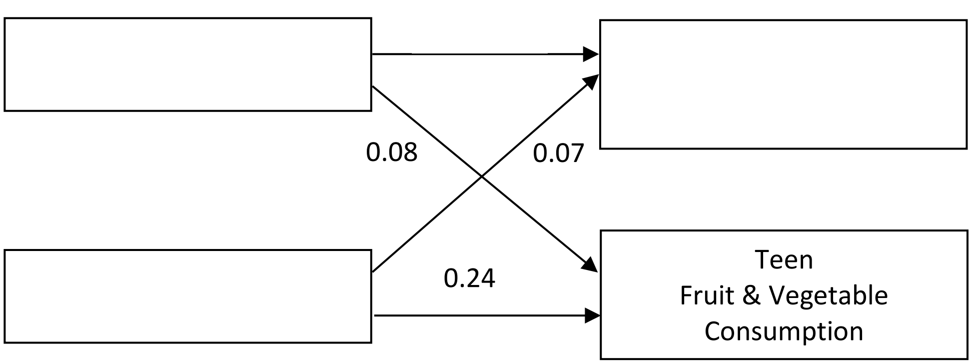
Are (parent and teen) partner effects larger for female than male parent dyads?	0.02491	0.04608	1484	0.54	0.5889	0.05	-0.06548	0.1153

Interpretation: There is no difference in partner effects for male and female parent dyads

Path model of Actor-Partner Interdependence Model results for male parents:



Path model of Actor-Partner Interdependence Model results for female parents:



```
********************************************************************************
END OF FILE: analyze-actor-partner-flashe-tiny2.sas
********************************************************************************;
```

Example Analysis of Dyadic Data Using Mplus

In the following section, Mplus code is provided to replicate the basic APIM results produced above using SAS PROC MIXED. Note that in Mplus a "!" symbol is used to indicate a comment and appears as a green color when viewing syntax in Mplus. The program below uses the dyad-level dataset "flashytiny2mplus" which has one row per dyad. The dataset was created in SAS and saved as a .csv file. Note that in Mplus, no variable names can be included in the .csv file.

```
TITLE:    Fruit and Veg on Efficacy APIM; ! A title is not required but useful to
have.

DATA:     FILE = Insert filepath to folder containing the FLASHE dataset csv file\
flashytiny2mplus.csv; !Note that can also include path to data
                       !Dataset needs to be structured so that there is
                       !one row per dyad with teen and parent
                       !variables for the constructs of interest in each row.

VARIABLE: NAMES = DYADID pftveg tftveg pefffv tefffv cpefffv ctefffv pfem tfem;
!Provide a list of the variable names in the order in which they appear as  columns in
the data file.
          USEVAR = pftveg tftveg cpefffv ctefffv;!USEVAR selects particular variables
                                                  for analysis.

ANALYSIS: TYPE = GENERAL;

MODEL:    tftveg ON ctefffv;  !Regress teen F&V consumption on a centered version of
                               teen efficacy for eating F&V.
          tftveg ON cpefffv;  !Regress teen F&V consumption on a centered version of
                               parent efficacy for eating F&V.
          pftveg ON cpefffv;  !Regress parent F&V consumption on a centered version of
                               parent efficacy for eating F&V.
          pftveg ON ctefffv;  !Regress parent F&V consumption on a centered version of
                               teen efficacy for eating F&V.
          tftveg WITH pftveg; !Specify residual covariance of teen and parent F&V
                               outcomes.

OUTPUT:   SAMPSTAT CINTERVAL STDYX; !Request sample statistics, confidence intervals,
                                     and standardized coefficients in output.

PLOT:     TYPE=PLOT1 PLOT2 PLOT3; !For basic univariate histograms and scatterplots of
                                   model variables.

!Note: input lines exceed 90 characters because of comments. Warning messages will be
included in the output
```

MODEL RESULTS

The first sets of results in the model results section are unstandardized estimates.

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value	
TFTVEG ON					
CTEFFFV	0.258	0.015	17.140	0.000	Teen actor effect
CPEFFFV	0.063	0.014	4.542	0.000	Parent partner effect
PFTVEG ON					
CPEFFFV	0.168	0.014	12.397	0.000	Parent actor effect
CTEFFFV	0.076	0.015	5.157	0.000	Teen partner effect
TFTVEG WITH					
PFTVEG	1.047	0.067	15.723	0.000	Covariance of the residuals between parent and teen fruit and vegetable consumption
Intercepts					
PFTVEG	3.186	0.039	81.157	0.000	Mean parent consumption
TFTVEG	2.781	0.040	69.286	0.000	Mean teen consumption
Residual Variances					
PFTVEG	2.291	0.084	27.258	0.000	Remaining unexplained variance in parent fruit and vegetable consumption
TFTVEG	2.399	0.088	27.258	0.000	Remaining unexplained variance in teen fruit and vegetable consumption

The next sets of results in the model results section are the standardized estimates. All estimates have the same meaning, but they have been standardized so that the estimates are in standard deviation units.

STANDARDIZED MODEL RESULTS

STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
TFTVEG ON				
CTEFFFV	0.408	0.022	18.665	0.000
CPEFFFV	0.108	0.024	4.562	0.000
PFTVEG ON				
CPEFFFV	0.307	0.024	12.986	0.000
CTEFFFV	0.128	0.025	5.194	0.000

```
TFTVEG   WITH

    PFTVEG            0.447      0.021        21.514        0.000
Intercepts
    PFTVEG            1.967      0.043        45.355        0.000
    TFTVEG            1.612      0.038        42.845        0.000

Residual Variances
    PFTVEG            0.873      0.016        54.113        0.000
    TFTVEG            0.804      0.018        43.546        0.000
```

The R-square output provides information on the amount of variation explained by the model for each dependent variable.

R-SQUARE

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value	
PFTVEG	0.127	0.016	7.863	0.000	12.7% of the variance of parent fruit and vegetable consumption is explained by the model
TFTVEG	0.196	0.018	10.610	0.000	19.6% of the variance of teen fruit and vegetable consumption is explained by the model

The next set of Mplus code conducts the APIM model regressing Fruit & Veg Consumption on efficacy where effects are allowed to differ by parent sex. These results replicate the earlier corresponding SAS PROC MIXED results.

```
TITLE:   Efficacy for Fruit and Veg APIM moderated by Parent Sex;
DATA:    FILE = flashytiny2mplus.csv;  !Note that can also include path to data.
                                      !Dataset needs to be structured so that there is
                                      !one row per dyad with teen and parent
                                      !variables for the constructs of interest in
                                      each row.

VARIABLE: NAMES = pftveg tftveg pefffv tefffv cpefffv ctefffv pfem tfem;
!Provide a list of the variable names in the order in which they appear as columns in
the data file.
          USEVAR = pftveg tftveg cpefffv ctefffv;!USEVAR selects particular variables
                                                  for analysis.
          GROUPING is pfem (0=dad,1=mom);    !Specify the parent sex variable and
                                               categories to use in stratified models.
ANALYSIS: TYPE = GENERAL;
MODEL:    tftveg ON ctefffv; !Regress teen F&V consumption on a centered version of
                              teen efficacy for eating F&V.
          tftveg ON cpefffv; !Regress teen F&V consumption on a centered version of
                              parent efficacy for eating F&V.
          pftveg ON ctefffv; !Regress parent F&V consumption on a centered version of
                              teen efficacy for eating F&V.
          pftveg ON cpefffv; !Regress parent F&V consumption on a centered version of
                              parent efficacy for eating F&V.
          tftveg WITH pftveg;!Specify residual covariance of teen and parent F&V
                              outcomes.
          ctefffv WITH cpefffv; !Specify the correlation between parent and teen
                                 centered efficacy.

!Create a model only among dads
MODEL dad:
          tftveg ON ctefffv (dad1); !(dad1) adds a label to the parameter estimated
                                      from this regression.
          tftveg ON cpefffv (dad2); ! Labels added to all parameters.
          pftveg ON ctefffv (dad3);
          pftveg ON cpefffv (dad4);
          tftveg WITH pftveg (cov1); !Constrain residual covariance to be the same for
                                      moms and dads; need for equivalency to SAS
                                      MIXED.
          ctefffv WITH cpefffv (dad5);
          [tftveg] (dad0t); [pftveg] (dad0p);!Adding labels to teen and parent F&V
                                              intake consumption  for dad only models.
          tftveg (var1); pftveg (var2); !Adding labels to the residual variances of
                                         teen and parent F&V intake to constrain
                                         across both.

!Create a model only among moms, add mom specific labels to estimates.
MODEL mom:
          tftveg ON ctefffv (mom1);
          tftveg ON cpefffv (mom2);
          pftveg ON ctefffv (mom3);
          pftveg ON cpefffv (mom4);
          tftveg WITH pftveg (cov1); !Constrain residual covariance to be the same for
                                      moms and dads; need for equivalency to SAS
                                      MIXED.
```

```
          ctefffv WITH cpefffv (mom5);
          [tftveg] (mom0t); [pftveg] (mom0p);!Adding labels to teen and parent F&V
                                              intake consumption  for mom only models.
          tftveg (var1); pftveg (var2);

MODEL CONSTRAINT:  !testing differences in estimates for mom vs. dad models.
new (tinterc pinterc tactor tpartner pactor ppartner coveff); !creating new
                                                                  parameters.
tinterc = mom0t-dad0t; !testing for a significant difference in mean teen F&V intake
                        for moms vs. dads.
pinterc = mom0p-dad0p; !testing for a significant difference in mean F&V parent intake
                        for moms vs. dads.
tactor = mom1-dad1; !testing for a significant difference in the teen actor effect for
                      moms vs. dads.
ppartner = mom2-dad2; !testing for a significant difference in the parent partner
                       effect for moms vs. dads.
pactor = mom4-dad4; !testing for a significant difference in the parent actor effect
                     for moms vs. dads.
tpartner = mom3-dad3; !testing for a significant difference in the teen partner effect
                       for moms vs. dads.
coveff = mom5-dad5; !testing for a significant difference in the correlation between
                     parent and teen efficacy for moms vs. dads.

OUTPUT:   SAMPSTAT CINTERVAL STDYX ; !Request sample statistics, confidence intervals,
                                      and standardized coefficients in output.

PLOT:     TYPE=PLOT1 PLOT2 PLOT3; !For basic univariate histograms and scatterplots of
model variables.

! For path model diagram, select "View diagram" under DIAGRAM menu option at top of
window;
```

The first sets of results in the model results section are unstandardized estimates separated by male parents versus female parents.

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value	
Group DAD					
TFTVEG ON					
CTEFFFV	0.305	0.033	9.262	0.000	Teen actor effect for teens with male parents
CPEFFFV	0.021	0.028	0.746	0.456	Parent partner effect among male parents
PFTVEG ON					
CTEFFFV	0.100	0.032	3.097	0.002	Teen partner effect for teens with male parents
CPEFFFV	0.161	0.028	5.836	0.000	Parent actor effect among male parents
TFTVEG WITH					
PFTVEG	1.051	0.066	15.825	0.000	Covariance of the residuals between parent and teen fruit and vegetable consumption for male parent dyads

CTEFFFV WITH					
CPEFFFV	1.626	0.379	4.297	0.000	Correlation between parent and teen efficacy for male parent dyads
Means					
CPEFFFV	0.079	0.149	0.527	0.599	Mean parent efficacy for male parents
CTEFFFV	0.237	0.127	1.865	0.062	Mean teen efficacy for teens with male parents
Intercepts					
PFTVEG	3.091	0.078	39.547	0.000	Mean parent consumption among male parents
TFTVEG	2.956	0.080	37.079	0.000	Mean teen consumption for teens with male parents
Variances					
CPEFFFV	8.417	0.612	13.748	0.000	Variance in parent efficacy for male parents
CTEFFFV	6.120	0.445	13.748	0.000	Variance in teen efficacy for teens with male parents
Residual Variances					
PFTVEG	2.288	0.084	27.258	0.000	Remaining unexplained variance in parent fruit and vegetable consumption among male parents
TFTVEG	2.381	0.087	27.258	0.000	Remaining unexplained variance in teen fruit and vegetable consumption for teens with male parents
Group MOM					
TFTVEG ON					
CTEFFFV	0.244	0.017	14.439	0.000	Teen actor effect for teens with female parents
CPEFFFV	0.075	0.016	4.741	0.000	Parent partner effect among female parents
PFTVEG ON					
CTEFFFV	0.071	0.017	4.277	0.000	Teen partner effect for teens with female parents
CPEFFFV	0.170	0.016	10.952	0.000	Parent actor effect among female parents

TFTVEG WITH					
PFTVEG	1.051	0.066	15.825	0.000	Covariance of the residuals between parent and teen fruit and vegetable consumption for female parent dyads
CTEFFFV WITH					
CPEFFFV	1.675	0.257	6.528	0.000	Correlation between parent and teen efficacy for female parent dyads
Means					
CPEFFFV	-0.080	0.090	-0.888	0.374	Mean parent efficacy for female parents
CTEFFFV	-0.068	0.084	-0.812	0.417	Mean teen efficacy for teens with female parents
Intercepts					
PFTVEG	3.218	0.045	70.790	0.000	Mean parent consumption among female parents
TFTVEG	2.723	0.046	58.709	0.000	Mean teen consumption for teens with female parents
Variances					
CPEFFFV	8.918	0.379	23.537	0.000	Variance in parent efficacy for female parents
CTEFFFV	7.862	0.334	23.537	0.000	Variance in teen efficacy for teens with female parents
Residual Variances					
PFTVEG	2.288	0.084	27.258	0.000	Remaining unexplained variance in parent fruit and vegetable consumption among female parents
TFTVEG	2.381	0.087	27.258	0.000	Remaining unexplained variance in teen fruit and vegetable consumption for teens with female parents

The model results section also includes standardized estimates, which were presented above for the model that did not stratify by parent gender.

Below are the additional tests requested in Mplus that tested the differences between moms and dads on the teen intercepts (`TINTERC`), the parent intercepts (`PINTERC`), the teen actor effect (`TACTOR`), the teen partner effect (`TPARTNER`), the parent actor effect (`PACTOR`), the parent partner effect (`PPARTNER`), and the correlation between parent and teen efficacy (`COVEFF`). These effects are replicates of what was reported above in the corresponding SAS analysis.

New/Additional Parameters

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value	
TINTERC	-0.233	0.092	-2.530	0.011	There is a significant difference in mean teen consumption for teens with female compared to male parents
PINTERC	0.128	0.090	1.412	0.158	There is not a significant difference in mean parent consumption for female compared to male parents
TACTOR	-0.061	0.037	-1.661	0.097	There is not a significant difference in teen actor effect for teens with female compared to male parents
TPARTNER	-0.029	0.036	-0.806	0.420	There is not a significant difference in teen partner effect for teens with female compared to male parents
PACTOR	0.009	0.032	0.298	0.766	There is not a significant difference in parent actor effect for female compared to male parents
PPARTNER	0.054	0.032	1.680	0.093	There is not a significant difference in parent partner effect for female compared to male parents
COVEFF	0.049	0.457	0.106	0.916	There is not a significant difference in the correlation between parent and teen efficacy by parent gender