

*Senior Project*  
*Department of Economics*



**The Effect of Depression  
on Academic Achievement  
for Students in 5<sup>th</sup>-12<sup>th</sup> Grade**

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*Abstract*

*This paper examines the relationship between adolescent depression and academic achievement in 5<sup>th</sup> through 12<sup>th</sup> grade populations. I use cross-sectional data from The Panel Study of Income Dynamics-The Child Development Supplement. I build upon previous literature that examines how depression affects human capital accumulation. I find that depression does not affect academic achievement on standardized tests for students in the 5<sup>th</sup>-12<sup>th</sup> grade.*

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## **I. Introduction, Hypothesis and Motivation**

It is estimated that over 1 in 10 students will develop a depressive disorder by age 18 (“NIMH”). During adolescence, students go through many life changes. Sometimes it can be hard to distinguish mood changes from depression. Unfortunately though, depression is not a temporary phase. Depression is characterized as a feeling of prolonged sadness and loss of interest in activities (“Mayo Clinic”). According to the World Health Organization major depressive disorder is the leading cause of disability among Americans age 15 to 44 (“NIMH”). Children suffering from depression may refuse to go to school, get in trouble at school, or have suicidal thoughts (“NIMH”).

There has been very little research in economics on the topic of depression and it’s impact on educational achievement especially in preadolescence and adolescence. Depression in childhood may lead to depression in adulthood if it is not treated. It is estimated that \$193.2 billion in earnings are lost each year due to serious mental illness (“NAMI”). However, with medication and therapy, youth depression can be treated. This is why it is important that intervention occur as early as possible to improve the chances of a productive future. The goal of this paper is to examine how depression impacts academic achievement in middle and high school students.

## **II. Literature Review**

When examining the literature, almost all of the empirical studies found differences between boys and girls when examining how mental health may impact educational attainment. Berndt et al. (2000) found that women with early onset depression (defined as presenting before

age 22) experience a decrease in educational attainment. Women with early onset depression also experienced losses of human capital accumulation in amounts of about 12 to 18 percent of annual earnings in comparison to women who had later onset depression or were not depressed. Berndt et al. (2000) noted that treatment earlier rather than later could improve depressed females economic outcomes.

Currie and Stabile (2006) also examined mental health. Rather than analyzing depression though they looked at ADHD in students from the National Longitudinal Survey of Youth and the Canadian National Longitudinal Survey of Children and Youth. Utilizing a family fixed effect model, their findings revealed that ADHD can be detrimental for boys, impacting their human capital accumulation greater than physical health problems. This is a great development in the literature because it notes that mental health can have a significant impact on the futures of children.

Fletcher (2008) examined the probability of being diagnosed with depression based on individual family, community characteristics, and symptoms of depression. Using the Adolescent Health Study, he found that males and minorities are less likely to be diagnosed with depression. Furthermore, he finds that males are relatively unaffected in terms of educational attainment and finds that females with depression are impacted much more severely. Fletcher (2008) finds that females with depression are more likely to drop out of high school and contingent on graduating high school; it is relatively unlikely that they will enroll in college.

Ding et al (2009) tackles a major problem in health and education research-namely endogeneity. Utilizing the Georgetown Adolescent Tobacco Research Study they surveyed students in 9<sup>th</sup>-12<sup>th</sup> grade. They utilize genetic markers to examine how particular mental health

conditions influence academic performance in adolescence. Findings suggest that depression may impact GPA negatively by 0.45 for women, leaving boys unaffected (Ding et al. 2009).

Finally, Fletcher (2010) revisits his previous research to determine if unobserved family-level characteristics are the explanation behind previous research linking depression and human capital accumulation. Fletcher (2010) utilizes a sibling fixed effect model to observe siblings in grades 7-12 and finds suggestive evidence of decreased educational attainment for those with depression and those with sub-clinical symptoms. Fletcher (2010) finds that children diagnosed with depression experience a decrease in educational attainment by about 0.16 to 0.5 years. For those with subclinical symptoms the decrease in educational attainment can be as large as 0.25 years (Fletcher 2010).

I hope to add to this literature by examining how middle and high school student's test scores are affected by depression. As Berndt et al. (2000) noted, earlier diagnoses can improve economic outcomes for those with early-onset depression.

### **III. Data Sources and Descriptions**

The purpose of this project is to examine the relationship between depression and academic achievement in adolescent populations. I examine how depression affects middle and high school academic achievement. I will test if depression affects academic achievement, and if it does how much.

The data for this paper is from the Child Development Supplement (2007), which started in 1997, and stems from the PSID that initially began in 1968. The PSID consisted of children ages 0-12 and extensive interviews were conducted. Information was then again collected from children of the PSID and the Child Development Supplement was created. These interviews

were conducted in 2002/2003 and again in 2007/2008. I will be using the 2007/2008 wave of children. Children remain in the study until they reach age 18. It includes information on physical health, emotional well-being, intellectual and academic achievement, cognitive ability, social relationships with family and peers, time diaries and more.

My variable of interest depression is measured utilizing the Child Depression Inventory-Short Form. The Child Depression Inventory assesses a child's self-reported symptoms of depression and feelings that may include worthlessness and loss of interest in activities (Pearson). The short form is able to assess a child's well-being in a time frame shorter than the standard CDI. It is a 10-question interview that surveys a child's feelings over the past 2 weeks. Responses range from 1-3 and are recorded and then summed. Depression scores are then normalized to a given population of 1,100 children aged 7-17 from 26 states. The scores range from 1-18. The Child Development Supplement interviewed children aged 12-18 utilizing the CDI Short-Form. This limits the availability for data including middle school aged children however there is still a small sample available.

To measure educational achievement, the Child Development Supplement utilized the Woodcock-Johnson Measures of Student Achievement. These tests allow researchers to focus on the degree of mastery in several subjects including Letter-Word Recognition, Passage Comprehension, and Applied Problem Solving. These tests are standardized and they are structured to progress in difficulty as the child works through them. The test is scored using an algorithm that is dependent on the type of test utilized for the child (PSID).

I am also including a variable that measures the amount of time the student spends on homework. The expected sign of this variable would be positive suggesting that as a student spends more time on homework they would perform better on a test.

#### IV. Theoretical Overview

Several studies have accounted for the problem of endogeneity and unobserved heterogeneity. The question is whether health affects education or if education makes health more productive. Grossman (1972) states that by having more education, health becomes more productive. On the contrary, Todd and Wolpin (2003) state that by being healthier, cognitive function improves. To control for this endogeneity, I will be utilizing a sibling fixed effect model.

The theory that my empirical study is based upon is Todd and Wolpin's (2003) estimation of the production function for cognitive achievement. Todd and Wolpin (2003) define the production function for cognitive achievement as:

$$T_{\alpha} = T_{\alpha} [ F(\alpha), S(\alpha), \mu, \varepsilon_{\alpha} ]$$

With  $T$  being a measure of achievement and  $\alpha$  representing age.  $F$  is a vector of parent supplied inputs and  $S$  is a vector of school supplied inputs. Finally, this model also takes into account endowed intelligence as measured by  $\mu$ .

#### V. Methodology

I will measure educational attainment through the Woodcock-Johnson Measures of Student Achievement. There are three separate measures, Letter Word, Passage Comprehension, and Applied Problem. I will measure depression by utilizing the CDI short form score that was collected for each individual over age 12. For the vector of school inputs, I will use a dummy variable that will note whether a student attends a public, private, or homeschooling system. I will also differentiate between grade levels and whether or not the student has a tutor. Finally, I

will include time the student spends on their homework and the time that the student spends sleeping. I do not have data to measure endowed intelligence and therefore that will be captured within the error term.

$$Achieve_i = \alpha_0 + \beta_1 Depression_i + \beta_2 Public_i + \beta_3 Private_i + \beta_4 Home_i + \beta_5 TimeHW_i + \\ \beta_6 TimeSleep_i + \beta_7 Tutor_i + \beta_8 SGroup_i + \beta_9 Female_i + \beta_{10} ParEvent_i + u_i$$

This first regression will encompass how student achievement is impacted by depression on the Woodcock-Johnson Letter Word Test. The Letter Word Test tests the student on letter detection and analysis, recognition of visual words, and pronunciation of visual words (Wendling, Schrank, Schmitt (2007)). The second regression will examine how depression affects a student's achievement on the Passage Comprehension portion of the Woodcock-Johnson Achievement test. This test measures a student's performance in reading comprehension and passage completion (cloze ability) (Wendling, Schrank, Schmitt (2007)). The third and final regression will measure a student's achievement on the Woodcock-Johnson Applied Problem exam. The Applied Problem portion tests a student on quantitative reasoning, math achievement, and math knowledge (Wendling, Schrank, Schmitt (2007)).

Following the OLS, I will utilize a sibling-fixed effect model to control for endogeneity. The model is as follows:

$$Achieve_{if} = \alpha_f + \beta_1 Depression_{if} + \beta_2 Public_{if} + \beta_3 Private_{if} + \beta_4 Home_{if} + \beta_5 TimeHW_{if} + \\ \beta_6 TimeSleep_{if} + \beta_7 Tutor_{if} + \beta_8 SGroup_{if} + \beta_9 Female_{if} + \beta_{10} ParEvent_{if} + u_{if}$$

This model looks at the achievement of student  $i$  that is a part of family  $f$ .

**Achieve** measures the students' performance on the Woodcock-Johnson Tests of Achievement.

This is the dependent variable.

**Depression** measures the student's self-reported feelings over the past 2 weeks and is scored on a scale of 1-18. The expected sign of this variable would be negative because as health (or mental health) deteriorates we would expect achievement to decrease according to Todd & Wolpin (2003)

**Public, Private, and Home** are dummy variables for the type of school the student attends. We would expect these signs to be positive, as schooling of any type should increase academic achievement.

**TimeHW** measures the amount of time a student spends on their homework in hours. We would expect this sign to be positive as the more time a student practices material, their mastery of it would increase.

**TimeSleep** measures the amount of time a student spends sleeping. We would expect this to have a positive sign. The more a student sleeps especially at a developmental age, the better they would perform in school.

**Tutor** is a dummy variable for whether or not a student uses a tutor. We would expect this variable to have a positive sign.

**SGroup** is a dummy variable for whether a student is involved in a school group or not. We would expect this to have a positive sign.

**Female** is a dummy variable for whether the student is female (1) male (0).

**ParEvent** is a measure of the number of events the parent has attended in the past 12 months. We would expect this to have a positive sign.

## VI. Results

### Ordinary Least Squares (OLS)

When I obtained the data there were originally 1623 observations. There were in total 859 observations used for the OLS model. Many observations were missing values or were not ascertained by interviewers. The reference group of this study is public school students.

My variable of interest-depression was only significant in the Applied Problem Solving Test but not the Letter Word Test or the Passage Comprehension Test. It was significant at the 90% level. These results imply that for every 1-point increase on the Child Depression Inventory Short Form, a student's raw score decreases by 0.15 points.

Time spent on homework was statistically significant across the board for all exams at the 99% level. The most interesting observation is that the sign is opposite of what would be expected. Instead of being positive, the sign is negative implying that as a student spends more time on homework the lower they score on these exams. This could potentially be because students who spend more time on homework could be struggling with material and therefore it takes them more time to complete an assignment. The largest impact was on the Applied Problem Solving Test where for every additional hour spent on homework there was a 0.22 decrease in the score achieved.

As a form of a school input, I decided to look at whether or not a student was a part of a school group or not. After school activities may benefit a student's social well-being and include educational activities to promote learning. If a student was involved in a school group, they performed better on all Woodcock Johnson Achievement Tests. This was significant at the 99% level with the biggest impact occurring again on the Applied Problem Solving Test. A student

that is involved in a school group will have a raw score on the Applied Problem Solving Test almost three points higher than a student that is not.

The next variable of interest was whether a student had a tutor or not. The expected sign was positive yet the coefficients were negative at the 99% confidence level. This suggests that students that have tutors may score lower on achievement tests because they are struggling with material and is what prompted the tutoring. The largest impact of having a tutor was on the Applied Problem Solving Exam. Students that had a tutor scored approximately 2.6 points lower than a student that did not have a tutor.

I wanted to account for school quality and therefore looked at the type of school a child attended. A student that attends public school can expect to score above the mean of the dataset on all exams. However a student that is homeschooled will score 2 points better on the Letter Word and 3 points better on the Applied Problem Solving Test. Both of these results were significant at the 90% confidence level. If a child is attending a private school, the only significant difference is that they will score a little over 1 point better on the Passage Comprehension Test.

I looked at the difference between males and females in respect to academic achievement. OLS suggests that if a student is female, she will score 1 point higher on the Letter Word Test with 99% confidence. Also, if a student is female she will score 1 point lower than her male counterpart on the Applied Problem Solving Test with 95% confidence.

Finally, to account for parent supplied inputs I included the variable ParEvent, which measured the amount of the child's events in the past year that the parent had attended. For each additional event a parent attends, a student will score 0.01 points higher on the Letter Word and Passage Comprehension test. This was significant at the 90% and 95% confidence level

respectively. For an additional event attended by the parent, the student will score approximately 0.04 points higher on the Applied Problem Solving Test with 99% confidence.

Because of endogeneity, I utilized a sibling-fixed effect model to determine if depression was actually impacting the academic achievement of students.

### Sibling Fixed Effect

The data for the sibling-fixed effect was a group of 218 siblings in 109 families. The expectation was that depression would still impact children's performance on the Applied Problem Solving Test, however the results were very different than that. The only difference in this model besides it consisting of siblings is that I am also accounting for birth order.

The results of my variable of interest were quite surprising. My results went from being significant in the OLS for the Applied Problem Solving test to becoming completely insignificant. Another important observation is that while the predicted sign was negative as showcased in the OLS, the sign became positive for all tests ran with a fixed-effect model. This would suggest that student who are depressed (while not significant) may perform slightly better on exams.

Time spent on homework is no longer statistically significant on Passage Comprehension Tests only results on the Letter Word and Applied Problem Solving Test are statistically significant. The sign of the coefficient is still negative and has doubled with the application of the fixed effect. If a student spends an additional hour on homework they now lose 0.45 points on the Applied Problem Solving Test whereas under the OLS they lost 0.22 points.

Involvement in a school group lost significance in the Letter Word and Passage Comprehension exams. Significance remained however in the Applied Problem Solving exam where the coefficient increased from 2.8 to 3.4 with the application of the sibling fixed effect regression technique. If a student is involved in a school group, they will score 3 points higher on the Applied Problem Solving Test.

The amount of time a student sleeps is statistically significant across the board. With the application of the fixed effect, the coefficients increased in size. For every additional hour of sleep, a student will score between 0.65 and 1.09 points lower on the exams.

In the previous OLS results, students who had tutors were predicted to perform worse on exams across the board at the 99% confidence level. We now see that having a tutor is not only insignificant, but now has a positive sign.

The results pertaining to the type of school a student attends has also changed significantly. Previously if a student was homeschooled they might score better on the Letter Word Test and the Applied Problem Solving Test whereas with the implication of the sibling-fixed effect, there is no significant difference in attending a public school and being homeschooled. However, the results for private school students have become more significant. Students that attend private schools get 11.21 more questions correct than students that attend public school on the Letter Word Test. Also, students that attend private school score 9.48 questions higher on the Passage Comprehension Test. Finally, if a student attends private school, they will score 8.76 points higher on the Applied Problem Solving Test. These results were statistically significant at the 95%, 99%, 90% levels respectively.

I controlled for gender by looking at how females compare to males. If a student is female, she scores 3-4 points higher on the Letter Word and Passage Comprehension Tests at the

99% confidence level. There is no statistically significant difference between males and females on the Applied Problem Solving Test.

I also observed how parent attendance to children's events affects educational achievement. I found that there was no statistically significant effect of a parent attending an additional event on educational achievement.

Finally, as all of the literature suggested and as Table 2 suggests, females are more affected by depression than males are. Utilizing the fact that 1 in 10 students develop a depressive disorder by age 18 (NIMH) I looked at the top 10% of the CDI Scores of all of the children in the dataset. I found that 69% of those with a depressive score of 7 or higher were female. I ran the Sibling-Fixed Effect again, this time using an interaction term called FemaleDepress (Table 4). This term includes whether or not the student is female and also their CDI score. I found that being female and depressed has no effect and is not statistically significant.

## **VII. Limitations**

Ultimately, it is important to acknowledge that there are limitations to my study. One problem is that I am unable to account for unobserved heterogeneity. There may be a third variable impacting both depression and health. Also, I utilized cross-sectional data where longitudinal data is better for this type of analysis.

## VIII. Appendix

Table 1: Descriptions of the variables that I utilized in my analysis. All data comes from the Child Development Supplement.

<b>Variable Definitions, Summary Statistics and Data Sources</b>		
<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<i>AchLW</i>	Letter Word Raw Score	Child Development Supplement ( <a href="http://psidonline.isr.umich.edu/">http://psidonline.isr.umich.edu/</a> )
<i>AchPC</i>	Passage Comprehension Raw Score	
<i>AchAP</i>	Applied Problem Raw Score	
<i>Depress</i>	Child Depression Inventory Score of 1-18	
<i>Sib</i>	Sibling Indicator	
<i>Female</i>	Dummy for Gender (1=Female)	
<i>ParEvent</i>	Number of events parent has attended in past 12 months	
<i>IN07</i>	Family Identifier	
<i>Age</i>	Age of Child at Survey Date	
<i>BirthOrder</i>	Created by utilizing the IN07 variable and Age Variable	
<i>Public</i>	Dummy for Public School	
<i>Private</i>	Dummy for Private School	
<i>Home</i>	Dummy for Home School	
<i>TimeHW</i>	Number of hours spent on homework	
<i>Tutor</i>	Dummy for Tutor	
<i>TSleep</i>	Hours of sleep	
<i>SGroup</i>	Dummy for does a child participates in a School Group	

*Table 2: Simple Statistics compiled based on the CDI score. After taking the top 10% of scores, I broke the groups up into Depressed and Non-Depressed groups to examine their differences. A score of 7 or above means that the child scored in the top 10% meaning they were depressed based on the statistic that 1 in 10 children will develop a depressive disorder by age 18 (NIMH). Here we can see that out of depressed children, 69% are female. However we also see very small differences in the scores of the children.*

Simple Statistics						
Variable	Non-Depressed (1-6) Bottom 90%			Depressed (7-18) Top 10%		
	Mean	Min	Max	Mean	Min	Max
<b>AchPC</b>	27.75	4	39	27.48	11	38
<b>AchLW</b>	46.8	14	56	46.73	22	55
<b>AchAP</b>	40.03	2	59	38.86	21	52
<b>TimeHW</b>	1.95	0	76	2.11	0	40
<b>SGroup</b>	0.49	1	0	0.37	1	0
<b>TSleep</b>	7.83	3.5	12	7.32	4	14.5
<b>Tutor</b>	0.23	0	1	0.20	0	1
<b>Public</b>	0.92	0	1	0.89	0	1
<b>Home</b>	0.06	0	1	0.01	0	1
<b>Private</b>	0.01	0	1	0.09	0	1
<b>Female</b>	0.47	0	1	0.69	0	1
<b>Male</b>	0.53	0	1	0.31	0	1
<b>ParEvent</b>	7.42	0	365	9.85	0	200
Observations: 768				Observations: 91		

Table 3: This table represents the two separate regressions for each test. OLS here is compared to the Sibling Fixed-Effect.

Variable	Letter Word		Passage Comprehension		Applied Problem	
	OLS	F.E.	OLS	F.E.	OLS	F.E.
Intercept	50.45*** 1.24	54.18*** 4.69	31.23*** 1.00	31.97*** 3.81	46.62*** 1.35	46.27*** 5.47
Depress	-0.08 0.07	0.0003 0.17	-0.07 0.05	-0.07 0.14	-0.15* 0.07	0.08 0.20
TimeHW	-0.16*** 0.04	-0.32* -0.16	-0.13*** 0.03	-0.21 0.13	-0.22*** 0.05	-0.45** 0.19
Sgroup	1.84*** 0.38	0.92 0.85	1.62*** 0.31	0.94 0.69	2.85*** 0.42	3.42*** 0.99
Tsleep	-0.55*** 0.14	-1.09*** 0.39	-0.48*** 0.11	-0.65** 0.32	-0.83*** 0.15	-1.06** 0.46
Tutor	-1.84*** 0.45	0.08 1.05	-2.02*** 0.36	-0.20 0.85	-2.66*** 0.49	0.85 1.22
Home	2.56 1.77	2.09 6.34	1.28 1.44	2.67 5.14	3.44* 1.93	0.09 7.38
Private	1.06 0.77	11.21** 4.44	1.10* 0.62	9.48*** 3.60	0.75 0.84	8.76* 5.17
Female	1.04*** 0.38	3.84*** 0.89	0.46 0.31	2.73*** 0.72	-1.03** 0.42	1.21 1.04
ParEvent	0.01* 0.009	-0.008 0.01	0.01** 0.007	-0.01 0.01	0.04*** 0.01	0.01 0.01
R-Squared	0.09	0.77	0.11	0.78	0.16	0.75
Observations	859	218	859	218	859	218
Statistical Significance Denoted as: 90% * 95% ** 99% ***						

Table 4: This table represents the inclusion of the interaction term *FemaleDepress*.

Variable	Letter Word	Passage Comprehension	Applied Problem
	F.E.	F.E.	F.E.
Intercept	53.92*** 4.72	31.61*** 3.82	46.23*** 5.52
TimeHW	-0.31* 0.16	-0.20 0.13	-0.45** 0.19
Sgroup	0.80 0.88	0.77 0.71	3.40*** 1.02
Tsleep	-1.11** 0.40	-0.66** 0.32	-1.06** 0.46
Tutor	-0.06 1.05	-0.22 0.85	0.85 1.23
Home	0.88 6.62	1.02 5.35	-0.10 7.73
Private	11.19** 4.45	9.46** 3.60	8.75* 5.20
Female	4.45*** 1.30	3.56*** 1.05	1.31 1.52
Depress	0.12 0.26	0.09 0.21	0.10 0.30
FemaleDepress	-0.20 0.31	-0.27 0.25	-0.03 0.36
ParEvent	-0.008 0.01	-0.01 0.01	0.01 0.01
R-Squared	0.78	0.78	0.75
Observations	218	218	218
Statistical Significance Denoted as: 90% * 95% ** 99% ***			

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## X. SAS Code

```

PROC IMPORT DATAFILE="E:\Senior Project\SP\data presentation.csv"
    out=SP1
    dbms=csv
    replace;
    getnames=yes;
run;

DATA SP2(rename=(ER30001=IN68
ER30002=PN68
ER32000=GENDER
ER41027=FAMINC
Q31IWage=Age
Q34IWage=AgeMo
Q31B24A=ParVol
Q31B24F=ParEvent
Q31B24G=ParPTA
ER33901=IN07
ER33902=PN07
ER33903=RTH
SIBIND07=Sib
Q31B4=InSchool
Q31B6=Grade
Q31B11=SchoolT
Q31IWAGE=Age
Q33K1A=TimeHW
Q33K2=Tutor
Q33K4A=SGroup
Q33K21=TSleep
CDI_07=Depress
Q34LWRAW=AchLW
Q34PCRAW=AchPC
Q34APRAW=AchAP));
    SET SP1;
RUN;

DATA SP3;
    set SP2;
if Sib="1" then Sib=1; else Sib=0;
if InSchool="1" then InSchool=1; else InSchool=0;
if InSchool="0" then delete;
if SchoolT="1" then Public=1; else Public=0;
if SchoolT="2" then Private=1; else Private=0;
if SchoolT="3" then Home=1; else Home=0;
if Tutor="1" then Tutor=1; else Tutor=0;
if SGroup="0" then SGroup=0; else SGroup=1;
if Grade="3" then delete;
if Grade="4" then delete;
if Grade="5" then Grade5=1; else Grade5=0;
if Grade="6" then Grade6=1; else Grade6=0;
if Grade="7" then Grade7=1; else Grade7=0;
if Grade="8" then Grade8=1; else Grade8=0;
if Grade="9" then Grade9=1; else Grade9=0;
if Grade="10" then Grade10=1; else Grade10=0;
if Grade="11" then Grade11=1; else Grade11=0;

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if Grade="12" then Gradel2=1; else Gradel2=0;
if Grade="13" then delete;
if Grade="14" then delete;
if ParVol="998" then delete;
if ParVol="999" then delete;
if ParEvent="998" then delete;
if ParEvent="999" then delete;
if ParPTA="998" then delete;
if ParPTA="999" then delete;
if Gender="1" then Male=1; else Male=0;
if Gender="2" then Female=1; else Female=0;
if SchoolT="8" then delete;
if TimeHW="99" then delete;
if Tutor="9" then delete;
if SGroup="9" then delete;
if TSleep="99" then delete;
if Depress="99" then delete;
if Depress="0" then delete;
if Depress>"6" then Depress1=1; else Depress1=0;
femaledepress=female*depress;
femaledepress2=female*depress1;

run;

PROC SORT data=sp3 out=OLS;
  by IN07;
run;

data ols2;
set ols;
if Timehw="." then delete;
if schoolt="." then delete;
run;

data Siblings;
  set ols2;
  by IN07;
  if not (first.IN07 and last.IN07) then output;
run;

data siblings2;
set siblings;
if IN07=131 and age=16.21 or
IN07=161 and age=16.05 or
IN07=486 and age=15 or
IN07=514 and age=14.78 or
IN07=515 and age=17.14 or
IN07=551 and age=16.31 or
IN07=613 and age=17.75 or
IN07=614 and age=17.01 or
IN07=660 and age=16.61 or
IN07=676 and age=17.32 or
IN07=778 and age=15.21 or
IN07=867 and age=16.32 or
IN07=872 and age=15.84 or

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IN07=893 and age=16.04 or  
IN07=909 and age=16.74 or  
IN07=1570 and age=17.77 or  
IN07=1595 and age=15.43 or  
IN07=1676 and age=17.04 or  
IN07=2032 and age=16.07 or  
IN07=2053 and age=18.64 or  
IN07=2093 and age=18.42 or  
IN07=2114 and age=16.36 or  
IN07=2157 and age=16.49 or  
IN07=2172 and age=17.51 or  
IN07=2208 and age=14.31 or  
IN07=2407 and age=16.66 or  
IN07=2440 and age=16.18 or  
IN07=2572 and age=17.26 or  
IN07=2708 and age=15.73 or  
IN07=2714 and age=14.05 or  
IN07=2749 and age=17.74 or  
IN07=2902 and age=16.39 or  
IN07=2916 and age=14.55 or  
IN07=2969 and age=16.29 or  
IN07=3107 and age=17.27 or  
IN07=3140 and age=17.3 or  
IN07=3182 and age=13.92 or  
IN07=3254 and age=17.53 or  
IN07=3261 and age=18.61 or  
IN07=3299 and age=16.05 or  
IN07=3348 and age=16.82 or  
IN07=3383 and age=18.09 or  
IN07=3448 and age=15.15 or  
IN07=3463 and age=17.28 or  
IN07=3465 and age=15.2 or  
IN07=3494 and age=14.79 or  
IN07=3502 and age=18.66 or  
IN07=3574 and age=15.6 or  
IN07=3606 and age=15.38 or  
IN07=3678 and age=14.37 or  
IN07=3761 and age=17.84 or  
IN07=3804 and age=18.53 or  
IN07=3940 and age=17.48 or  
IN07=3980 and age=17.27 or  
IN07=4088 and age=18.47 or  
IN07=4242 and age=17.83 or  
IN07=4346 and age=15.46 or  
IN07=4397 and age=16.98 or  
IN07=4424 and age=15.38 or  
IN07=4430 and age=14.75 or  
IN07=4509 and age=17.05 or  
IN07=4511 and age=15.19 or  
IN07=4543 and age=16.46 or  
IN07=4562 and age=17.58 or  
IN07=4578 and age=18.36 or  
IN07=4591 and age=17.36 or  
IN07=4608 and age=16.86 or  
IN07=4635 and age=17.68 or  
IN07=4711 and age=16.77 or  
IN07=4848 and age=16.91 or

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IN07=4898 and age=17.84 or
IN07=4944 and age=16.36 or
IN07=4945 and age=17.47 or
IN07=4953 and age=17.71 or
IN07=4972 and age=15.82 or
IN07=5013 and age=17.54 or
IN07=5051 and age=13.27 or
IN07=5166 and age=15.25 or
IN07=5195 and age=16.18 or
IN07=5265 and age=18.44 or
IN07=5316 and age=18.35 or
IN07=5358 and age=16.25 or
IN07=5516 and age=17.64 or
IN07=5545 and age=13.17 or
IN07=5558 and age=17.81 or
IN07=5651 and age=16.43 or
IN07=5664 and age=17.43 or
IN07=5736 and age=16.31 or
IN07=5861 and age=15.51 or
IN07=5978 and age=15.01 or
IN07=6069 and age=15.92 or
IN07=6132 and age=16.38 or
IN07=6323 and age=17.1 or
IN07=6357 and age=17.57 or
IN07=6448 and age=14.76 or
IN07=6755 and age=17.01 or
IN07=6773 and age=16.96 or
IN07=6795 and age=15.75 or
IN07=6831 and age=15.53 or
IN07=7071 and age=15.94 or
IN07=7115 and age=15.21 or
IN07=7203 and age=17.77 or
IN07=7303 and age=14.59 or
IN07=7501 and age=13.87 or
IN07=7542 and age=15.68 or
IN07=7569 and age=18.45 or
IN07=7606 and age=15.84 or
IN07=7631 and age=16.6 or
IN07=7758 and age=14.84 or
IN07=7795 and age=15.01 or
IN07=8233 and age=14.68 or
IN07=8278 and age=17.08 or
IN07=8323 and age=15.56 then birthorder=1; else birthorder=2;
run;
proc sort data=siblings2;
by IN07 birthorder;
run;

data siblings3;
set siblings2;
if IN07="2708" and PN07="4" then birthorder=2;
if IN07="3182" and PN07="5" then birthorder=2;
if IN07="3678" and PN07="4" then birthorder=2;
if IN07="5273" and PN07="3" then birthorder=1;
if IN07="5731" and PN07="3" then birthorder=1;

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run;

proc sort data=siblings3;
by in07 birthorder;
run;

Proc reg data=ols2;
    OLS:model AchLW=Depress TimeHW SGroup TSleep Tutor Home Private Female
ParEvent;
run;

Proc reg data=ols2;
    OLS:model AchPC=Depress TimeHW SGroup TSleep Tutor Home Private Female
ParEvent;
run;

Proc reg data=ols2;
    OLS:model AchAP=Depress TimeHW SGroup TSleep Tutor Home Private Female
ParEvent;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchLW=TimeHW SGroup Tutor TSleep Depress Home Private Female
ParEvent/fixone;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchPC=TimeHW SGroup Tutor TSleep Depress Home Private Female
ParEvent/fixone;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchAP=TimeHW SGroup Tutor TSleep Depress Home Private Female
ParEvent/fixone;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchLW=TimeHW SGroup Tutor TSleep Home Private depress female
femaledepress ParEvent/fixone;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchPC=TimeHW SGroup Tutor TSleep Home Private depress female
femaledepress ParEvent/fixone;
run;

proc panel data=siblings3;
id in07 birthorder;
model AchAP=TimeHW SGroup Tutor TSleep Home Private depress female
femaledepress ParEvent/fixone;
run;

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