Interpreting (Even Tricky) Regression Coefficients

The Context of the Full Model: Putting it all Together

Karen Grace-Martin

Putting it all Together

- The Context of the Full Model
- Choices about Coding and Scaling: Discrete and Ordinal Predictors

The Context of the Full Model

Predicting Physical Health

Poverty Status (2 categories) Reference Group = Not In Poverty
Marital Status (5 categories) Reference Group = Never Married

Years of Education (Centered at 12, mean = 13.05)
Depression (Centered at 3.5, the mean)
Number of Children
Mental Health Composite (Centered at mean = 5280.05)
Mental Health Composite Squared (Centered before squaring)

Poverty Status*Depression
Years of Education*Depression

Predicting Physical Health

Correlations

	PCS2000	PovertyD	CESDCen	EducCen	Number Children	MCSCen	MCSSq	DeprXEduc
PCS	1							
PovertyD	-.238**	1						
CESDCen	-.350**	.289**	1					
EducCen	.160**	-.275**	-.178**	1				
Number Children	.070**	.027	-.043	-.014	1			
MCSCen	.135**	-.181**	-.676**	.077**	.017	1		
MCSSq	-.153**	.128**	.550**	-.077**	-.038	-.757**	1	
DeprXEduc	-.008	-.004	.197**	-.142**	-.038	-.142**	.137**	1
DeprXPov	-.292**	.424**	.580**	-.138**	-.001	-.380**	.319**	-.127**

Predicting Physical Health

ANOVA

Dependent Variable: PCS

Source	Type III Sum of Squares	df	Mean Square	F	P
Model	206806048.527[a]	12	17233837.377	29.983	.000
Poverty Status	9948919.862	1	9948919.862	17.309	.000
Marital2000c5	1260348.969	4	315087.242	.548	.700
Years of Education Centered	7068693.191	1	7068693.191	12.298	.000
Number Children	3478312.140	1	3478312.140	6.052	.014
MCS Centered	20139628.527	1	20139628.527	35.039	.000
MCS Squared	5370546.909	1	5370546.909	9.344	.002
Depression Centered	92117202.829	1	92117202.829	160.265	.000
Depression Centered * Years of Education Centered	5106280.087	1	5106280.087	8.884	.003
Poverty Status * Depression Centered	2935344.180	1	2935344.180	5.107	.024
Error	969654337.028	1687	574780.283		
Total	1176460385.555	1699			

Predicting Physical Health

Regression Coefficients

Dependent Variable: PCS

Variable	B	se	t	p
Intercept	5212.840	49.581	105.138	.000
Poverty Status=In	-249.505	59.971	-4.160	.000
Widowed	-159.534	162.327	-.983	.326
Divorced	30.442	63.971	.476	.634
Separated	-73.713	93.836	-.786	.432
Married	-8.516	54.908	-.155	.877
Years of Education Centered	27.477	7.835	3.507	.000
Number Children	37.866	15.393	2.460	.014
MCS Centered	-.221	.037	-5.919	.000
MCS Squared	-4.973E-5	1.627E-5	-3.057	.002
Depression Centered	-68.627	6.786	-10.113	.000
Depression Centered * Years of Education Centered	5.533	1.856	2.981	.003
Poverty Status=In * Depression Centered	-23.182	10.258	-2.260	.024

Predicting Physical Health

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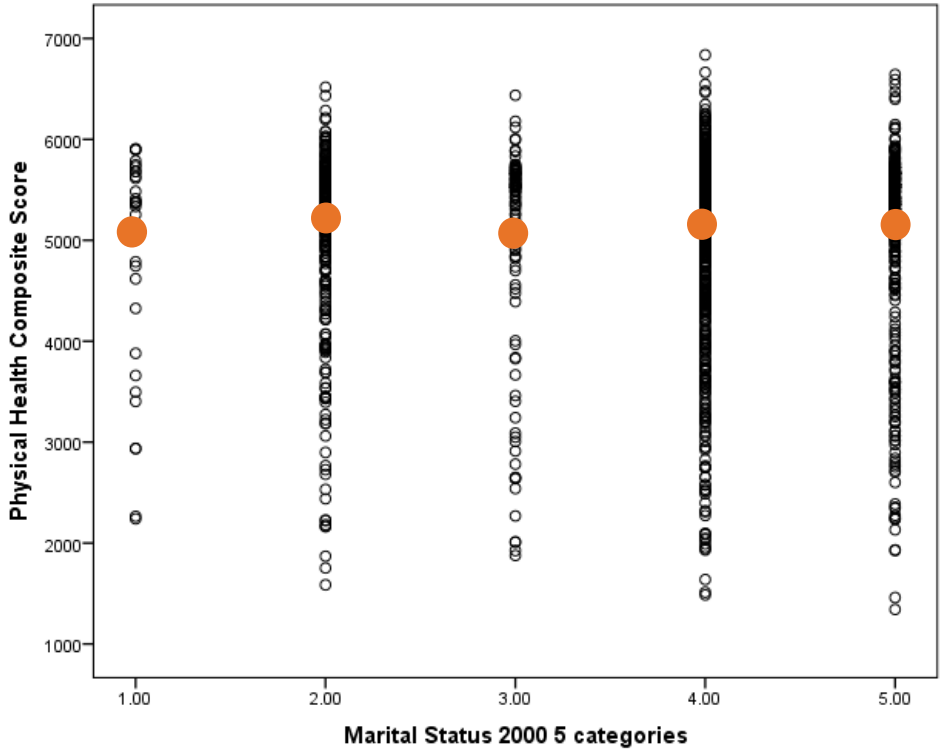
Marital Status Predicting Physical Health

E(Y|X) = 5212.84

- 159.5*Widowed
+ 30.4*Divorced
- 73.7*Separated
- 8.5*Married

Holding all other X at 0



Predicting Physical Health

Regression Coefficients

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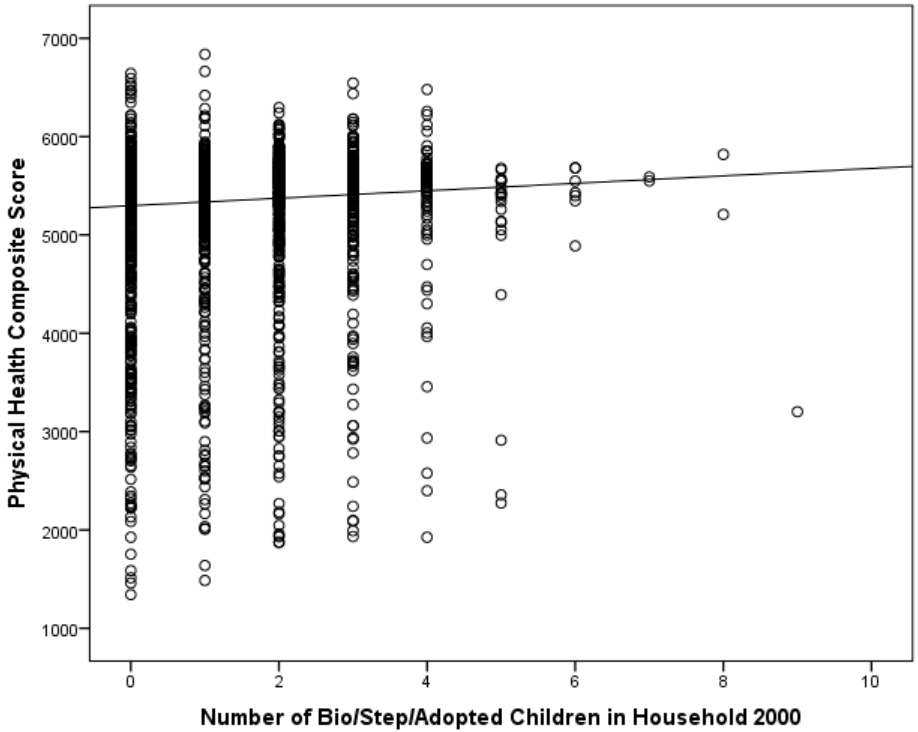
Predicting Physical Health



$E(Y|X) = 5212.84 + 37.9*\text{Number of Children}$

Holding all other X at 0

Predicting Physical Health

Regression Coefficients

Dependent Variable: PCS

Variable	B	se	t	p
Intercept	5212.840	49.581	105.138	.000
Poverty Status=In	-249.505	59.971	-4.160	.000
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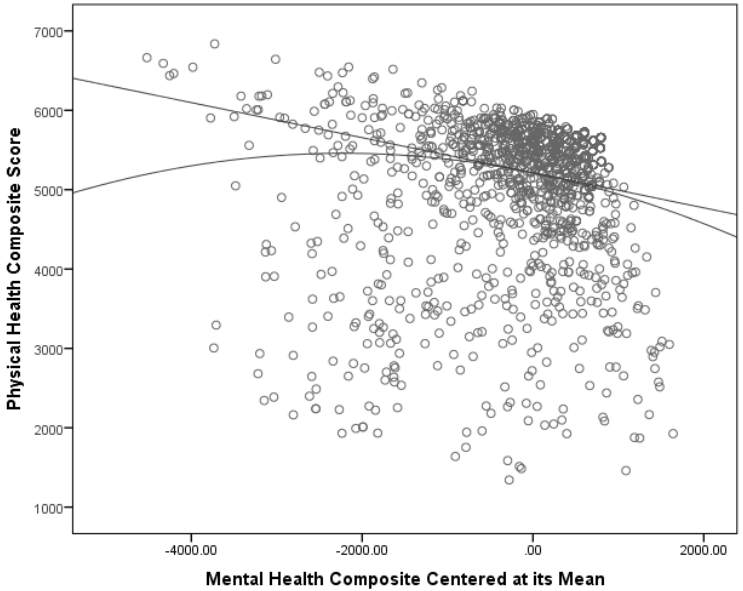
Depression Centered * Years of Education Centered	5.533	1.856	2.981	.003
Poverty Status=In * Depression Centered	-23.182	10.258	-2.260	.024

Predicting Physical Health

$$E(Y|X) = 5212.840 - .221 * \text{MCS Centered} - .00004973 * (\text{MCS Centered})^2$$



Holding all other X at 0

Effect of Poverty and Depression on Physical Health

Regression Coefficients

Dependent Variable: PCS

Variable	B	se	t	p
Intercept	5212.840	49.581	105.138	.000
Poverty Status=In	-249.505	59.971	-4.160	.000
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Depression Centered * Years of Education Centered	5.533	1.856	2.981	.003
Poverty Status=In * Depression Centered	-23.182	10.258	-2.260	.024

Predicting Physical Health

For Never Married individuals with mean Education, MCS, with 0 children:

Not in Poverty:

E(Y|X) = 5212.840 -249.505*0 +

(-68.627 - 23.182*0)*Depression

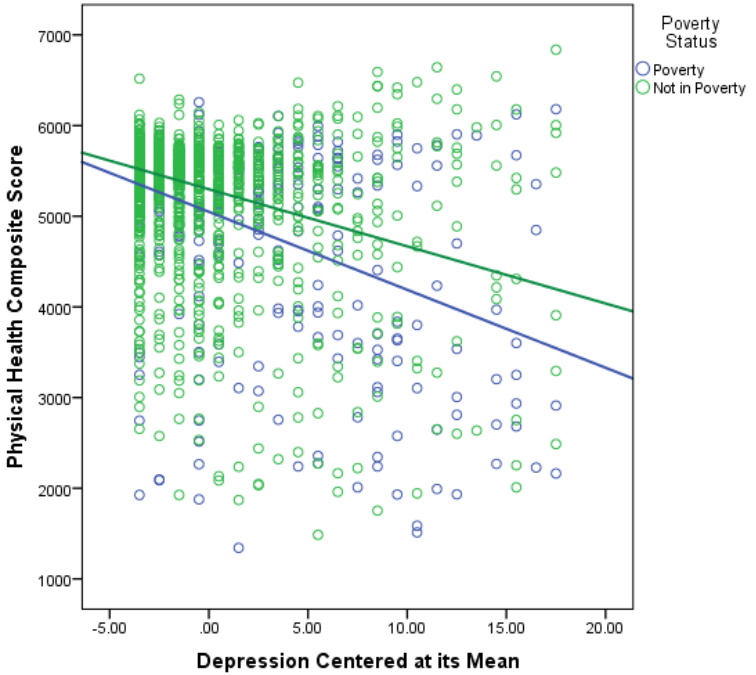
= 5212.840 – 68.627*Depression

In Poverty:

E(Y|X) = 5212.840 - 249.505*1 +

(-68.627 - 23.182*1)*Depression

= 4963.335 – 91.809*Depression



Dependent Variable: PCS

Poverty Status	Mean	se
2 In Poverty	5266.218[a]	77.921
3 Not in Poverty	5434.585[a]	46.665

Depression Centered = -3.50

Dependent Variable: PCS

Poverty Status	Mean	se
2 In Poverty	4966.484[a]	59.646
3 Not in Poverty	5215.988[a]	41.225

Depression Centered = 0

Dependent Variable: PCS

Poverty Status	Mean	se
2 In Poverty	3896.005[a]	3896.005[a]
3 Not in Poverty	4435.285[a]	4435.285[a]

Depression Centered = 12.50, Years of Education Centered = 1.1153, Number Children = 1.44, MCS Centered = 13.0588, MCS Squared = 7450008.3228.

Pairwise Comparisons

Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	168.368*	78.524	.032

Pairwise Comparisons

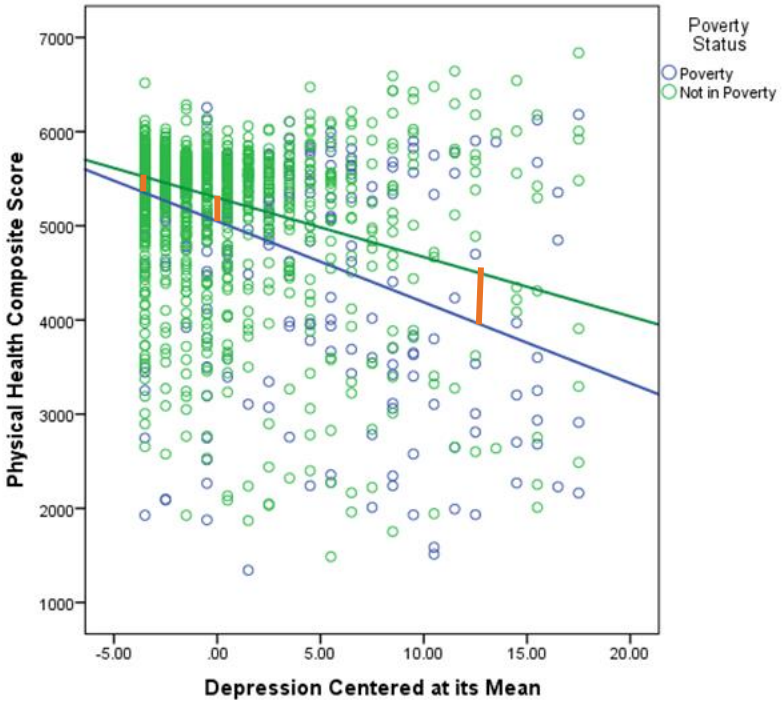
Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	249.505*	59.971	.000

Pairwise Comparisons

Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	539.280*	124.362	.000



Pairwise Comparisons

Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	168.368*	78.524	.032

Pairwise Comparisons

Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	249.505*	59.971	.000

Pairwise Comparisons

Dependent Variable: PCS

			Mean Difference	se	p
Not in Poverty	-	Poverty	539.280*	124.362	.000

Predicting Physical Health

Regression Coefficients

Dependent Variable: PCS

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Depression Centered * Years of Education Centered	5.533	1.856	2.981	.003
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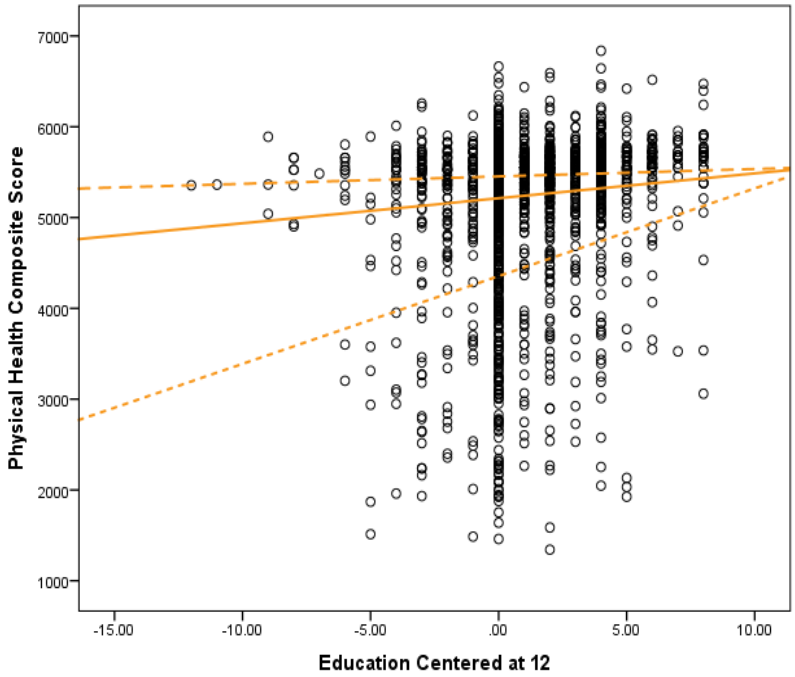
Effect of Education and Depression on Physical Health



When Depression = mean - 3.5

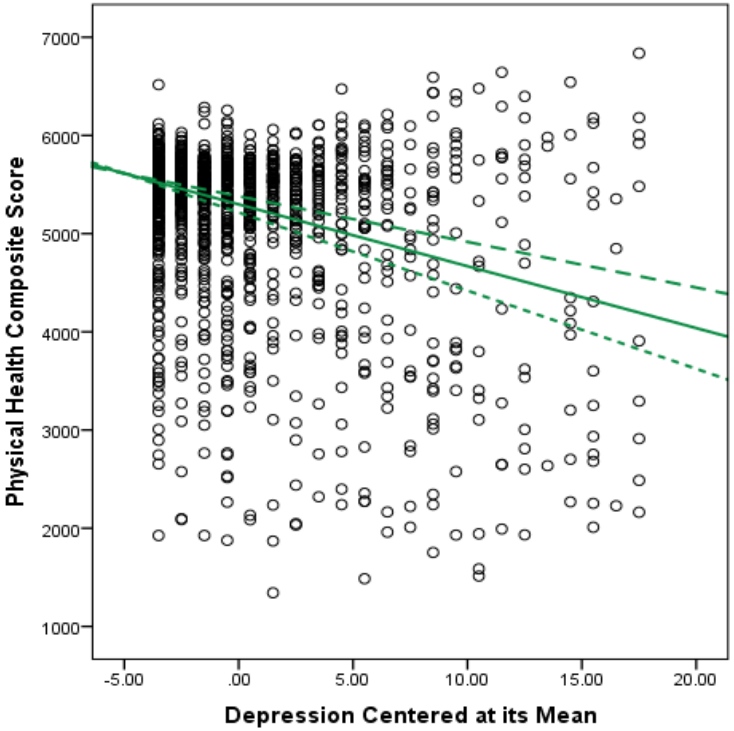
E(Y|X) = (5212.840 + (-68.627)*(- 3.5))
+ (27.477+ 5.533*(-3.5))*Education
E(Y|X) = 5453.0 + 8.1* Education

When Depression = mean + 12.5

E(Y|X) = (5212.840 + (-68.627)*(12.5))
+ (27.477 + 5.533*(12.5))*Education
E(Y|X) = 4355.0 + 96.6*Education

Holding all other X at 0

Effect of Education and Depression on Physical Health



When Education = mean + 3

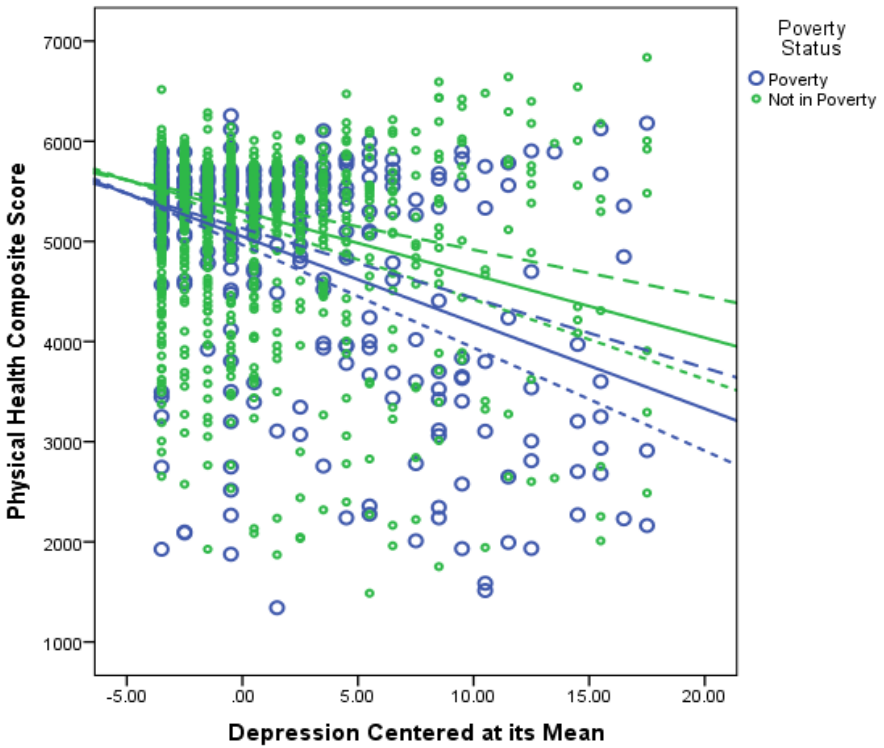
E(Y|X) = (5212.840 + 27.477*3)
+ (-68.627+ 5.533*3)*Depression
E(Y|X) = 5295.3 – 52.0*Depression

When Education = mean – 3

E(Y|X) = (5212.840 + 27.477*(-3))
+ (-68.627+ 5.533*(-3))*Depression
E(Y|X) = 5130.4 – 85.2*Depression

Holding all other X at 0

Effect of Depression on Physical Health



Poverty = Not In Poverty

- - - Education = mean + 3

——— Education = mean

---- Education = mean - 3

Poverty = In Poverty

- - - Education = mean + 3

——— Education = mean

---- Education = mean - 3

Choices about Coding and Scaling: Discrete and Ordinal Predictors

Types of Variables

Response Variable:

- Continuous
- Unbounded
- Interval or Ratio Scale

Predictor Variables:

- Numerical
  - Continuous
  - Discrete

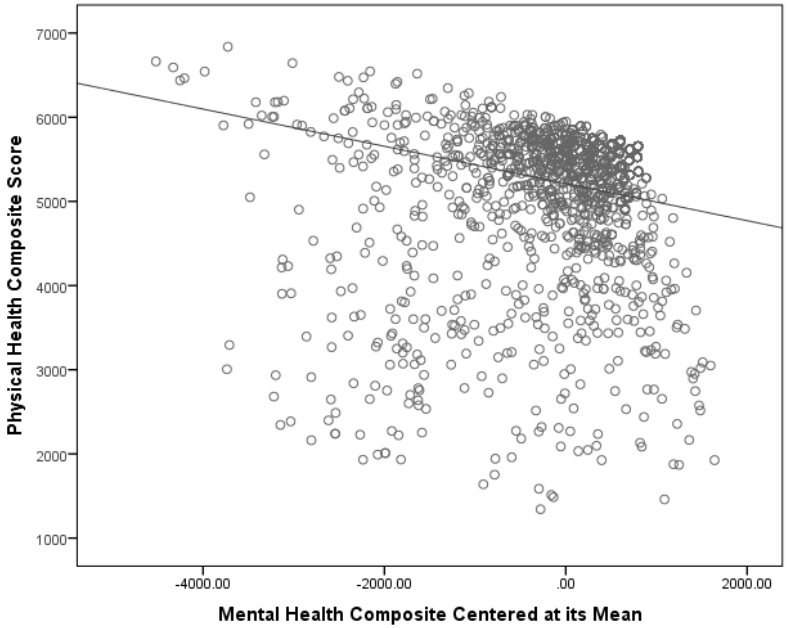
Regression Line
Effect = Slope or curvature

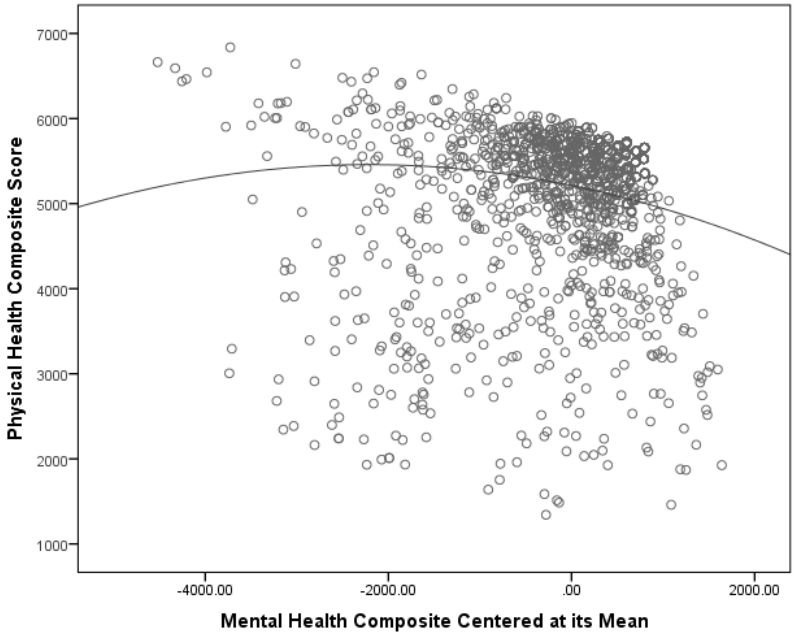
- Categorical
  - Nominal
  - Ordinal

Set of Dummy Codes
Effect = Mean Differences

Continuous Predictor

Regression Line
Effect = Slope or Curvature



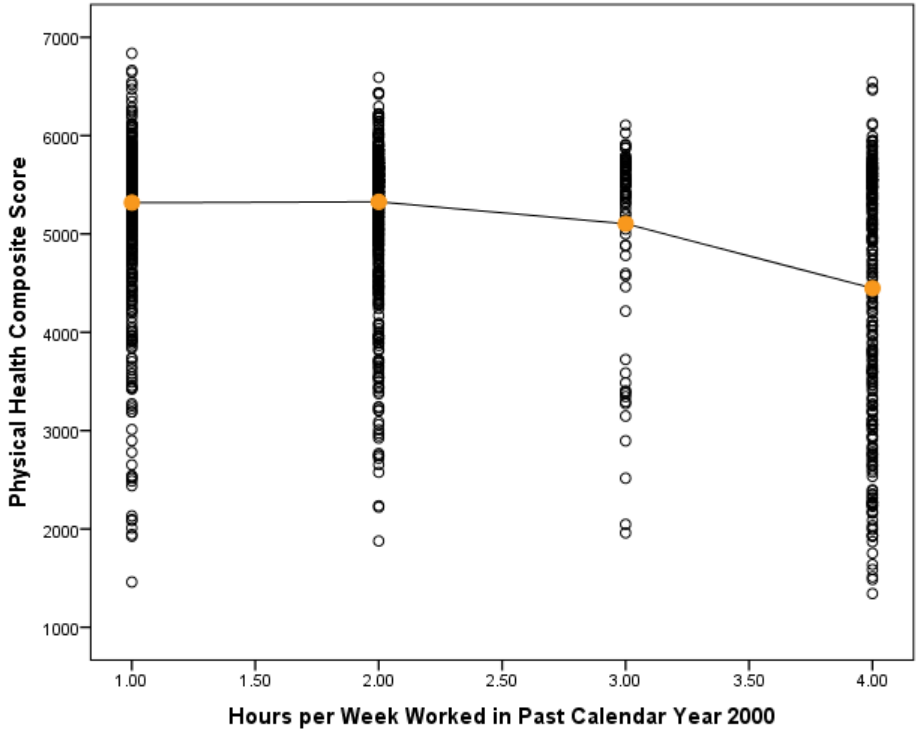


Ordinal Predictor

Set of Dummy Codes
Effect = Mean Differences

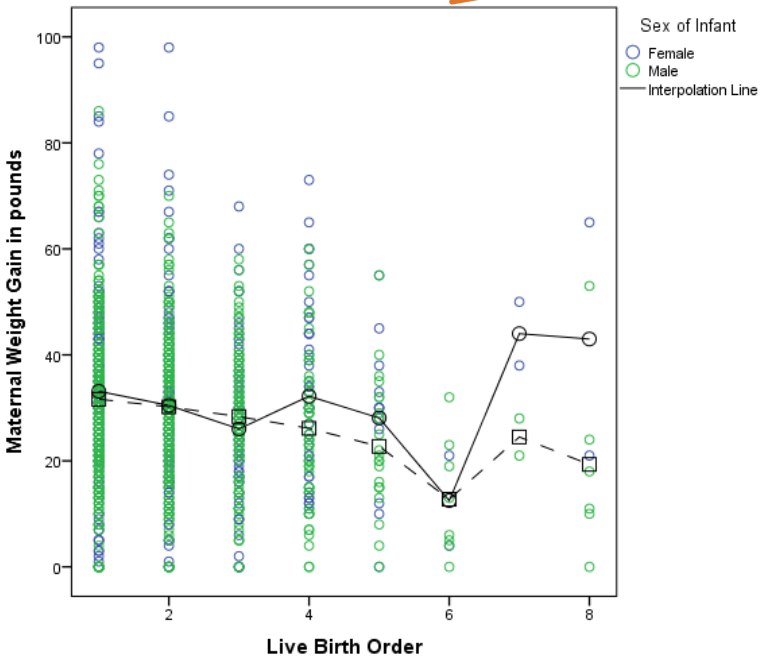
WorkTimeHrsperWkPastCalYr2000cat4

		Frequency	Percent
Valid	1 > 40 hrs/wk	757	36.0
	2 >20 to 40 hrs/wk	949	45.1
	3 > 0 to 20 hrs/wk	89	4.2
	4 0 hrs/wk	295	14.0
	Total	2090	

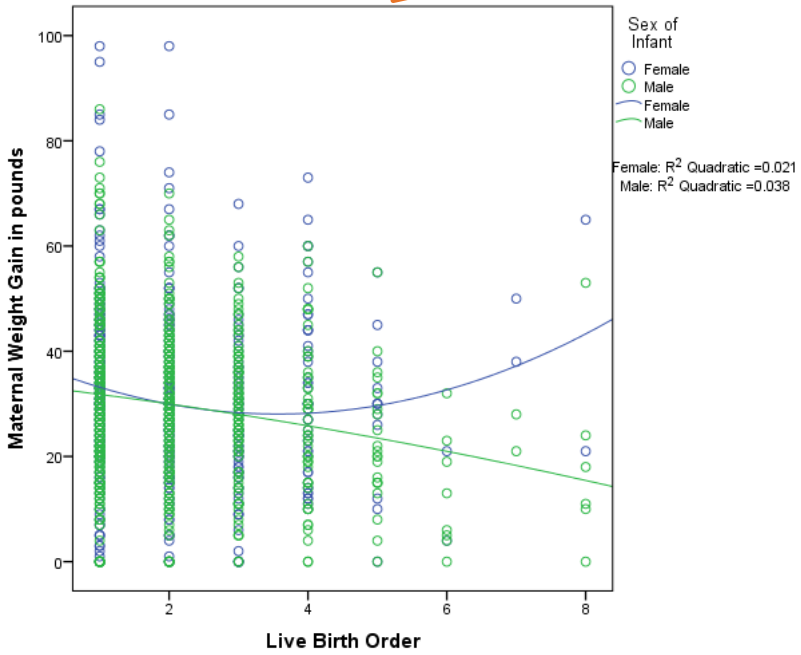


Discrete Predictor

Set of Dummy Codes
Effect = Mean Differences



Regression Line
Effect = Slope or Curvature



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Set of Dummy Codes
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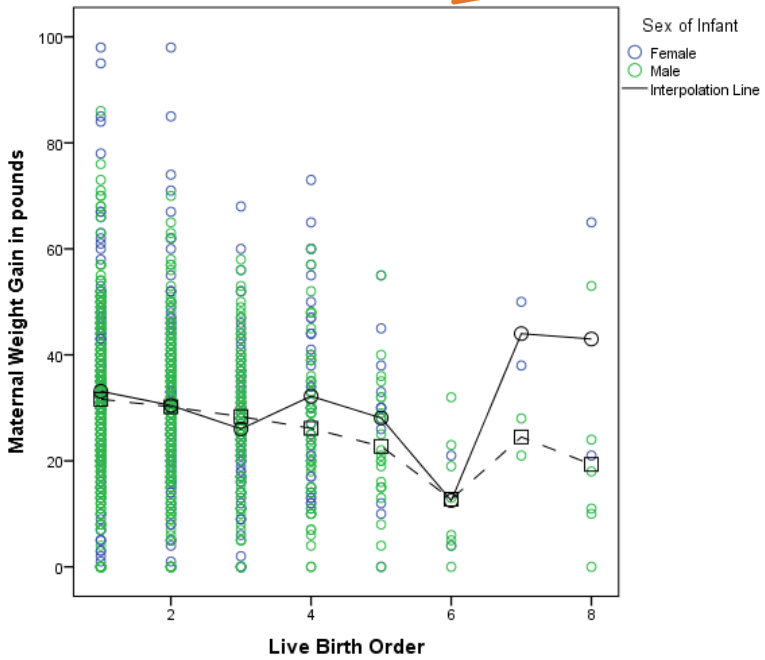


Regression Coefficients

Dependent Variable: wtgain

Variable	B	se	t	p
Intercept	19.333	5.991	3.227	.001
[sex=Female]	23.667	11.983	1.975	.048
[sex=Male]	0	.	.	.
[birth_order=1]	12.289	6.064	2.026	.043
[birth_order=2]	10.860	6.085	1.785	.075
[birth_order=3]	9.017	6.169	1.462	.144
[birth_order=4]	6.807	6.341	1.073	.283
[birth_order=5]	3.394	6.759	.502	.616
[birth_order=6]	-6.583	7.926	-.831	.406
[birth_order=7]	5.167	11.983	.431	.666
[birth_order=8]	0	.	.	.
[birth_order=1] * [sex=Female]	-22.159	12.056	-1.838	.066
[birth_order=2] * [sex=Female]	-23.404	12.082	-1.937	.053
[birth_order=3] * [sex=Female]	-25.995	12.169	-2.136	.033
[birth_order=4] * [sex=Female]	-17.607	12.357	-1.425	.154
[birth_order=5] * [sex=Female]	-18.311	13.089	-1.399	.162
[birth_order=6] * [sex=Female]	-23.917	16.680	-1.434	.152
[birth_order=7] * [sex=Female]	-4.167	18.947	-.220	.826
[birth_order=8] * [sex=Female]	0	.	.	.
[birth_order=8] * [sex=Male]	0	.	.	.

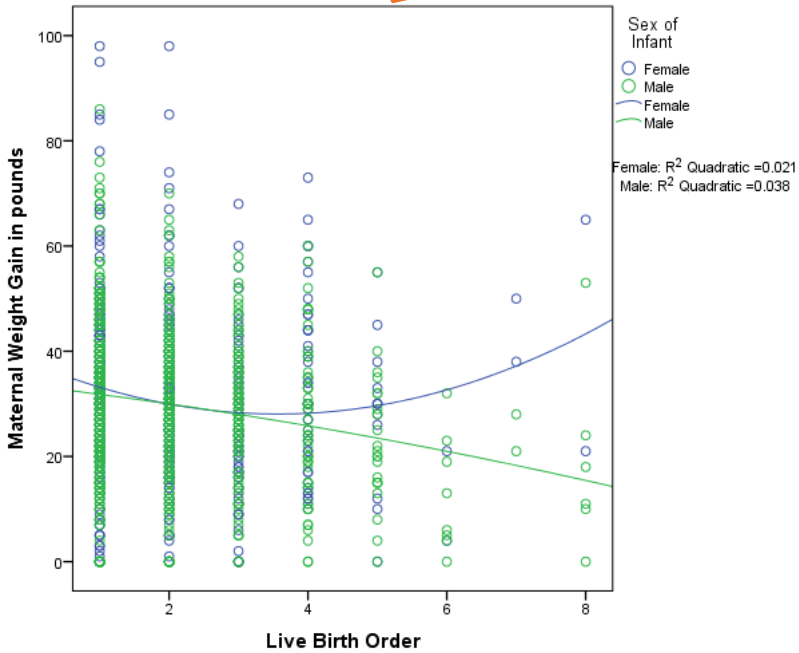
Discrete Predictor

Regression Coefficients

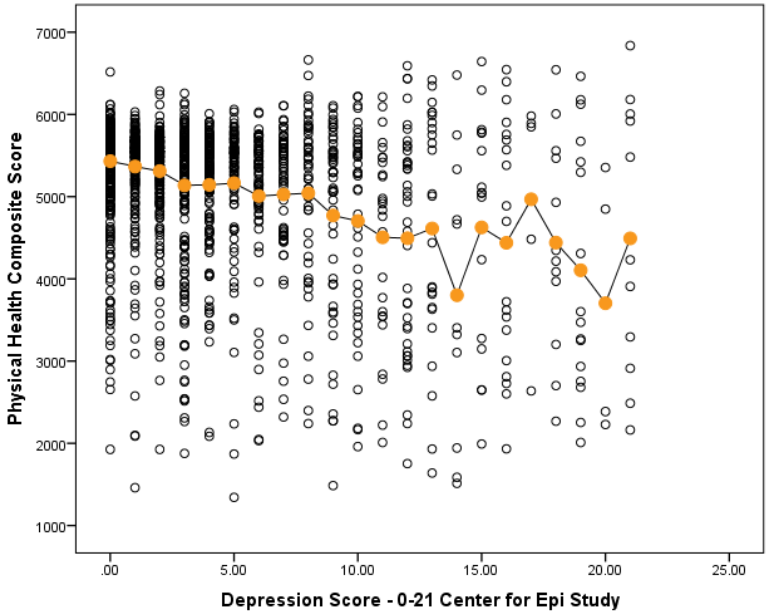
Dependent Variable: bwt_pnds

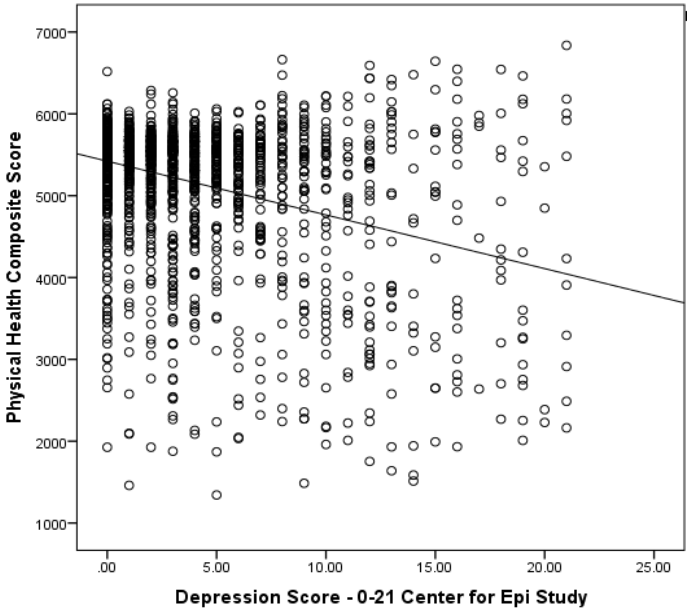
Variable	B	se	t	p
Intercept	27.992	.904	30.952	.000
Female	.325	1.332	.244	.807
OrderCen	-2.078	.447	-4.648	.000
Order_sq	-.086	.202	-.428	.669
Female * OrderCen	1.206	.695	1.736	.083
Female * Order_sq	.860	.335	2.571	.010

Regression Line
Effect = Slope or Curvature



Discrete Predictor





E(Physical Health) = 5421.387 – 65.629(Depression)

What to consider

- Is the predictor truly numerical or is it ordinal?
- Is your research question about mean differences or general effects or prediction?
- How many discrete values are there?
- Would a curve fit even if a line doesn't?
- Are the means in a linear pattern or are there jumps?
- Are there gaps between the discrete values or are they close?
- Are there qualitative differences between the numbers or do they only differ quantitatively?