Abstract Title Page

Title:
Associations between School Connection and Depressive Symptoms from Adolescence through Adulthood: The Moderating Influence of Early Adversity

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Associations between School Connection and Depressive Symptoms from Adolescence through Adulthood: The Moderating Influence of Early Adversity

Background / Context:

Depression is the most common psychiatric disorder worldwide. Conservative estimates Suggest that 20% of Americans will experience depression during their lifetime (Gotlib & Hammen, 2008; Gotlib & Joormann, 2010), inflicting high interpersonal, labor market, and health care costs (Kessler et al., 2006; Murray & Lopez, 1996). Although depression is highly heritable, environmental factors can powerfully influence its development both negatively and positively (Franic et al., 2010; Sullivan, Neale, & Kendler, 2000; Taylor et al., 2006). Early stressors, including parental separation, neglect, and maltreatment, have been linked with greater depressive symptoms in adolescence and adulthood (Toth, Manly, & Cicchetti, 1992; Brown, Cohen, Johnson, & Smailes, 1999; Hussey, Chang, & Kotch, 2006; Nanni, Uher, & Danese, 2012), whereas high levels of social support have been associated with lower levels of depression (e.g. Kawachi & Berkman, 2001; Cohen, Gottlieb, & Underwood, 2000). The present study explores the interaction between risk and protective factors in the etiology of depression by asking whether social support in the school context – referred to here as school connection – plays a uniquely protective role among youth who have experienced early stressors.

A growing body of research has established that school connection, a student's sense of belonging in and relatedness to school (Blum & Libbey, 2004), is associated with lower levels of depression and better overall socioemotional health (Shochet et al., 2008; Bond et al., 2007; Joyce & Early, 2014). This link is not surprising given that children and adolescents spend more than a third of their time in school: if a school provides a positive emotional environment, it can offer students ample opportunities to develop healthy social relationships with peers and adults. However, no study has explored whether the social support that schools provide serves as a uniquely protective factor for youth at heightened risk for depressive symptoms, even though the broader social support literature—in particular, the stress-buffering hypothesis—suggests that students at-risk of depression may benefit more from social support than their peers (Cohen et al., 2000; Marroquin, 2011). Although a range of environmental factors can elevate the risk of depression in youth, this study focuses on youth who have experienced early adversity, including parental separation, social services involvement, neglect, and child maltreatment, both because this group is surprisingly large (up to 12% of children, Finkelor et al., 2014) and because early adversity is one of the strongest and most consistent risk factors for depression (Cicchetti & Toth, 1998; 2005; Nanni et al., 2012; Toth, Manly, & Cicchetti, 1992).

I explore this interaction using data from a nationally representative, longitudinal study of adolescents and young adults in the U.S. Moreover, this project assesses whether protective impacts appear immediately or arise in early adulthood when symptoms of depressive disorders often emerge. Identifying whether school connection is able to protect youth who have experienced early adversity from depression will illuminate the potential influence of school connection in enhancing outcomes for vulnerable youth, and whether and how schools can impact important long-term developmental outcomes.

Purpose / Objective / Research Question / Focus of Study:

The present study will (1) identify whether school connection is associated with depressive symptoms in models that account for potential endogeneity, (2) assess whether this association persists from adolescence through early adulthood, and (3) explore whether school

connection can serve as a protective factor for youth at risk for depression. Risk for depression is defined using a 3-group categorization of the experience of early adversity: no adversity, stress only, and maltreatment. The impact of school connection is explored separately for each group.

Population / Participants / Subjects:

Data are drawn from Waves 1 through 4 of the National Longitudinal Study of Adolescent Health (Add Health), a large, nationally representative dataset collected from 1994-2008 (see Harris et al., 2009; Bearman et al., 1997 for a detailed description of sampling and study design). The first wave of data was collected in 1995 (n=20,745) from students aged 12-18. The second wave of data was collected in 1996 (n=14,738), excluding 12th graders from the first wave. The third wave was collected in 2001/2002, including 12th graders from the first wave (n=15,197). The fourth wave was collected in 2007/2008, when the adolescents were ages 26-32 (n=15,701). The analytic sample includes all individuals with complete data on the key independent and dependent variables (all measures excluding covariates, n= 12,031 in adolescence, n= 10,432 in late adolescence, and n= 9,230 in early adulthood). To address missing data on covariates, data were multiply imputed following vonHippel (2007). Multiple imputation was conducted using the ICE command in Stata 12.0 (Royston, 2007). Following conventional guidelines (Graham, 2009), 20 imputed datasets were generated. Multiple regression analyses were run on the imputed datasets. Coefficients and standard errors were combined using the MIM command.

Intervention / Program / Practice:

The Add Health surveys collected data on respondents from adolescence through adulthood, and assessed a variety of developmental experiences and outcomes. No intervention was conducted; rather this study assesses student reported connection to school and its long-term correlates *absent* intervention. *School connectedness*, the school characteristic of interest, was measured with 6 items at wave 2 (Cronbach's $\alpha = 0.71$). Items were coded following previously published work using Add Health data (e.g. McNeely, Nonnemaker, & Blum, 2002; McNeely & Falci, 2004) and standardized. To assess *early adversity,* the potential moderator, participants were asked to recall early stressful experiences including emotional abuse, physical, and sexual abuse and indicators of disrupted parenting such as involvement with social services and parental incarceration. Youth who experienced no items prior to age 6 were coded as experiencing no adversity. Youth who experienced highly stressful events such as parental incarceration or social service investigation prior to age 6 but not abuse were coded as experiencing stress only. Youth who experienced physical, sexual, or emotional abuse, or who were removed from their homes by social services prior to age 6 were coded as experiencing maltreatment. The Add Health Survey assessed *depressive symptoms*, the dependent variable, using the Center for Epidemiologic Studies Depression Scale (Radloff, 1991), a 10-item scale asked at each wave (with the exception of wave 3, which included 9 items).

Research Design:

This was a secondary data analysis; I used multiple regressions with robust controls (see Data Analysis) including family income-to-needs ratio, and youth's reported relationship with his/her mother, sexuality, immigrant status, cognitive ability (Peabody Picture Vocabulary Test; Dunn & Dunn, 1997), gender, age, and race. Finally, all models included a measure of youth depression from wave 1 to address the threat of reverse causality.

Data Analysis:

First, ordinary least squares (OLS) regression models were run to examine the main effects of early adversity and school connection from adolescence through early adulthood. Second, interactions between school connection and maltreatment status and school connection and stress were added to explore how school connection may moderate the relationship between different levels of early adversity and depression. Specifically, the coefficients on these interactions tested whether the school connection is more, less, or equally beneficial for youth who had experienced early adversity compared to youth who have not. Finally, simple slopes analyses tested whether the relationship between school connection and depression was different from zero for each of the three groups—no adversity, stress only, or maltreated.

All analyses included the full set of covariates, including a lagged dependent variable to account for the threat of endogeneity in the estimated impact of school connection. Models were weighted using the Add Health wave 2, wave 3, and wave 4 survey weights to account for the clustered nature of the sample and to produce nationally representative estimates based on sampling design and attrition (Chantala, 2006).

Findings / Results:

Descriptive statistics for the full sample and at each wave are presented in Table 1. Multivariate regression results are presented in Table 2. Because depressive symptoms were standardized, coefficients can be interpreted in standard deviation units (SDs) (insert Tables 1 and 2 here)

Adolescent depression.

Model 1a examined the relationship between school connection, early adversity, and adolescent depression, with all covariates, including previous depressive symptoms, held constant. Model 1a suggests that a standard deviation increase in school connection yields a 0.06 SD decrease in depressive symptoms ($p < 0.01$). Conversely, the experience of early adversity increases depressive symptoms. Youth who experienced early maltreatment reported depressive symptoms that were 0.10 SDs higher than their no-adversity peers ($p < 0.05$). Youth who reported early stress, but no maltreatment, reported 0.05 SDs more depressive symptoms than their no-adversity peers ($p < 0.05$).

Model 1b examines whether the impact of school connection on adolescent depression differs for youth who have experienced early adversity, accounting for all covariates. The main effect of school connection remains in size and significance ($b = -0.05$, $p < 0.01$), suggesting that for youth who have not experienced early adversity, school connection provides a buffer against depressive symptoms. Neither interaction term reached statistical significance, however simple slopes analysis reveals that the slopes of the linear relationship between school connection and adolescent depression is statistically significantly different from zero for the no adversity and the stress only groups only ($p < 0.05$). These lines are graphed in Figure 1 (insert Figure 1 here).

Late adolescent depression.

Model 2a replicated Model 1a for late adolescent outcomes. Model 2a suggests that after accounting for previous levels of depressive symptoms, a standard deviation increase in school connection yields a 0.04 SD decrease in depressive symptoms ($p < 0.01$), slightly reduced from earlier adolescence. Again, the experience of early adversity increases depressive symptoms relative to no-adversity peers ($b= 0.25$ for maltreatment, $b= 0.08$ for stress only, both $p <0.05$).

In Model 2b the main effect of school connection retains its size, though is slightly decreased in significance ($b = -0.03$, $p < 0.10$), suggesting that for youth who have not

experienced early adversity, school connection continues to provide a buffer against depressive symptoms. Again, neither interaction is statistically significant, suggesting that school connection affects all youth similarly.

Early adulthood depression.

Model 3a examined the relationship between school connection, early adversity, and early adulthood depression. Model 3a suggests that holding previous depressive symptoms constant, a standard deviation increase in school connection yields a 0.04 SD decrease in depressive symptoms ($p < 0.01$). Again, the experience of early adversity is associated with higher levels of depressive symptoms (0.25 and 0.08 SDs for maltreated and stressed youth relative to non-stressed peers, respectively, $p < 0.05$).

Model 3b assesses whether the impact of school connection on adolescent depression differs for youth who have experienced early adversity, accounting for all covariates. The main effect of school connection was reduced in size and significance ($b = -0.02$, $p > 0.05$), suggesting that for youth who have not experienced early adversity, the beneficial impact of school connection attenuates by early adulthood. The interaction between school connection and maltreatment is near zero and nonsignificant, again suggesting that school connectedness is not an effective buffer for youth who have experienced early maltreatment. However, the interaction between school connection and stress only was negative and statistically significant ($b = -0.07$, $p < 0.05$), suggesting that school connection continues to benefit youth who experienced early stress through early adulthood. Indeed, simple slopes analysis reveals that the slope of the linear relationship between school connection and adolescent depression is statistically significantly different from zero only for youth who experienced early stress but not maltreatment ($p < 0.05$), as graphed in Figure 2 (insert Figure 2 here).

Conclusions:

This study replicates previous work documenting a positive association between early adversity and depressive symptoms in adolescence and early adulthood (Brown et al., 1999; Nanni et al., 2012; Toth & Cicchetti, 2005), and a negative association between youth reported school connection and depressive symptoms in adolescence for normative populations (Bond et al., 2007; Joyce & Early, 2014; Shochet et al., 2006; Shochet et al., 2008). This study extends the previous literature by demonstrating that the benefits of school connection persist for all youth through late adolescence (ages ≈ 19-25). Moreover, the present study suggests that school connection can be particularly beneficial for youth who have experienced early stress, and that this unique benefit emerges in early adulthood. Importantly, though, this protective effect does not extend to youth who experienced early maltreatment, suggesting that youth in extreme circumstances may need more substantial intervention than a high quality school alone can provide. Though this study incorporates a robust list of controls and a lagged dependent variable, it is correlational. Moreover, youth report retrospectively on early adversity, introducing measurement error. Nonetheless, these findings suggest that fostering school connection may be an important policy lever for the prevention of depression among all children and among at-risk youth, and that educational policies should be evaluated, in part, by how they may impact youth's connection to school. However findings also indicate that for the most vulnerable, a sense of connection to school may not provide enough support to effectively combat depressive risk, highlighting the importance of identifying effective, targeted interventions for maltreated youth.

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1. Descriptive statistics by time of outcome measure.

	Full Sample		Adolescent Outcomes		Late. Ado. Outcomes		Young Adult Outcomes	
Wave 1 depressive symptoms	6.74	(4.72)	6.74	(4.72)	6.74	(4.71)	6.76	(4.71)
Wave 2 depressive symptoms	6.68	(4.71)	6.68	(4.71)	6.68	(4.71)	6.71	(4.73)
Wave 3 depressive symptoms	4.62	(4.07)	4.62	(4.07)	4.62	(4.07)	4.62	(4.06)
Wave 4 depressive symptoms	6.04	(4.65)	6.03	(4.65)	6.03	(4.65)	6.03	(4.63)
School connectedness	21.19	(4.25)	21.19	(4.26)	21.19	(4.23)	21.17	(4.24)
Maltreated	17.68		17.66		18.84		19.61	
Stressed only	24.99		25.00		28.05		27.84	
Female	52.26		52.25		53.09		54.55	
White	54.97		55.00		55.36		56.58	
Black	21.44		21.43		20.97		20.86	
Hispanic	16.16		16.14		15.84		15.46	
Other	7.43		7.43		7.83		7.10	
Age at wave 1	15.78	(1.57)	15.77	(1.57)	15.76	(1.57)	15.75	(1.57)
PPVT	100.65	(14.37)	100.68	(14.35)	100.80	(14.35)	101.09	(14.26)
Identifies as mostly homosexual	2.67		2.64		2.69		2.65	
Born outside of US	8.92		8.88		8.90		8.22	
Relationship with mother	3.28	(0.70)	3.28	(0.70)	3.28	(0.68)	3.27	(0.69)
Income to needs	2.94	(3.57)	2.94	(3.57)	2.96	(3.62)	2.98	(3.63)
N	12054		12031		10432		9230	

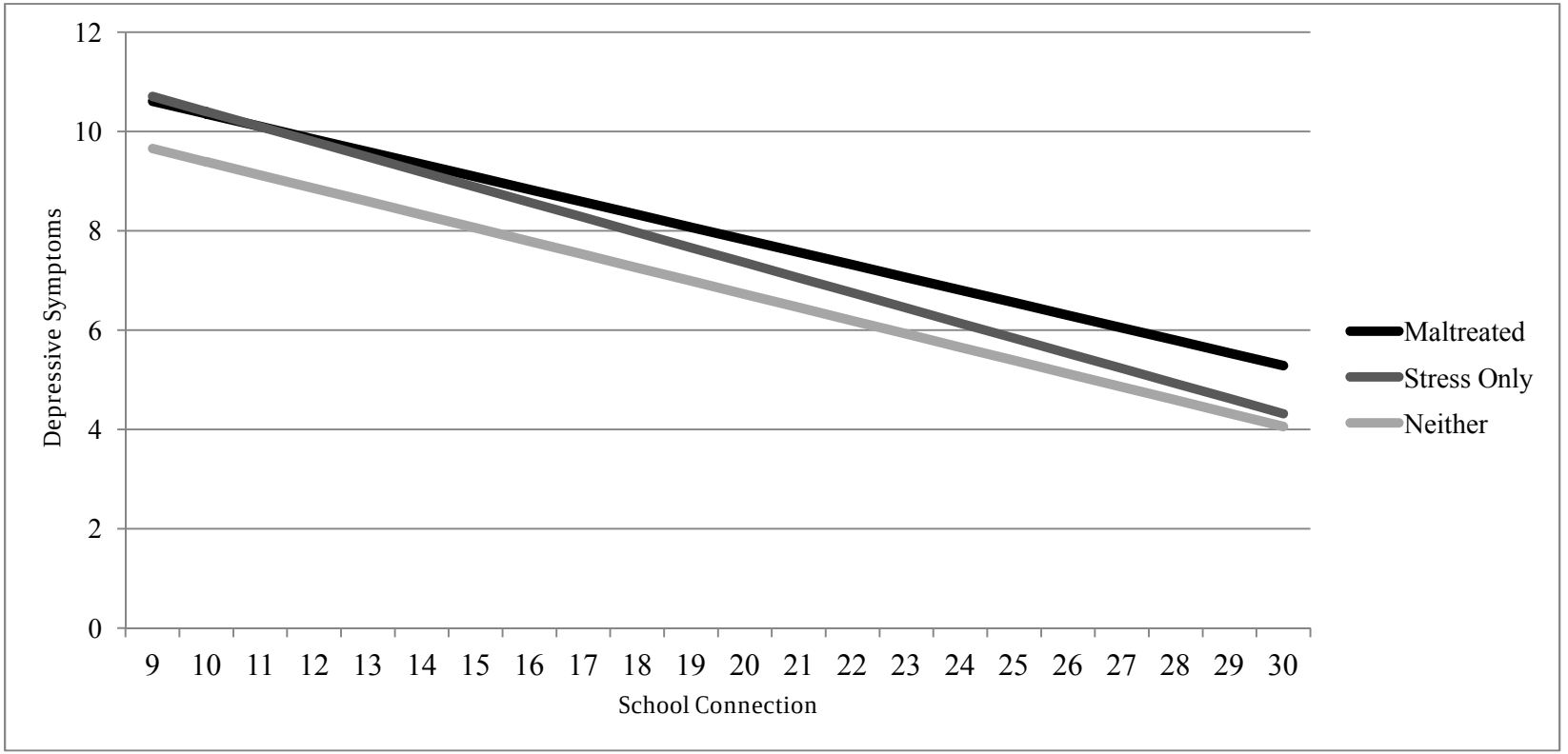
Note. Data are drawn from the National Longitudinal Study of Adolescent Health. Wave 3 depressive symptoms scores reflect the use of one less item; scales are standardized in analyses.

Table 2. Multiple regression models predicting adolescent and early adulthood depressive symptoms.

	Adolescent Depressive Symptoms						Late Ado. Depressive Symptoms						Early Adulthood Depressive Symptoms					
	Model 1a			Model 1b			Model 2a			Model 2b			Model 3a			Model 3b		
	b	SE	*p*	b	SE	*p*	b	SE	*p*	b	SE	*p*	b	SE	*p*	b	SE	*p*
School Connection	-0.06	0.01	**	-0.05	0.01	**	-0.03	0.01	*	-0.03	0.01	+	-0.04	0.01	**	-0.02	0.02	
Maltreated	0.10	0.03	**	0.11	0.03	**	0.27	0.04	**	0.27	0.04	**	0.25	0.04	**	0.25	0.04	**
Stressed Only	0.05	0.02	*	0.05	0.02	**	0.14	0.03	**	0.14	0.03	**	0.08	0.03	*	0.08	0.03	*
Connect*Maltreat				0.03	0.02					0.02	0.04					-0.01	0.04	
Connect*Stress				-0.04	0.03					-0.02	0.03					-0.07	0.03	*
Covariates																		
W1 Depression	0.11	0.00	**	0.11	0.00	**	0.06	0.00	**	0.06	0.00	**	0.05	0.00	**	0.05	0.00	**
Black	0.04	0.03		0.04	0.03		0.09	0.04	*	0.09	0.04	*	0.10	0.05	*	0.10	0.05	*
Hispanic	0.15	0.04	**	0.14	0.04	**	0.10	0.04	*	0.10	0.04	*	0.05	0.04		0.04	0.04	
Other	0.16	0.05	**	0.16	0.05	**	0.12	0.06	+	0.12	0.06	+	0.05	0.06		0.05	0.06	
Female	0.13	0.02	**	0.13	0.02	**	0.15	0.03	**	0.15	0.03	**	0.12	0.03	**	0.12	0.03	**
Age	0.07	0.01	**	0.07	0.01	**	0.05	0.02	*	0.05	0.02	*	0.07	0.02	**	0.07	0.02	**
Rel. with mother	-0.09	0.02	**	-0.09	0.02	**	-0.05	0.02	*	-0.05	0.02	*	-0.08	0.02	**	-0.08	0.02	**
PPVT	-0.01	0.00	**	-0.01	0.00	**	-0.01	0.00	**	-0.01	0.00	**	-0.01	0.00	**	-0.01	0.00	**
Income to needs	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		-0.01	0.00	*	-0.01	0.00	*
Homosexual	0.12	0.06	*	0.12	0.06	*	0.12	0.08		0.12	0.08		0.07	0.08		0.07	0.08	
Immigrant status	-0.06	0.05		-0.06	0.05		-0.01	0.02		-0.01	0.05		-0.06	0.06		-0.06	0.06	
Grade at W1	-0.07	0.02	**	-0.06	0.02	**	-0.09	0.02	**	-0.09	0.02	**	-0.10	0.03	**	-0.10	0.03	**
Constant	-0.56	0.17	*	-0.56	0.17	*	0.02	0.23		0.01	0.23		0.07	0.26		0.08	0.26	
N	12,031						10,432						9,230					

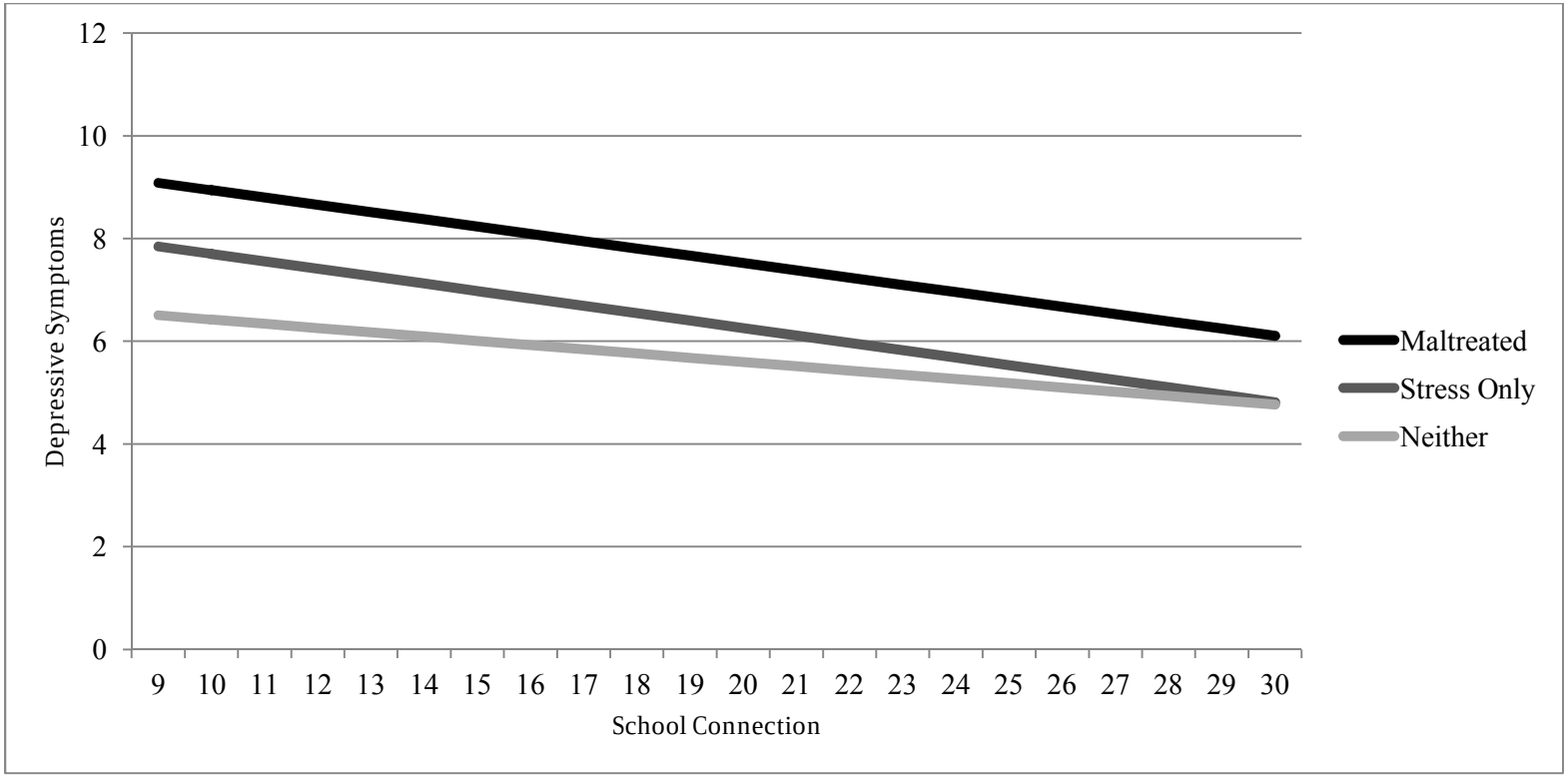
Note: Data are drawn from the National Longitudinal Study of Adolescent Health. Adolescent and early adulthood regressions weighted using GSWGT2, GSWGT3, and GSWGT4_2, respectively. +$p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Figure 1. Adolescent depressive symptoms as a function of school connection and early childhood experience.



Note. Data drawn from the National Longitudinal Study of Adolescent Health.

Figure 2. Early adulthood depressive symptoms as a function of school connection and early childhood experience.



Note. Data drawn from the National Longitudinal Study of Adolescent Health.