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Adolescent Depressive Symptomology: Do Siblings Hurt or Help?

Jared D. Thorpe

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

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Abstract

Adolescent Depressive Symptomology: Do Siblings Hurt or Help?

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Adolescents in the United States are currently experiencing a mental health crisis. While evidence shows that parents play an important role in shaping the mental health of youth, little has been done to understand how siblings may contribute to the psychological well-being of adolescents. I examine this association through the lenses of social capital and resource dilution perspectives. Social capital theory suggests that siblings may act as an additional source of resources, such as social support, which promote positive mental health. In contrast, resource dilution theory posits that the presence of siblings decreases the availability of parental resource in a way that negatively impacts adolescent psychological well-being. Utilizing a sample of 6,454 American youth from the *National Longitudinal Study of Adolescent to Adult Health*, I estimate a series of Generalized Linear Models predicting adolescent CES-D depression scores. Results, which are largely consistent with a resource dilution perspective, indicate that having three or more siblings is detrimental to the mental health of adolescents. These results indicate that interventions aimed at improving or protecting adolescent mental health should be targeted at creating networks that provide additional sources of adult social support for children from large families.

Keywords: adolescence, siblings, mental health, resource dilution, social capital

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Adolescent Depressive Symptomology: Do Siblings Hurt or Help?

The United States is in the midst of an adolescent mental health crisis. Between 2005 and 2014, the prevalence of adolescents meeting DSM criteria for a Major Depressive episode rose by nearly 30 percent (Mojtabai, Olfson, and Han 2016). Several hypotheses have been forwarded to explain the observed trends (Bernaras, Jaureguizar, and Garaigordobil 2019), however, the precise causes of these trends remain unknown (Mojtabati et al. 2016). Depression during adolescence is particularly worrisome given its association with a variety of outcomes that impact the life chances of the individual, such as poor academic performance, lower self-esteem (Compas, Connor, and Hinden 1998), increased physical health problems in early-adulthood (Keenan-Miller, Hammen, and Brennan 2007), and lower levels of social support in adulthood (Naicker et al. 2013). Additionally, adolescent depression is comorbid with a number of other health outcomes, including poorer physical health (Keenan-Miller et al. 2007), recurring depression, somatic symptoms, poor self-reported health (Naicker et al. 2013), and a variety of other mental health disorders (Rohde 2009). Given the increasing prevalence of depression among adolescents and the lasting implications it has for the individual and their life chances, it is increasingly important to understand the factors that either place adolescents at risk for, or that protect adolescents from, mental health issues.

The family-of-origin is an important factor for many adolescent outcomes due to the implications that parents—both the number of parents in the home and their biological relationship to the adolescent—have on the availability of resources and the level of parental investment in children (Carlson and Berger 2013; Sun and Li 2011). Findings from research examining family structure and its association with mental health mirror findings of research on other adolescent outcomes: children who live with both biological parents have, on average,

better mental health than do children who experience other family structures (Barrett and Turner 2005; Langenkamp and Frisco 2008). However, a focus on parent-child relationships (e.g. biological vs. non-biological parents, or two-parent vs. single-parent homes) provides a limited view of family structure. Despite a robust body of literature linking factors associated with siblings, including number of siblings, birth order, time between sibling births, and sex composition of the sibship, with adolescent outcomes such as academic achievement (Blake 1989) and delinquency (Brownfield and Sorenson 1994), the relationship between siblings and adolescent mental health remains understudied. However, if sibling relationships promote positive mental health, or if the presence of siblings dilutes parental resources—like time or support—and negatively impacts the mental health of the individual, then the relationship between siblings and adolescent mental health warrants additional investigation.

Within the mental health literature, sibling effects have largely been considered from only a psychological perspective where the presence of siblings alters the intrapersonal development of the individual (Adler 1964). However, there are good theoretical reasons to believe that the presence of siblings in the home may influence the mental health of children and adolescents through mechanisms outside of the individual (Bernaras et al. 2019). As such, the sociological study of the effects of siblings on adolescent mental health—which focuses on how siblings shape the mental health of the individual in ways that cannot be reduced to individualistic explanations, such as personalities or brain chemistry—adds a key dimension to our understanding of the mental health of individuals during this life stage. For example, empirical evidence demonstrates that social support is an important resource in the promotion of positive mental health (Coyne and Downey 1991; House, Landis, and Umberson 1988; Kawachi and Berkman 2001; Thoits 1995). Siblings may increase the social support available to an

individual by serving as additional members of the individual's network. Alternatively, siblings may decrease the social support available to an individual if they dilute resources—like available time and attention—of important members of the individual's support network. Indeed, while there is a growing body of literature linking siblings and sibling relationships to positive outcomes across the life-course (Bobbitt-Zeher and Downey 2013), studies considering the effects of siblings on mental health have met with mixed results (Carballo et al. 2013; Green et al. 2005; Lawson and Mace 2010). This lack of agreement may stem, at least in part, from an incomplete theoretical orientation toward siblings.

Given that theoretical pathways exist for siblings to act as both promoters and detractors of adolescent mental health, the disparate findings in the literature are not surprising. Additionally, differences in the sampling and modeling strategies utilized across these studies, and the varying definitions of siblings—different combinations of biological relation and residential status—they employ, may further limit the ability of the literature to reach a clear consensus. Moreover, studies that have considered the relationship between siblings and adolescent mental health commonly treat number of siblings in a continuous fashion; evidence from studies on other outcomes demonstrates that more nuanced operationalizations of siblings are often necessary in order to reveal the true nature of the relationship (Downey and Condrón 2004). I address this gap in the literature, and these methodological concerns, by applying two well-developed sociological theories—social capital and resource dilution—to the relationship between siblings and adolescent mental health. Then, utilizing data from a large-scale, nationally representative dataset—the *National Longitudinal Survey of Adolescent to Adult Health*—I examine the relationship between siblings and adolescent depression with several different operationalizations of siblings.

Siblings and Mental Health

The limited empirical evidence suggests that a significant association between number of siblings and mental health may exist (Blake 1981; Carballo et al. 2013; Green et al. 2005). For example, in a case-control study of individuals under the age of 18 who were diagnosed with a mental health disorder at a public mental health center in Madrid, Spain between 1980 and 2008, Carballo and colleagues (2013) found significant positive associations between the number of siblings an individual had and the likelihood of being diagnosed with a variety of mental health disorders. However, other studies conclude that there is no statistically significant association between number of siblings and mental health (Ford, Goodman, and Meltzer 2004; Harlow et al. 2002; Lawson and Mace 2010). In one of the only studies to use a large, representative dataset to examine this association, Lawson and Mace (2010) drew upon a sample of more than 13,000 children in the United Kingdom and concluded that sibship size was largely unrelated to a number of mental health outcomes. The application of several well-developed sociological theories may help to explain these divergent findings.

The majority of studies to date have been grounded in psychological perspectives which focus on how the presence of siblings alters the personality or brain chemistry of the individual (Adler 1964). However, sociologists have long known that social context is an important predictor of individual mental health (Aneshensel, Phelan, and Bierman 2013). There are several sociological theories that can be leveraged to help explain the potential association between the number of siblings an individual has and their mental health, particularly during the period of adolescence. Social capital and resource dilution theories have usefully been applied to the study of a variety of outcomes in the adolescent context ranging from academic to behavioral (Dufur et al. 2019; Gibbs, Workman, and Downey 2016). The application of these theories to questions

about mental health may prove useful given that previous sociological studies have focused on the predictive power of social support and other resources for psychological well-being. Social capital theory suggests that siblings may provide additional resources, such as social support, and that individuals with higher levels of social capital enjoy better mental health. However, resource dilution theory holds that siblings dilute available resources such that individuals with more siblings experience worse mental health. While each offers a theoretical pathway through which siblings may be associated with adolescent mental health, neither theory has been leveraged to empirically explore this relationship. I move now to a discussion of each of these sociological theories, how they may usefully be applied to the study of adolescent mental health, and the implications of each theory for the association between number of siblings and adolescent depressive symptomology.

Social Capital Theory

One sociological framework that offers a pathway for an adolescent's siblings to be associated with their mental health is that of social capital theory. Although prior research has identified several factors that promote an adolescent's ability to cope with and adapt to stress and adversity, evidence suggests that social relationships are a particularly important factor in the determination of individual psychological wellbeing (Lindström et al. 2000; Lindström, Hanson, and Östergren 2001; Umberson, Crosnoe, and Reczek 2010; Umberson and Karas Montez 2010; Weitzman and Kawachi 2000). Social capital theory helps to explain how and why social relationships may protect against negative outcomes for adolescent mental health (Almedom 2005; Dufur et al. 2019; Rose 2000).

Social capital, as discussed by Coleman (1990, 1988), can be understood as a stock of resources, much like financial or human capital, which can be mobilized by or across

interpersonal relationships. Coleman's description of the resources that comprise social capital focused on several factors that help children learn about and internalize behaviors which are socially acceptable; namely: information, norms, and obligations that can be transmitted across social ties. In much the same way as financial or human capital, social capital is built in children through purposeful investment by adults, particularly the child's parents (Coleman 1988). For example, the time and attention that parents dedicate to promoting child well-being, interacting with the child, and supporting the child's activities reflect ways that parents may purposefully invest in the creation of social capital within the home (Dufur et al. 2016; Dufur, Parcel, and Troutman 2013; Kim and Schneider 2005). It is important to note that the creation of social capital is reliant on not only the specific parenting practices that parents engage in, but also on the strength of the parent-child relationship (Coleman 1988). While it is true that social capital is also contained in the relationships that parents and children share with individuals outside the home (Crosnoe 2004; Dufur et al. 2015, 2016, 2019; Dufur, Parcel, and Troutman 2013), I focus my discussion here on social capital built within the family context due to its generally stronger association with child and youth outcomes (Dufur, Parcel, and McKune 2013; Dufur, Parcel, and Troutman 2013) and the status of siblings as members of the family.

Social capital theory has been especially fruitful in the study of adolescent outcomes. Higher levels of social capital in adolescents is associated with a number of positive outcomes including better academic achievement, fewer behavior problems, and lower levels of substance use (Dufur et al. 2015; Dufur, Parcel, and McKune 2013; Lindström et al. 2000; Parcel and Dufur 2001). Furthermore, social capital theory has been applied to the study of a variety of health outcomes (Ertel, Glymour, and Berkman 2009; Everson-Rose and Lewis 2005; Uchino 2006). Indeed, there is mounting evidence that social capital protects children and adolescents

from negative mental health outcomes (Almedom 2005; Drukker et al. 2003; Rose 2000; Thorpe, Dufur, and Jarvis 2020; Thorpe, Dufur, and Shafer 2020). A recent study of 6,500 youth in the United States found that social capital is significantly associated with lower levels of depressive symptomology (Thorpe, Dufur, and Shafer 2020). These results seem to be robust to cultural differences as similar results were observed among a nationally representative set of youth from South Korea (Thorpe, Dufur, and Jarvis 2020).

The connection between social capital and mental health outcomes operates through several behavioral and psychosocial mechanisms. The social relationships that individuals share transmit obligations, norms, and information which exert informal social control over and attach symbolic meaning to various health behaviors (Crosnoe, Muller, and Frank 2004; Ellison and Levin 1998; Schnittker and McLeod 2005; Waite 1995). For example, information and norms regarding healthy self-care practices and coping mechanisms that are transmitted from parents to children may alleviate the effects of stressors on mental health. Additionally, and of particular importance for mental health outcomes, these relationships provide individuals with a sense of personal control (Thoits 2006) and a source of social support (Cohen 2004). Social support can be understood as the informational, emotional, and instrumental assistance that can be derived from those with whom we share social bonds (House et al. 1988). The association between social support and mental health is illustrated by an extensive body of literature (Coyne and Downey 1991; House et al. 1988; Kawachi and Berkman 2001; Thoits 1995). Social support scholars differentiate between structural—the number of relationships one has—and functional—the quality of those relationships—components of social support (Kawachi and Berkman 2001; Thoits 1995). Evidence also suggests that indicators of social capital—such as, parental warmth, encouragement, and engagement—promote the ability of an adolescent to successfully cope with

and adapt to stressful events, conditions, and environments (Olsson et al. 2003). Similarly, evidence suggests that belonging to a group within which the individual members invest in the collective good—of which the family unit is a particularly strong example—may provide individuals with a sense of belonging and purpose that is protective against negative mental health outcomes (Hagerty and Williams 1999). Furthermore, sibling relationships may reduce stress by providing individuals the opportunity to access important psychological, social, and financial resources they may otherwise be lacking.

Despite the growing body of literature linking social capital and mental health during the period of adolescence, the application of social capital theory to the association between siblings and mental health is hampered by the under-theorization of siblings as a source of social capital. One of the major gaps in the social capital literature is that it has focused almost exclusively on the ties that children share with adults. This is not surprising given that Coleman's work focuses primarily on the parent-child relationship (Coleman 1988). However, as some researchers have identified (Gillies and Lucey 2006; Morrow 1999), Coleman treats children as passive, disconnected consumers of social capital, ignoring the active role that children play in developing relationships and the capacity that siblings have to interact with and support one another. Indeed, research has demonstrated that children play an active role in the generation of family social capital as they build peer networks and bring together different sets of parents (Edwards and Gillies 2005; Tomanović 2004). Additionally, there is considerable research that illustrates how sibling relationships provide opportunities similar to those provided by the parent-child relationship during the creation of social capital, such as navigating conflict (Conger et al. 2009), understanding the viewpoints and emotions of others, managing anger, and providing nurturance (Brody 2004). Research also suggests that siblings serve as founts of

support and information during important transitions in early adulthood (Jensen, Whiteman, and Fingerman 2018) and in times of crisis (Troll 1975). Indeed, in a qualitative study of 44 siblings from 16 sibling formations, Gillies and Lucey (2006) documented how siblings are a “source of considerable social capital” (491) for one another.

Although there are good theoretical reasons to believe that siblings act as a positive source of social capital, it is also possible that additional siblings act as a source of negative social capital. While social capital is generally treated as a promotive or protective resource, the quality of social capital may depend on with whom social bonds are shared. Empirical evidence indicates that depressive symptoms and moods are contagious among members of the same social network (Joiner and Katz 2006). Thus, instead of providing positive social capital and promoting positive mental health outcomes, a sibling may act as a source of negative social capital and place an individual at greater risk of negative mental health outcomes if they have poor mental health themselves. However, evidence of “negative” social capital is sparse and the few studies that have found such an association have indicated that social capital is “negative” only when the norms and information received from social ties is predominantly negative (Koutra et al. 2014; Martins et al. 2017). Given this, I anticipate that sibling relationships should be a source of positive social capital, even if a sibling suffers from poor mental health.

Thus, the implication of social capital theory for the relationship between number of siblings and adolescent mental health is that additional siblings may serve as important members of a child’s social network, as additional sources of social support. Siblings may promote adolescent mental health if they are viewed as friends, provide someone the child can confide in, and/or decrease feelings of loneliness, all factors that are associated with lower levels of psychological distress (Coyne and Downey 1991). Therefore, in the theoretical framework of

social capital theory, we may anticipate that additional siblings would be associated with lower levels of adolescent depressive symptomology.

Resource Dilution Theory

Resource dilution is another sociological theory that provides a pathway linking number of siblings to mental health. This theoretical approach has implications for the ‘quantity-quality hypothesis’, which states that as the number of children in a family increases, the children in that family will experience poorer outcomes overall. The theory addresses this hypothesis by asserting that resources, such as financial capital and parental time, operate under zero-sum conditions. Thus, the implications of the model can generally be understood as: the more children present within the family unit, the fewer resources available to each child. The most extensive test of this model was produced by Blake (1989) when she assessed the relationship between sibship size and educational attainment measured in years of education completed. Utilizing data from every large-scale study available at the time, Blake demonstrated that, in general, individuals with fewer siblings completed more years of education than did individuals with a greater number of siblings. Building on this work, Downey (1995) further tested the assumptions underlying this model. Drawing upon data from the *National Education Longitudinal Study*, Downey analyzed a sample of more than 24,000 eighth graders and was able to reproduce the relationship that Blake had documented. Further, Downey was able to demonstrate a negative association between number of siblings and a variety of parental resources (i.e. money saved for college, availability of educational objects in the home, and the frequency of parent-child conversations related to school matters), and that the relationship between sibship size and educational outcomes was mediated by these parental resources (Downey 1995).

This model is particularly well suited for the study of child and adolescent outcomes because of its emphasis on parental resources for child outcomes. While children and adolescents are young and living at home they rely largely on the resources of their parents. Even as the reliance on parental financial resources loosens as adolescents begin to enter the labor market, interpersonal resources—such as parenting practices and the time that a parent has to help with homework or provide support for extra-curricular activities—remain important predictors of adolescent behavioral outcomes (Fletcher, Steinberg, and Williams-Wheeler 2004; Kane and Garber 2004, 2009; Stattin and Kerr 2000). Because of the simple, yet effective explanation that the resource dilution model offers of how parental resources operate, and given the central importance of parental resources—both financial and interpersonal—for adolescent outcomes, the model is an attractive theoretical framework from which to approach outcomes for children in this age range.

While the resource dilution model has predominately been used in the study of educational outcomes (Blake 1981, 1989; Downey 1995, 2001; Gibbs et al. 2016; Steelman et al. 2002), the implications of this model extend to other outcomes where resource availability plays an important role (Keister 2003, 2004; Lawson and Mace 2008; Li, Manor, and Power 2004; Li and Power 2004; Riswick 2018). Within the family, the dilution of resources across children may have additional implications for the mental health of youth. For example, there is a robust body of literature that illustrates the general salience of resource availability for mental health outcomes; various measures of mental health follow a socio-economic gradient, where deficits in mental health are found disproportionately among those from lower socio-economic status backgrounds (Dunn et al. 1998; Ford et al. 2004; Green et al. 2005; Lorant et al. 2003; McMunn et al. 2001). Dilution of financial capital across children may have negative effects if it results in

additional stress, reduces opportunities to engage in activities or results in a sense of loss of control. Further, resource dilution within the family is not limited to strictly financial resources. As the number of children in a family increases, other resources, such as parental time and attention are also diluted. The dilution of these resources poses a serious risk for the mental health of children and youth because it diminishes the capacity of adults to provide social support for children. If the presence of additional siblings alters the ability of parents to build and maintain quality relationships with their children, then the social support that parents provide may dilute as the number of children in the family increases. This may be the case if additional children in the home results in increased total hours worked by parents in order to support a larger family, or, simply, if more children mean less time and attention that parents can devote to each child.

Thus, resource dilution theory associates the number of siblings an adolescent has with their mental health through reduced parental resources, such as time, attention, and financial resources. As the number of children in a family increases, there are fewer parental resources—both financial and interpersonal—available to each child. Decreased social support, fewer opportunities to participate in activities, and additional stress may all lead to poorer mental health outcomes. Thus, within the resource dilution framework, we may anticipate that additional siblings will be associated with higher depression scores.

The Current Study

To date, the majority of studies examining the association between number of siblings and adolescent mental health have been guided by a psychological perspective and have met with mixed results. However, there are good theoretical reasons to believe that the social context of the sibling relationship is an important determinant of adolescent mental health. As such, I have

described two sociological theories that each offer potential pathways through which the sibling relationship may have an effect on the mental health of the individual. Social capital theory allows for siblings to act as an important node in the network of the adolescent, acting as an additional source of social support and thus promoting positive mental health. In contrast, resource dilution theory would have siblings operate as competitors for a finite amount of parental time and attention, decreasing the amount of social support available to any one child, and consequently negatively affect the mental health of the adolescent. Thus, I add to both the sibling and mental health literatures by assessing which of these opposing theoretical perspectives is operative on the association between number of siblings and adolescent depressive symptomology.

The current study also makes important methodological contributions to the body of literature. As the majority of studies have employed a psychological perspective, the body of literature on the association between sibship size and mental health is built on small, non-representative, clinical or community samples. Studies that have utilized large-scale, representative samples have come exclusively from the United Kingdom (Ford et al. 2004; Green et al. 2005; Lawson and Mace 2010). This is problematic because the processes through which social capital is created and exchanged and by which resources are diluted within the family are each culturally embedded (Gibbs et al. 2016; Ream 2005). Thus, the study of the association between number of siblings and adolescent mental health with representative samples from various contexts is an important endeavor to determine the extent to which previous findings are generalizable across cultural contexts. I address this gap in the literature by drawing data from a large-scale, nationally representative dataset of American youth.

The study makes additional methodological contributions in its treatment of siblings. Previous studies in this body of literature have almost exclusively treated siblings in a continuous fashion. However, as Downey and Condrón (2004) discuss, when considering the relationship of siblings to an outcome, it is important to employ measures of sibship size that allow the detection of non-linear relationships and threshold effects. For example, if siblings act as a source of social support, the presence of one sibling may provide a large benefit to the focal child and the addition of other siblings may only provide marginal benefits. In this case, a linear association may not be detected but an association with the presence of any siblings may be. Additionally, comparing individuals with specific numbers of siblings to individuals without siblings may demonstrate these diminishing returns. Similarly, if siblings do dilute resources that are important for the mental health of children and youth, it is possible that effects of additional siblings may only be observed when parental resources are diluted past a certain point; in which case, an association may be observed among individuals with a high number of siblings, but not among youth with few siblings. As such, I measure sibship size in a variety of ways which will allow me to detect these more nuanced associations.

Mental health is a broad concept, encapsulating factors of emotional, psychological, and social well-being. While all dimensions of mental health are important, I focus here on adolescent depressive symptomology. Given the increasing prevalence of depression in adolescents and its important implications for outcomes across the life-course, understanding how siblings may be associated with depression during adolescence is important. I add to this understanding by utilizing a nationally representative sample of American adolescents to estimate a series of General Linearized Models predicting adolescent depression scores. Furthermore, each set of models employs a different operationalization of sibship size, allowing

for the detection of non-linear associations. Positive coefficients in estimated models would indicate that siblings have a negative effect on adolescent mental health, while negative coefficients would indicate a protective effect of siblings against adolescent depressive symptomology.

DATA AND METHODS

Data

This paper draws upon data from the *National Longitudinal Study of Adolescent to Adult Health* (Add Health). Add Health is a nationally representative, longitudinal panel survey of adolescents in the United States. The study began in the 1994-1995 school year and surveyed students who were in grades 7-12 during that academic year; a total of four follow-up waves were conducted with the final wave concluding in 2018. Data at Wave 1 were collected in several ways, including: (a) an in-school questionnaire administered to 90,118 students, (b) a questionnaire given to school administrators from sampled schools, (c) an in-home questionnaire which was administered to 20,745 students, and (d) an in-home questionnaire from 17,670 parents of the sampled children. The Add Health study utilized a complex stratified sampling strategy; as such, in order to account for this complex design, I follow the guidance of the survey publishers (Chen and Chantala 2014) in utilizing probability sampling weights.

Sample

My analytic sample is drawn from the subset of data from Wave 1 of data collection that is available for public use. Thus, the sample begins with all children in the public-use, Wave 1 data for whom valid sampling weights were available ($N = 6,504$). Data are missing on a number of analytic variables. Little's test for covariate dependent missingness indicated that data were not missing at random. These results suggest that data were missing in a fashion systematically

related to the dependent variable. Generally, this would indicate that multiple imputation was not an appropriate approach for handling missingness. However, supplemental analyses revealed that models estimated using multiply imputed data and data treated with listwise deletion of missing values resulted in substantively similar results. As such, I employ multiple imputation in order to preserve cases in the sample and thus its statistical power and generalizability to the population. Variables missing data on fewer than three percent of cases were treated with listwise deletion ($n = 50$)(Enders 2010). Other variables were missing on up to twenty-four percent of cases. These variables were treated with Multiple Imputation via Chained Equations in Stata 16. A total of 20 completed datasets were imputed with a burn-in period of 500 iterations. Imputed datasets were assessed for consistency with observed data and no systematic problems were observed. The final analytic sample consists of 6,454 adolescents.

Dependent Variable

The dependent variable is the adolescent's depression score. Add Health included a modified version of the CES-D depression scale during the first two waves of data collection, replicating word-for-word 18 of the 20 items included in the CES-D scale; the two omitted items, which ask about the frequency of restless sleep and crying spells, were omitted for undocumented reasons by the survey administrators. All items asked youth about their experiences and feelings over the past seven days. Four of the eighteen items asked of respondents were worded in such a way that lower scores for the item corresponded to higher depressive symptomology; responses to these items were reverse coded. After reverse coding the noted items, all items were scored on a scale from 0 (never) to 3 (everyday). Responses from the eighteen items were then summed together to create an index ranging from 0 to 54, with higher scores representing more depressive symptoms. For the purpose of comparability to studies that

have employed the full CES-D questionnaire, I follow the procedures outlined by Goodman and Capitman (2000) to convert scores from these eighteen items to the original 0 to 60 range of the CES-D depression scale ($\alpha = 0.87$).

Key Independent Variables

Add Health gathered information from the study child about each person living in the child's home. Utilizing this household roster data, and following the convention in previous sibling research (Merry, Bobbitt-Zeher, and Downey 2020), I construct a number of sibling measures. These measures include and are operationalized as follows: a continuous variable ranging from 0 to 10+ siblings, a dichotomous variable indicating the presence of any siblings, and a categorical variable representing specific sibship sizes ranging from being an only child to having four or more siblings (a total of five distinct categories). As noted by Downey and Condrón (2004), this range of operationalizations of sibship size allows the researcher to determine if any observed association is non-linear or exhibits threshold effects where the effects are only seen after reaching a certain number of siblings.

Controls

Empirical evidence has demonstrated that several child and family socio-demographic characteristics are associated with mental health outcomes. Furthermore, several of these socio-demographic characteristics serve as indicators of parental resource availability for children. As such, I include these factors as controls in each set of estimated models.

At the family level I control for household income, family structure, and parental education. While the association between each of these factors and mental health outcomes has been documented previously (Lorant et al. 2003; Umberson, Thomeer, and Williams 2013), I also include them here as indicators of parental resources that may be diluted across siblings.

Parent responses to the question “About how much total income, before taxes did your family receive in 1994?” were collapsed to a range of \$0 to \$150+ thousand; the square root of responses was taken to address skewness. Family structure was derived from household roster data and was divided into four categories (Two parents – Both biological; Two parents – One biological; One parent – Biological; Other). As an indicator of parental resources, both the number of parents in the home and the biological relation of parents to the child have important implications for the availability of parental time for children and the level of parental investment in the child (Carlson and Berger 2013; Langenkamp and Frisco 2008). Parental education is measured as the highest level of education completed by a residential parent and consists of four categories (Less than high school; High school degree; Some college; Bachelor’s degree or more). Similar to family structure, this measure has important implications for the availability of parental time to children as previous studies show that higher-educated parents spend more time with their children (Guryan, Hurst, and Kearney 2008).

At the adolescent level, I also control for a number of socio-demographic characteristics that have associations with mental health outcomes. These include the age (Ferraro and Wilkinson 2013), sex (Rosenfield and Mouzon 2013), race/ethnicity (Brown et al. 2013), global health (Keenan-Miller et al. 2007), and religiosity of the respondent (Schieman, Bierman, and Ellison 2013). Although students reported their own age during the in-school questionnaire, the age variable I utilize is constructed by subtracting the child’s birth month and year—which they reported during the in-home questionnaire—from the month and year in which the in-home questionnaire was administered. Utilizing this measure for child age addressed two issues: first, not all children sampled for the in-home questionnaire were present in school during the in-school administration; and second, child misreports during the in-school questionnaire. I include

this derived measure of age in models as a continuous variable measured in years. The biological sex of the adolescent is included as a dichotomous indicator where an affirmative response indicates the adolescent is female (0 = male; 1 = female). Racial/ethnic identification was reported by the study child as responses to two questions. The first question asked the child to identify their racial background from a list of options, and the second asked about the child's Hispanic background. Responses from these two questions were combined into five distinct categories (White, Black, Hispanic, Asian/Pacific Islander, and Other). Self-reported global health is measured dichotomously (0 = Less than Very Good; 1 = Very Good or Excellent). Similarly, I include a self-reported dichotomous indicator of whether the study child attends religious services at least once a week.

Analytic Strategy

To assess the association between siblings and adolescent mental health, I estimate three sets of nested regression models. The first set of models regresses CES-D depression score on the continuous measure of siblings. The second and third set of models are the regressions of CES-D depression score on the dichotomous measure of the presence of siblings and the measure of specific sibship sizes, respectively. The first model in each set is the simple bivariate regression. I then introduce the control variables outlined above in two distinct sets. The first set of controls, which are introduced in the second model of each set, consist of the family-level controls (household income, family structure, and parental education). As noted above, each of these controls is an important indicator of parental resources. As such, if the addition of these controls drastically attenuates an observed relationship at the bivariate level, this would suggest that parental resources are potentially an explanatory mechanism through which the association operates. The final model in each set introduces the child-level control variables to assess any

observed relationship when other factors associated with adolescent mental health are held constant.

The CES-D depression scores observed in the analytic sample were slightly positively skewed. Analyses revealed that residuals from Ordinary Least Squares regression models were not normally distributed. As such, I estimate Gaussian Generalized Linear Models with the log link function to address the skewness of the dependent variable.

RESULTS

Weighted descriptive statistics are presented in Table 1. The analytic sample approximates a nationally representative sample of adolescents. The average age of the sample is between fifteen and sixteen years of age. Seventy-seven percent of adolescents had at least one sibling, with the average number of siblings being between one and two siblings. Approximately half of adolescents lived with both biological parents, over sixty percent had at least one parent who attended college, and average household income was between \$35,000 and \$40,000. Sixty-two percent of the sample were White adolescents with fourteen percent of the sample identifying as Black and an additional fourteen percent identifying as Hispanic. Approximately half of the sample were female. In terms of global health and religiosity, nearly seventy percent indicated that their overall health was very good or better and just over forty percent of adolescents in the sample attended religious services at least once a week.

(Table 1 about here)

Given my interest in differences in adolescent depressive symptomology across number of siblings, I also present the results of a series of t-tests comparing the means of all variables used in my analyses across different sibship sizes (Only child; One sibling; Two siblings; Three siblings; Four or more siblings). These results are presented in Table 2. These comparisons

revealed several interesting trends. Of primary interest, adolescents who had one sibling had a significantly lower average of reported depressive symptoms than did their peers who were only children ($p < 0.001$). Additionally, adolescents who had two or three siblings were not significantly different in their reporting of depressive symptomology than those without any siblings. Finally, adolescents with four or more siblings reported significantly higher average levels of depressive symptomology than did adolescents with two or fewer siblings (at least $p < 0.05$). These findings suggest that the association between number of siblings and adolescent depressive symptomology may be more nuanced than either social capital or resource dilution theories predict. That children with one sibling have significantly lower depression scores than only children would suggest that the presence of a sibling does provide some resource that is beneficial for the mental health of adolescents. However, as that positive effect is no longer observed in larger sibships, and that those with the greatest number of siblings exhibit higher levels of depressive symptomology, there is also evidence that resource dilution may be occurring.

(Table 2 about here)

A number of additional interesting trends emerged from these t-tests. Compared to individuals who were only children, adolescents with exactly one sibling came from homes with higher household incomes ($p < 0.001$), had more highly educated parents ($p < 0.001$), had a higher proportion of individuals in intact homes ($p < 0.001$), and had a higher proportion of White adolescents ($p < 0.001$). Conversely, adolescents who had four or more siblings came from homes with lower levels of income, had parents with lower levels of education, and were disproportionately from an ethnic/racial minority than their peers. It is important to note that, compared to their peers with any number of siblings, adolescents who were only children

disproportionately came from homes with either only a single biological parent or where neither biological parent was present. Additionally, a higher proportion of children with no siblings attended religious services at least once a week, with attendance at weekly religious services tapering off as number of siblings increased. This suggests that selectivity may be an issue, particularly if the results of the estimated models indicate that resource dilution is occurring. If parental resources are of particular importance for adolescent mental health, then the fact that individuals with the greatest number of siblings come from the homes with the least amount of resources to begin with places those children at a great disadvantage.

Moving to the results of the multivariate regression models, Tables 3 through 5 presents the results of the regressions of adolescent depression scores on sibship size measured in various manners. Again, the modeling strategy employed in these analyses is a log-linear approach estimated utilizing the GLM. The results I present here are the exponentiated coefficients of the estimated model. These coefficients can thus be interpreted in a fashion similar to odds ratios resultant from logistic regressions; coefficients greater than 1 represent a coefficient minus 1 percentage increase in depression scores, while coefficients between 0 and 1 represent a 1 minus the coefficient percentage decrease in depression scores. For example, if the coefficient for the continuous measure of siblings was 0.900, it would indicate that each additional sibling is associated with a ten percent decrease in adolescent depression scores.

(Table 3 about here)

Table 3 presents the set of regression models regressing CES-D depression scores on sibship size measured continuously. The results from Model 1, which represent the simple bivariate regression, indicate that each additional sibling is associated with a 2.6 percent increase in adolescent depression scores ($p < 0.01$). Model 2 introduces a set of covariates that

statistically control for sociodemographic factors associated with the family. The results from this model indicate that, when controlling for these family factors, the association between number of siblings and adolescent depression scores is strengthened such that each additional sibling is associated with a 3.1 percent increase in reported depressive symptoms ($p < 0.001$). The model also indicates that, when other covariates are held constant, each of the family factors for which I control are significantly associated with adolescent depression scores. Every one square-root unit increase in household income is associated with a 1.2 percent decrease in depression scores ($p < 0.05$). Compared to youth with at least one parent whose highest level of education was graduation from high school, (1) youth who had no parent who graduated high school are expected to have 10.1 percent higher depression scores ($p < 0.01$), (2) youth who had at least one parent attend college are expected to have depression scores 6.6 percent lower than those that did not ($p < 0.01$), and (3) youth who had at least one parent graduate from college are expected to have depression scores that are 12.4 percent lower ($p < 0.001$). In terms of family structure, compared to youth with both biological parents, (1) youth with two parents—only one of whom is a biological parent—are associated with 10.5 percent higher depression scores ($p < 0.01$), (2) youth with only a single biological parent are expected to report depression scores that are 15.8 percent higher ($p < 0.001$), and (3) youth with no biological parent present are associated with 32.0 percent higher depression scores ($p < 0.001$).

Model 3 introduces individual characteristics and demographic factors. The model indicates that the addition of these individual level factors has no appreciable effect on either the magnitude or the level of significance of the association between number of siblings and adolescent depression scores. The additional controls do slightly attenuate the associations between the family factors and adolescent depression scores such that the only level of parental

education that remains statistically different than only having a high school diploma is having a parent with a college degree. All other effect estimates—while retaining their levels of significance—see the magnitude of their effect estimates attenuated. At the individual level, each additional year of age was associated with a 3.8 percent increase in depression scores ($p < 0.001$), identifying as any racial/ethnic minority was associated with an increase in depressive symptomology, and females reported depression scores 16.2 percent higher than their male counterparts ($p < 0.001$). Individual level factors that were associated with lower levels of adolescent depressive symptomology were self-assessments of overall health as very good or better and attending religious services at least once a week, which were associated with 22.9 percent and 7.4 percent lower depression scores respectively (both $p < 0.001$). The results from this set of models are consistent with what one might expect to see when approaching the association from a resource dilution perspective.

(Table 4 about here)

The next sets of models were estimated to assess the possibility that the association between number of siblings and adolescent depressive symptomology is non-linear. For example, it may be the case that the effect of diluted parental resources may not be felt until a certain threshold of siblings is reached. Conversely, if siblings act as a resource for positive mental health, additional siblings may only provide an incremental benefit and diminishing returns may be observed. Thus, Table 4 presents the results from the set of models estimating the regression of adolescent CES-D depression scores on the presence of any sibling. Model 4 presents the results of the bivariate regression and indicates that the presence of any sibling in the home is associated with a 4.7 percent decrease in adolescent depression scores ($p < 0.05$). However, the addition of family level control variables in Model 5 attenuates this association

such that the association is no longer statistically significant. Just as was the case with the siblings measured in a continuous fashion, each of the family level control variables has a significant association with adolescent depression scores. Once again, higher levels of household income are associated with lower depression scores, having parents without a high school degree is associated with higher levels of depression while having parents that attended or completed college is associated with lower levels of depression, and family structures other than two biological parents are associated with higher depression scores. Model 6 sees the addition of the individual level control variables. The results from Model 6 mirror those from Model 3 in that age, racial/ethnic minority status, and being female are all positively and significantly associated with adolescent depression scores, while having good overall health and attending weekly religious services are both negatively and significantly associated with adolescent depressive symptomology. These results begin to indicate that the relationship between siblings and adolescent mental health is more complex than those suggested by the first set of models. The bivariate regression seems to indicate that siblings do provide some protective effect against depressive symptomology; however, that effect is no longer observed when indicators of parental resources are controlled for. Additionally, if a simple negative relationship like that observed in the first set of models were present, we would have expected to see a negative relationship between the indicator of the presence of siblings and adolescent depressive symptomology; such a relationship is not observed.

(Table 5 about here)

I further test for non-linear relationships by regressing adolescent depression scores on the set of specific sibship sizes—Only child (reference), One siblings, Two siblings, Three siblings, Four or more siblings—and the results from these models are presented in Table 5.

Model 7 again represents the bivariate regression of sibship size and adolescent depression scores with results indicating that having exactly one sibling is associated with 9.2 percent lower levels of depression ($p < 0.001$) as compared to those who are only children, while having four or more siblings is associated with 11.3 percent higher levels of adolescent depression ($p < 0.01$); individuals with exactly two or three siblings reported depressive symptoms at levels that were not statistically different than their peers who were only children. The addition of family level control variables in Model 8 modify these relationships such that having exactly one sibling is no longer statistically different than having no siblings, and having four or more siblings is associated with 14.1 percent higher depression scores ($p < 0.01$). The effect size and significance of the family level control variables in Model 8 are similar to those observed in Models 2 and 5: higher levels of income and having a college educated parent are associated with lower levels of depressive symptomology, while having parents without a high school diploma and not having both biological parents present in the home are associated with higher levels of adolescent depression. The addition of individual level controls in Model 9 further alters the association between sibship size and adolescent depressive symptomology. When controlling for both family and individual level factors, having exactly one or two siblings is not statistically different than having no siblings in terms of reporting of depressive symptoms; conversely, having exactly three siblings is associated with 9.0 percent higher depression scores ($p < 0.05$) and having four or more siblings is associated with depression scores that are 14.5 percent higher ($p < 0.01$). While the association between sibship size and CES-D depression scores changes with the addition of both family and individual controls, the associations between the control variables and depression scores among adolescents in Model 9 are consistent with the associations revealed in Models 3 and 6. Similar to the results from the second set of models, these results

indicate that the relationship between number of siblings and adolescent depressive symptomology is nuanced and that siblings may provide resources that promote mental health while simultaneously diluting parental resources, consequently negatively affecting adolescent mental health.

DISCUSSION AND CONCLUSIONS

The purpose of this study was to examine the association between the number of siblings an adolescent has and the adolescent's reported depressive symptoms. The study builds upon the existing body of literature by examining the association under the light of two well-developed sociological theories. Siblings may act as important additional sources of social capital, particularly if they serve as sources of social support that an adolescent may not have had access to otherwise. On the other hand, research on the association between sibship size and educational outcomes has long documented the inverse relationship between number of siblings and academic outcomes, driven by a dilution of parental resources across children (Downey 1995; Gibbs et al. 2016). Parental resources important for adolescent mental health, such as time available to provide social support, may also be diluted as the number of children in a family increase. Evidence from the results of the analyses presented here suggest that siblings do not provide social capital in a form that protects against negative mental health. Further, the results indicate that siblings dilute parental resources in a way that negatively impacts the mental health of adolescents.

Results from regression models that include both family and individual level controls tend to support a resource dilution perspective of the association between number of siblings and adolescent depression as measured by scores on the CES-D depression scale. Consistent with results from studies examining the association between number of siblings and educational

outcomes, estimated models indicate an incremental increase in adolescent depression scores associated with each additional sibling. Previous studies have held that the presence of additional siblings in the home dilutes financial and interpersonal resources that are important for educational outcomes (Downey 1995). While this perspective has been applied almost exclusively to educational outcomes, the results presented here indicate that the presence of additional siblings in the home may also dilute parental resources in ways that are important for the mental health of children, particularly during adolescence. While the results of this study do tend to suggest that additional siblings are associated with higher levels of depression in adolescents, it is important to note that the results from the second and third sets of models indicate that the association between number of siblings and adolescent depressive symptomology is not linear.

The results from Model 6 begin to establish that the relationship between number of siblings and adolescent depressive symptomology cannot be linear. Indeed, the results from Model 9 indicate that a threshold effect exists for the number of siblings an individual must have before mental health is negatively impacted. Largely consistent with the results of studies of sibling effects on other outcomes (Downey and Condrón 2004), sibling effects are only observed for individuals with the greatest number of siblings. The effects of having two or fewer siblings are statistically indistinguishable from having no siblings. While the overall nature of the relationship is clear, the precise cause of this non-linear relationship is less so.

The nuanced relationship between number of siblings and adolescent mental health may be the result of several mechanisms. It may be that siblings do act as a source of social capital and promote positive mental health while simultaneously diluting parental resources and, consequently, negatively impact the mental health of siblings. Models 4 and 7 provide evidence

of this. However, the relationships observed in these models do not hold in the presence of control variables and, as seen in Table 2, may be the product of a higher proportion of children with no siblings coming from a single parent home. Alternatively, adolescents may only need a certain amount of parental resources that are important for adolescent mental health, such as time and support, to experience the beneficial effects of those resources. Thus, coming from a home with fewer siblings, which tend to have more resources to begin with, may mean that those resources are not diluted past the point of providing advantageous effects for the mental health of adolescents. Unfortunately, Add Health did not collect information about parental time use, was not designed to measure adolescent perception of parental social support, and did not ask respondents about the quality of the relationship with their siblings. Thus, while it is beyond the scope of this study, it will be important for future research to build upon the results presented here by directly testing potential causal pathways—dilution of parental time and social support, siblings providing additional social support—that explain both the overall association and why the association is not observed among individuals with fewer siblings.

Further, given that the evidence presented here is suggestive that a resource dilution perspective explains the association between number of siblings and adolescent mental health, it is important to consider the implications of the conditional resource dilution model (Gibbs et al. 2016) for adolescent mental health. The conditional resource dilution model posits that the association between parental resource dilution across siblings is moderated by the degree to which the burden of parenting is shared with the community or State. Thus, if certain parental resources—such as available time—are important for adolescent mental health and are diluted across siblings, we may anticipate observing different trends across times or populations when those parental resources were either less important or were being supplemented by resources at

the community or State level. For example, Gibbs and colleagues (2016) found that the association between number of siblings and educational outcomes was different for individuals who identified as Mormon, an association they propose is due to the high sense of community in Mormon congregations and the consequently larger number of adults who invest in the children and youth of congregants; a similar association may hold for the association between number of siblings and adolescent depressive symptomology. Similarly, these parental resources may be less important at times or in populations where these resources are more abundant and readily available. Accordingly, future research should be aimed at exploring these associations across both time and populations.

The implications of these results are far-reaching. As the mental health crisis continues in the United States, interventions aimed at improving the mental health of adolescents should be aware that children in larger families exhibit higher levels of depressive symptomology on average. The results I present here indicate that parental resources are of particular importance for the mental health of adolescents. Indeed, the introduction of the set of parental resource indicators in each set of models significantly altered the observed bivariate relationships. Knowing that these resources are especially important, and that these resources are diluted to a point that negatively impacts youth in large families, interventions should be aimed at creating networks for these youth from which the social support that they may not be able to receive at home can be derived. These may take the form of programs that promote the participation of youth from larger families in extracurricular activities where they may be able to build relationships with peers and adults outside the home. Additionally, parents of large families need to be aware of this relationship so that they can take extra care to seek to create and provide additional sources of the interpersonal resources being diluted across their children. Furthermore,

given the mounting evidence that sibling relationships provide positive effects across the life-course (Bobbitt-Zeher and Downey 2013; Merry et al. 2020) and because the results of bivariate models indicate that siblings may provide some protective effects for adolescent mental health, it will be important for social capital scholars to further theorize and explore the possibility that siblings act as sources of social capital in a manner that is distinct from the social capital that is derived from the parent-child bond.

My analysis is not without limitations. I acknowledge that the Add Health data are becoming somewhat aged and that this calls into question the generalizability of the findings I present to the youth of today. I note that the mental health crisis that has inspired renewed interest in adolescent mental health has only worsened since the time that the data was collected. Furthermore, the increased prevalence and capability for use of technology among youth has made it easier for siblings to transmit social capital to one another while also introducing additional risk factors for their mental health, such as cyber-bullying and problematic use of mobile phones. One implication of these trends is that it may indicate that the findings presented here are more salient today than they were at the time this data was collected; however, because the Add Health remains the most contemporary nationally representative dataset with high quality measures of adolescent mental health of which I am aware, I am not able to test these possibilities adequately. Additionally, because of the nature of the measure of adolescent depressive symptomology I employ—asked of youth regarding their feelings in the past seven days—the results of my analysis are sensitive to recency bias, in that youth who more recently experienced a traumatic event, were stressed at school, or who were simply having a bad day are more likely to have reported higher levels of depressive symptoms. However, given the extended

period of time between waves of data collection in the Add Health, a more robust measure of adolescent depressive symptomology is not possible.

Despite these limitations, the present study offers several significant contributions to the adolescent mental health and sibling literatures. The first of these contributions is the application of sociological theory to a literature that has largely been guided by a psychological perspective. The application of theories from different disciplines to the same problem opens doors for the consideration of previously unexplored causal pathways resulting in a more complete understanding of the phenomena. This is particularly important for issues such as adolescent mental health which pose a serious public health crisis. The results of this study indicate new potential pathways linking siblings and adolescent mental health. A second major contribution of this study is that it is the first study that explores this association in a large-scale, nationally representative sample of American youth. This is important as it echoes the results of studies that utilize representative samples in other countries (Drukker et al., 2003; Green et al., 2005). In light of this mounting evidence from representative samples in multiple countries, we can conclude that the presence of many additional siblings is a detriment to the mental health of adolescents. Finally, this study indicates the importance of considering potential non-linear associations and threshold effects for the study of sibling effects. Had I operationalized siblings in only a continuous fashion, as most other studies considering the association between number of siblings and adolescent mental health have done, I would have concluded that a linear relationship between number of siblings and adolescent depressive symptomology exists. Instead, I find evidence of a threshold effect. Knowing that the relationship between the number of siblings an adolescent has and their mental health follows this non-linear relationship will be important for those who interact with adolescents who are at risk of or who exhibit high levels of

depressive symptomology, particularly the parents of these youth. Parents should take special care to ensure that youth with a large number of siblings are able to receive the time, attention, and support that they need in order to remain mentally healthy. While parents may be able to provide a sufficient supply of these resources to a small number of children on their own, the evidence indicates that parents should seek other sources of these important resources for their children as their time and attention becomes increasingly diluted by additional children.

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Table 1. Weighted Descriptive Statistics of Analytic Sample; $n = 6,454$

	Mean/Proportion	SD	Range
<i>Dependent</i>			
CES-D depression score	11.97	8.05	0 - 60
<i>Key Independent</i>			
Number of siblings	1.38	1.17	0 - 10
Any siblings	0.77		0 - 1
Sibship size			0 - 4
Only child	0.23		
1 sibling	0.38		
2 siblings	0.24		
3 siblings	0.09		
4 or more siblings	0.05		
<i>Controls</i>			
Household income – Square root	6.23	2.61	0 – 31.61
Family structure			0 - 3
Two parents - Both biological	0.54		
Two parents - One biological	0.11		
One parent - Biological	0.28		
Other	0.07		
Parental education			0 - 3
Less than high school	0.11		
High school degree	0.28		
Some college	0.30		
Bachelor's or more	0.31		
Age	15.48	1.80	12 - 19
Sex (1 = Female)	0.49		0 - 1
Race			0 - 4
White	0.62		
Black	0.14		
Hispanic	0.14		
Asian/Pacific Islander	0.06		
Other	0.05		
Global health (1 = Very good or better)	0.68		0 - 1
Attend religious service weekly (1 = Yes)	0.43		0 - 1

Table 2. Means Comparison Tests for Model Variables Across Sibship Sizes

	Only Child		One Sibling		Two Siblings		Three Siblings		Four or More	
	Mean/Prop.	SD	Mean/Prop.	SD	Mean/Prop.	SD	Mean/Prop.	SD	Mean/Prop.	SD
<i>Dependent</i>										
CES-D Depression Score	12.42	8.40	11.28 ^a	7.79	11.95 ^f	8.17	12.73 ^d	7.81	13.82 ^{c,d,h}	7.65
<i>Controls</i>										
Household Income – square root	6.13	2.74	6.49 ^a	2.49	6.27 ^f	2.54	5.71 ^{c,d,h}	2.64	5.55 ^{c,d,h}	2.87
Family Structure										
Two parents - Both biological	0.34		0.61 ^a		0.61 ^a		0.55 ^{a,f,i}		0.55 ^a	
Two parents - One biological	0.09		0.09		0.12 ^{c,e}		0.18 ^{a,d,h}		0.17 ^{a,d,i}	
One parent - Biological	0.35		0.27 ^a		0.24 ^{a,f}		0.25 ^a		0.25 ^b	
Other	0.22		0.03 ^a		0.03 ^a		0.02 ^a		0.03 ^a	
Parental Education										
Less than HS	0.11		0.08 ^b		0.12 ^e		0.15 ^d		0.26 ^{a,d,g,k}	
HS degree	0.29		0.26		0.29		0.28		0.25	
Some college	0.32		0.30		0.28 ^c		0.31		0.27	
Bachelor's or more	0.28		0.36 ^a		0.31 ^f		0.26 ^{d,i}		0.22 ^{d,i}	
Age	15.90	1.78	15.35 ^a	1.79	15.35 ^a	1.79	15.32 ^a	1.73	15.39 ^a	1.72
Sex (1 = Female)	0.51		0.50		0.51		0.53		0.51	
Race										
White	0.62		0.68 ^b		0.61 ^d		0.50 ^{a,d,g}		0.38 ^{a,d,g,k}	
Black	0.15		0.12 ^b		0.14		0.16 ^c		0.19 ^{e,i}	
Hispanic	0.12		0.10		0.16 ^{c,d}		0.23 ^{a,d,i}		0.29 ^{a,d,g}	
Asian/Pacific Islander	0.06		0.05		0.06		0.05		0.08	
Other	0.05		0.05		0.03 ^f		0.07 ^h		0.06	
Global Health (1 = Good or better)	0.36		0.30 ^b		0.31 ^c		0.36 ^f		0.34	
Attend Religious Service Weekly (1 = Yes)	0.66		0.58 ^a		0.52 ^{a,e}		0.50 ^{a,e}		0.46 ^{a,e}	

Notes: Difference from Only Child - ^a $p < 0.001$; ^b $p < 0.01$; ^c $p < 0.05$; Difference from One Sibling - ^d $p < 0.001$; ^e $p < 0.01$; ^f $p < 0.05$;
Difference from Two Siblings - ^g $p < 0.001$; ^h $p < 0.01$; ⁱ $p < 0.05$; Difference from Three Siblings - ^j $p < 0.001$; ^k $p < 0.01$; ^l $p < 0.05$

Table 3. Log-Linear Regression of CES-D Depression Score on Number of Siblings

	Model 1	Model 2	Model 3
Number of siblings	1.026 ** (0.008)	1.031 *** (0.008)	1.032 *** (0.007)
Household income (Square rooted)		0.988 * (0.005)	0.989 * (0.005)
Parental education (ref. = High school degree)			
Less than high school		1.101** (0.039)	1.063 (0.038)
Some college		0.934 ** (0.024)	0.952 (0.024)
Bachelor's degree or more		0.876 *** (0.025)	0.926 ** (0.026)
Family structure (ref. = Two parents - Both biological)			
Two parents - One biological		1.105 ** (0.035)	1.094 ** (0.033)
One parent - Biological		1.158 *** (0.028)	1.121 *** (0.026)
Other		1.320 *** (0.046)	1.204 *** (0.042)
Age			1.038 *** (0.005)
Race			
Black			1.072 * (0.029)
Hispanic			1.109 *** (0.031)
Asian/Pacific Islander			1.171 *** (0.045)
Other			1.050 (0.050)
Female			1.162 *** (0.022)
Global health			0.771 *** (0.015)
Religiosity			0.926 *** (0.019)
Constant	11.546 *** (0.177)	11.994 *** (0.472)	7.278 *** (0.674)

Notes: Robust standard errors in parentheses

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Table 4. Log-Linear Regression of CES-D Depression Score on Presence of Siblings

	Model 4	Model 5	Model 6
Any siblings	0.953 *	1.020	1.038
	(0.021)	(0.024)	(0.024)
Household income (Square rooted)		0.987 **	0.988 *
		(0.005)	(0.005)
Parental education (ref. = High school degree)			
Less than high school		1.113 **	1.074 *
		(0.039)	(0.039)
Some college		0.934 **	0.952
		(0.024)	(0.025)
Bachelor's degree or more		0.875 ***	0.924 **
		(0.025)	(0.026)
Family structure (ref. = Two parents - Both biological)			
Two parents - One biological		1.113 **	1.102 **
		(0.035)	(0.034)
One parent - Biological		1.149 ***	1.113 ***
		-0.027	(0.026)
Other		1.292 ***	1.188 ***
		(0.046)	(0.043)
Age			1.037 ***
			(0.005)
Race			
Black			1.079 **
			(0.029)
Hispanic			1.121 ***
			(0.031)
Asian/Pacific Islander			1.179 ***
			(0.045)
Other			1.052
			(0.051)
Female			1.162 ***
			(0.022)
Global health			0.770 ***
			(0.015)
Religiosity			0.930 **
			(0.019)
Constant	12.417 ***	12.454 ***	7.471 ***
	(0.238)	(0.525)	(0.711)

Notes: Robust standard errors in parentheses

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$

Table 5. Log-Linear Regression of CES-D Depression Score on Specific Sibship Sizes

	Model 7	Model 8	Model 9
Sibship size			
1 sibling	0.908 *** (0.023)	0.985 (0.025)	1.005 (0.026)
2 siblings	0.963 (0.027)	1.030 (0.030)	1.051 (0.030)
3 siblings	1.025 (0.035)	1.072 (0.038)	1.090 * (0.037)
4+ siblings	1.113 ** (0.044)	1.141 ** (0.046)	1.145 ** (0.045)
Household income (Square rooted)		0.988 * (0.005)	0.989 * (0.005)
Parental education (ref. = High school degree)			
Less than high school		1.100 ** (0.039)	1.064 (0.038)
Some college		0.933 ** (0.024)	0.951 (0.024)
Bachelor's degree or more		0.877 *** (0.025)	0.926 ** (0.027)
Family structure (ref. = Two parents - Both biological)			
Two parents - One biological		1.099 ** (0.035)	1.090 ** (0.034)
One parent - Biological		1.154 *** (0.028)	1.118 *** (0.026)
Other		1.298 *** (0.047)	1.194 *** (0.043)
Age			1.037 *** (0.005)
Race			
Black			1.072 ** (0.029)
Hispanic			1.106 *** (0.031)
Asian/Pacific Islander			1.170 *** (0.045)
Other			1.050 (0.050)
Female			1.163 *** (0.022)
Global health			0.770 *** (0.015)
Religiosity			0.926 *** (0.019)
Constant	12.417 *** (0.238)	12.346 *** (0.517)	7.463 *** (0.709)

Notes: Robust standard errors in parentheses

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$