Dynamic Associations of Parent-Adolescent Closeness and Friend Support With Adolescent Depressive Symptoms Across Ages 12-19

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Abstract

Supportive relationships with parents and friends reduce adolescent risk for depression; however, whether and how the strength of these associations changes across adolescence remains less clear. Age-varying associations of mother- and father-adolescent closeness, and friend support with depressive symptoms were examined across ages 12.5 to 19.5 using data from the National Longitudinal Study of Adolescent to Adult Health (*N* = 4819). Positive relationships with mothers, fathers, and friends were associated with lower depressive symptoms across adolescence and the associations were generally stable across age. The association between father-adolescent closeness and depressive symptoms was stronger for girls than for boys during mid-adolescence. Mother-adolescent closeness was more strongly negatively associated with depressive symptoms in the context of higher friend support during mid-adolescence.

Keywords

Adolescent depression; parent-adolescent relationship; time-varying effect modeling

Adolescent depression is a common mental health problem and has been on the rise in recent years (Substance Abuse and Mental Health Services Administration, 2019; Twenge, Joiner, Rogers, & Martin, 2018). In 2018, 14.4% of adolescents aged 12 to 17 experienced a major depressive episode in the past year and 10% had it with severe impairment (Substance Abuse and Mental Health Services Administration, 2019). These rates were highest in the adolescent group than any other adult age group. Depression in adolescence is associated with social and educational impairments, an increased risk for suicide, and adult mental

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health problems (Johnson, Dupuis, Piche, Clayborne, & Colman, 2018; Lewinsohn, Rohde, & Seeley, 1998; Nock et al., 2013). Although it is certainly important to understand adolescents who meet the diagnostic criteria for major depression, the presentation of depression is likely to follow a continuum of symptom severity ranging from low to severe (Hankin, Fraley, Lahey, & Waldman, 2005). Past studies have shown that individuals with subthreshold depression show similar functional impairment and mental health prognosis as those with clinical depression (Fergusson, Horwood, Ridder, & Beautrais, 2005; Judd, Paulus, Wells, & Rapaport, 1996; Sheeber, Davis, Leve, Hops, & Tildesley, 2007), underscoring the importance of studying depressive symptoms. In addition, adolescent depressive symptoms are consistently associated with other adjustment problems, including education impairment, substance use, suicidal ideation, and higher risk for adult depression (Glied & Pine, 2002; Pine, Cohen, Cohen, & Brook, 1999).

Developmentally, the prevalence of major depressive disorder is low in childhood and increases significantly in adolescence, especially for girls (Lewinsohn, Clarke, Seeley, & Rohde, 1994; Lewinsohn et al., 1998). The life-time prevalence of major depressive disorder in childhood is about 1.5% to 2.5% and it increases dramatically to 15% to 20% by the end of adolescence, making it one of the most common disorders in adolescence (Graber & Sontag, 2009; Merikangas et al., 2010). Across middle childhood to middle adolescence (ages 8 to 16), boys and girls have quite different age trends in depressive symptoms. For boys, mean level of depressive symptoms is relatively stable across age whereas for girls, mean level of depressive symptoms increases significantly from age 11 to age 16 (Kim, McHale, Crouter, & Osgood, 2007; Rawana & Morgan, 2014; Twenge & Nolen-Hoeksema, 2002). Gender differences in depressive symptoms emerge around age 13 with girls reporting more depressive symptoms than boys and gender differences in depression are maintained in adolescence through adulthood (Graber & Sontag, 2009; Merikangas et al., 2010; Schuler, Vasilenko, & Lanza, 2015; Thapar, Collishaw, Pine, & Thapar, 2012; Twenge & Nolen-Hoeksema, 2002). For both boys and girls, depressive symptoms seem to decrease somewhat toward young adulthood (Finan, Ohannessian, & Gordon, 2018; Ge, Natsuaki, & Conger, 2006; Vannucci, Flannery, & Ohannessian, 2018). Thus, depression bears great significance in adolescence, especially for girls.

The Developmental Significance of Parents and Friends for Adolescent Depression

Two of the most important interpersonal relationships in adolescence are those with parents and friends (Smetana, Campione-Barr, & Metzger, 2006). Adolescents with strong bonds and supportive relationships with parents and friends are less likely to suffer from depression (Laible, Carlo, & Raffaelli, 2000; Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). Existing theories are consistent with this observation. Baumeister and Leary (1995) postulated that humans have an innate need to belong and having supportive relationships and positive interactions with significant others, including parents and friends, are paramount to one's well-being. Individuals who are deprived of this need are more likely to suffer from psychological problems such as depression. Similarly, attachment theory postulates that individuals who have close and enduring bonds with caregivers tend to develop mental

representations about themselves as deserving of love and others as trustworthy (Bowlby, 1969, 1973). In adolescence, some friendships fulfill important attachment needs by being available in time of distress and provide a sense of security for adolescents (Gorrese, 2016). Individuals with secure attachment with parents and friends tend to have lower levels of depressive symptoms (Brumariu & Kerns, 2010; Gorrese, 2016; Rice, Cunningham, & Young, 1997). Likewise, interpersonal theories of depression and suicide (e.g., Hames, Hagan, & Joiner, 2013; Joiner, 2005) point to the central role of undermined feelings of belonging and support in depression and underscore the importance of having close, supportive relationships in reducing depression risk (Chang, Batra, Premkumar, Chang, & Hirsch, 2020; Davidson, Wingate, Grant, Judah, & Mills, 2011). The unmet need of belonging has also been found to mediate the relationship between parental attachment and adolescent depression (Venta, Mellick, Schatte, & Sharp, 2014). These theories converge to suggest that adolescents with close and supportive relationships with parents and friends tend to have a lower risk of developing depression.

Feelings of closeness and perceived support are two important indicators of the quality of close relationships. Closeness generally refers to one's perception of intimacy in a relationship or satisfaction of the relationship. Support may encompass a wide range of assistance, including emotional support, instrumental support, informational support, and companionship (Abramowitz et al., 2009). Despite the common belief that adolescents place greater emphasis on peer relationships, research suggests that the quality of parent-adolescent relationships remains important in adolescence (Hair, Moore, Garrett, Ling, & Cleveland, 2008; Levitt, Guacci-Franco, & Levitt, 1993). Specifically, having a close and supportive relationship with one's parents is associated with less depressive symptoms in adolescence (Ackard, Neumark-Sztainer, Story, & Perry, 2006; Branje, Hale, Frijns, & Meeus, 2010; Hair et al., 2008; Meadows, Brown, & Elder, 2006). Developmentally, changes related to maturation during adolescence are likely to evoke changes in parent-child relationship (Laursen & Collins, 2009). Specifically, as adolescents undergo physical changes, increases in autonomy striving, and advancement in abstract thinking and reasoning, they seek more egalitarian relationships with their parents, which may upset the established way of parent-adolescent interactions and may result in increased conflicts and diminished closeness in early adolescence. Parent-adolescent relationships often improve after parents and adolescents have successfully redefined their roles in the family, usually in late adolescence or early adulthood (Laursen & Collins, 2009).

Similar to parent-adolescent relationships, supportive friendships are also crucial for healthy social and emotional adjustment in adolescence (Erdley & Day, 2017; Hussong, 2000; La Greca & Harrison, 2005; Waldrip, Malcolm, & Jensen-Campbell, 2008), given friendships are highly salient in this period of development (Bagwell & Schmidt, 2011). Having supportive and close relationships with friends promotes feelings of acceptance and security, which is crucial for building self-esteem, and in turn, contributing to lower levels of depression (Gorrese & Ruggieri, 2013; Wilkinson, 2004). Across adolescence, individuals report increase in mean level of friend support (Helsen, Vollebergh, & Meeus, 2000). Although there are developmental changes in the mean levels of parent-adolescent closeness and friend support across adolescence, it is less clear whether and how the strength of

association between these interpersonal factors and depressive symptoms varies across adolescence.

Changes in Strength of Associations Across Adolescence

There are significant interpersonal transformations in adolescence, including decreases in time spent and disclosure with parents as adolescents spend more time and are more disclosing with their peers (Buhrmester & Furman, 1987). This is consistent with Sullivan's (1953) perspective on intimacy, which suggests that the need for intimacy surfaces in preadolescence and intimacy is increasingly evidenced in friendships in adolescence. Nevertheless, family relationships remain the most important source of social support in adolescence (Levitt et al., 1993). In addition, individuals become increasingly involved in romantic relationships over the course of adolescence (Carver, Joyner, & Udry, 2003; Montgomery, 2005). Therefore, it remains unclear if the magnitude of benefits of having close relationships with parents and friends remains constant across adolescence.

Corresponding to interpersonal transformations, some work evaluates whether there are changes in the *degree* to which particular relationships are associated with depression risk over the course of development. Regarding parent-child relationships, empirical evidence suggests that both family support and parent-adolescent closeness have a relatively consistent association with lower depressive symptoms for children, younger adolescents, and older adolescents (Branje et al., 2010; Rueger et al., 2016). Regarding the strength of association between peer support and adolescent depressive symptoms across adolescence, meta-analytic findings revealed that the effect size was small to moderate and that support from general peers (e.g., classmates) is more strongly associated with depressive symptoms in younger adolescents than in older adolescents, but the magnitude of the association between depressive symptoms and support from close friends does not differ between younger and older adolescents (Rueger et al., 2016). Nevertheless, these studies have relied on analyses comparing two or three age periods (e.g., younger vs. older adolescents). While this provides important information regarding developmental associations, this is limited because when age is "cut" into a small number of categories rather than being modeled continuously, more nuanced age-varying associations (e.g., curvilinear trends) may go undetected. This approach also makes comparisons across studies difficult, especially when different age categories are used. In addition, existing evidence examining how the magnitude of associations between these interpersonal factors and adolescent depression varies across adolescence generally examines parents and friends separately, however, examining them simultaneously would provide information about the unique interpersonal transformations and their potential age-varying relations to adolescent depressive symptoms. Furthermore, examining parents and friends in the same analysis allows for the examination of interaction effects. As adolescents expand their social world beyond the family to include peers, these interpersonal influences may not function independently. Some evidence suggests that adolescents' relationships with parents and friends interact with each other to affect adolescent adjustment (Helsen et al., 2000; Mak, Russell, Lanza, Feinberg, & Fosco, 2020; Schwartz, Dodge, Pettit, & Bates, 2000; Sentse & Laird, 2010; Sentse, Lindenberg, Omvlee, Ormel, & Veenstra, 2010; Young, Berenson, Cohen, & Garcia, 2005), although the patterns of interaction are not entirely consistent (Zhang, Baams, van de Bongardt, & Dubas,

2018). Moreover, little is known about whether the degree of interdependence between these two relationships varies by age.

Gender Differences in Interpersonal Closeness and Support

Adolescent gender is an important consideration in depression research and it enhances our understanding of the etiology of depression (Hammen, 2018). Gender differences in the *mean level* of perceived support have been documented in some studies. Specifically, some studies suggest that adolescent girls and boys report similar levels of closeness with parents, but girls tend to report higher level of closeness with friends (Ma & Huebner, 2008; Raja, McGee, & Stanton, 1992; Rueger, Malecki, & Demaray, 2010). However, evidence regarding whether interpersonal closeness functions differentially for boys and girls (i.e., gender differences in the *strength of associations* of closeness and support with depressive symptoms) is somewhat mixed. Consistent with the perspective that adolescent girls have a heightened affiliative need and therefore may be particularly influenced by social relationships (Cyranowski, Frank, Young, & Shear, 2000), some evidence suggests that social support is more strongly associated with well-being in adolescent girls than in boys (Chu, Saucier, & Hafner, 2010). Other evidence, however, suggests that gender differences in the association of family and friend support with depressive symptoms are minimal (Rueger et al., 2016). Limited research has examined whether gender differences in these associations vary over the course of adolescence. Therefore, we have limited understanding of the potential dynamic nature of gender moderation in the association between interpersonal closeness and depressive symptoms across adolescence. It is possible that gender differences in the associations may be present only at certain ages but not for the entire adolescence and may be more pronounced at certain ages. Understanding potential gender differences in susceptibility in interpersonal relationships may shed light on factors that contribute to gender differences in depressive symptoms as well as the timing in which it emerges.

Research examining how parental relationships influence adolescents' adjustment may differ by parental gender offers inconsistent results. Some evidence suggests that there are different implications for adolescents' relationships with mothers and fathers in relation to their mental and behavioral health (Branje et al., 2010; Finan et al., 2018; Mak, Fosco, & Feinberg, 2017; Ohannessian, 2012). Other work suggests that mother- and father-adolescent relations exert comparable impacts on adolescents' internalizing symptoms (Brumariu & Kerns, 2010). Despite inconsistencies across studies, this literature underscores the importance of examining mother-adolescent and father-adolescent relationships separately in relation to adolescent depressive symptoms.

The Present Study

Past research underscores the importance of supportive parent-adolescent relationships and friendships against adolescent depression and existing research suggests potential age-varying associations between interpersonal closeness or support and depression across adolescence. The present study advances our current understanding by examining associations of parent-adolescent closeness and friend support with adolescent depressive

symptoms across continuous age, which allows for more nuanced changes in the strength of associations to be detected. In doing so, this study has the potential to identify ages at which specific interpersonal relationships may be particularly correlated with depressive symptoms and guide the optimal timing of prevention and intervention efforts. Moreover, this study examines the associations of parent-adolescent closeness and friend support simultaneously with depressive symptoms across adolescence, which provides information about the unique association between each factor and depressive symptoms across adolescence as well as the examination of parent and friend interaction. In this study, we evaluate the role of adolescent closeness with mothers and fathers separately to provide specificity in the implications of these relationships for adolescent depression. Further, we considered whether the strength of these age-varying associations may differ as a function of adolescent gender. This may help clarify some of the inconsistent findings in the current literature regarding gender moderation as well as may illuminate our understanding of how gender differences in the strength of associations may contribute to the gender differences in the mean level of adolescent depressive symptoms we commonly observe.

The present study uses an innovative method, time-varying effect modeling (TVEM), to examine age-varying associations of parent-adolescent closeness and friend support with adolescent depressive symptoms. TVEM can estimate flexibly the means of predictors and outcome as well as the strength of associations between predictors and outcome across continuous age (Lanza, Vasilenko, & Russell, 2016; Tan, Shiyko, Li, Li, & Dierker, 2012). Therefore, it is possible to examine how the strength of associations of mother-adolescent or father-adolescent closeness and friend support with depressive symptoms varies naturally across age, including identifying possible nonlinear associations. TVEM helps to identify ages at which specific interpersonal factors are particularly important against depressive symptoms. In addition, it allows for the examination of dynamic moderation by gender across adolescence. This is important because gender differences in the magnitude of association may be stronger or only present at certain ages; TVEM allows for such an examination.

The present study aims to address the following research questions:

1) How are parent-adolescent closeness (separately for mothers and fathers) and friend support associated with adolescent depressive symptoms across ages 12.5 to 19.5?

2) How does the age-varying association between parent-adolescent closeness (separately for mothers and fathers) and adolescent depressive symptoms differ as a function of friend support?

3) How do the age-varying associations of parent-adolescent closeness (separately for mothers and fathers) and friend support with adolescent depressive symptoms differ by adolescent gender?

As the existing literature suggests that close parent-adolescent relationships and supportive friendships are consistently associated with lower adolescent depressive symptoms, it is expected that mother-adolescent closeness, father-adolescent closeness, and friend support to be significantly negatively associated with depressive symptoms across adolescence. Also, it

is expected that the association between parent-adolescent closeness and depressive symptoms would be relatively stable across age based on past research (Branje et al., 2010; Rueger et al., 2016). However, the extant literature offers limited guidance about age-specific hypotheses regarding the strength of association between friend support and depressive symptoms as existing evidence is based on the associations of general peers and close friends with depression, but not friends in general (Rueger et al., 2016). Nevertheless, it is expected that the association between friend support and depression would be slightly more strongly associated in early than in late adolescence. As previous literature provides inconsistent findings regarding the interaction between parental relationships and friendships in predicting adolescent adjustment, this interaction also will be explored. Finally, the associations of parent-adolescent closeness and friend support with depressive symptoms are expected to be stronger for adolescent girls than for boys.

Methods

Participants

Data are from Waves 1 and 2 of the public-use sample of the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris et al., 2009), which is a nationally representative sample. Adolescents from Grade 7 through Grade 12 were interviewed at Wave 1 (1994–1995) and they were interviewed again at Wave 2 approximately one year later (1995–1996; 12th graders at Wave 1 were not interviewed at Wave 2). Given the primary interest of this study on adolescence, data from subsequent waves when participants were young adults were not examined. About 74% of Wave 1 sample (N = 4834) participated at Wave 2 (13.8% did not participate at Wave 2 because they were 12th graders at Wave 1). Further, the sample was restricted to include observations provided within the age range of 12.5 to 19.5 to improve estimation precision; very few participants provided data outside this age range. Age was rounded to the nearest one decimal place. The final sample consists of 4819 participants (males = 47.8%) providing 9545 observations. Adolescents reported their race as: White (58.6%), Black (23.2%), Hispanic (11.7%), Asian (3.7%), Native American (2.1%), and Other (0.8%). Of all participants at Wave 1, 68.2% were from two-parent households and 28.4% of the participating parents had a college degree, and the median household income was $40,000.

Measures

Depressive symptoms.—The Center for Epidemiologic Studies Depression Scale (CES-D) is a 20-item measure of depressive symptoms in the general population (Radloff, 1977). It has been shown to be reliable in measuring depressive symptoms in the adolescent and young adult populations (Radloff, 1991). Adolescents in the Add Health study responded to an 18-item "modified" version of the CES-D. The items "my sleep was restless" and "I had crying spells" in the original CES-D questionnaire were omitted from the CES-D measure used in Add Health. Also, the original item "I felt that everything I did was an effort" was modified to "You felt that you were too tired to do things" and the original item "I could not get going" was modified to "It was hard to get started doing things". Adolescents responded on a 4-point scale ranging from 0 – *never or rarely* to 3 – *most of the time or all of the time*. Scores from the 18 items were summed so that a higher score reflects higher symptomology.

The mean depressive symptoms across all observations was 10.7 (SD = 7.3, range = 0 to 53). The Cronbach Alpha was .86 at Wave 1 and .87 at Wave 2.

Parent-adolescent closeness.—Adolescents responded to four items assessing closeness with each of their residential parents. The four items measuring closeness with mothers are: "most of the time, your mother is warm and loving toward you", "you are satisfied with the way your mother and you communicate", "overall, you are satisfied with your relationship with your mother", and "how close do you feel to your mother". The four items assessing closeness with fathers were identical except for using the word "father" instead of "mother". Adolescents reported their closeness with parents using 5-point scales (ranging from 1 – *strongly agree* to 5 – *strongly disagree* for the first three items and from 1 – *not at all* to 5 – *very much* for the last item). Items were reverse coded if necessary and averaged for each parent so that a higher score reflects higher closeness. The scale had high reliability (Cronbach Alpha = .85 for mother-adolescent closeness at both Wave 1 and Wave 2 and .89 for father-adolescent closeness at both Wave 1 and Wave 2).

Friend support.—Friend support was assessed by one item "how much do you feel that your friends care about you?" Adolescents responded on a 5-point scale ranging from 1 – *not at all* to 5 – *very much*. Thus, a higher score indicates greater friend support.

Demographics.—Age at each wave was calculated using the difference between interview date and birth date and rounded to the nearest decimal place in years. Gender was coded 0 – *male* and 1 – *female*. Two-parent household structure at each wave was deduced from the skip pattern of the home interview questionnaire and coded 0 – *single-parent household* and 1 – *two-parent household*.

Statistical Analyses

Analyses were conducted using TVEM, which is a direct extension of multiple regression in which regression coefficients (intercept, slopes) can be flexibly estimated as nonparametric functions of continuous time (e.g., age). The dependency of repeated measures within persons as well as students' observations within schools was adjusted at the highest level of clustering (i.e., nested within schools) using robust sandwich standard error estimation. All TVEM models were conducted using the weighted TVEM SAS macro (Dziak, Li, & Wagner, 2017). Longitudinal Wave 2 weights were used in all analyses to account for sample design and attrition. All TVEM models were estimated using the B-spline method and the Bayesian Information Criterion (BIC) was used for selecting models with the optimal number of knots for each coefficient function. The number of knots determines the complexity of coefficient functions.

Age-varying mean levels of depressive symptoms and interpersonal factors. —In Step 1, intercept-only models were used to estimate the mean levels of depressive symptoms, mother-adolescent closeness, father-adolescent closeness, and friend support as a function of age across ages 12.5 to 19.5. A sample model equation (e.g., depressive symptoms; Dep) is:

$$Dep_{ij} = \beta_0(t_{ij}) + e_{ij}$$

where t is age, i indicates person ($i = 1, 2, \ldots, n$), and j indicates measurement occasion or wave ($j = 1$ or 2).

Gender differences in mean levels.—In Step 2, gender differences in mean levels of depressive symptoms, mother-adolescent closeness, father-adolescent closeness, and friend support across ages 12.5 to 19.5 were estimated. A sample model equation (e.g., depressive symptoms) is:

$$Dep_{ij} = \beta_0(t_{ij}) + \beta_1(t_{ij}) Gender_i + e_{ij}$$

Age-varying associations between interpersonal factors and depressive symptoms.—In Step 3, age-varying associations of mother-adolescent closeness and friend support with adolescent depressive symptoms were estimated across ages 12.5 to 19.5, controlling for gender as well as two-parent household. The same model was examined for father-adolescent closeness. A sample model equation (e.g., mother-adolescent closeness) is:

$$Dep_{ij} = \beta_0(t_{ij}) + \beta_1(t_{ij}) MA\,Closeness_{ij} + \beta_2(t_{ij})\,Friend\,Support_{ij} + \beta_3(t_{ij})Gender_i \\ + \beta_4\,Two\,Parent_{ij} + e_{ij}$$

Parent-adolescent closeness and friend support interaction.—In Step 4, age-varying association between mother-adolescent closeness with adolescent depressive symptoms across ages 12.5 to 19.5 as a function of friend support was estimated. The same model was again examined for father-adolescent closeness. A sample model equation (e.g., mother adolescent closeness) is:

$$Dep_{ij} = \beta_0(t_{ij}) + \beta_1(t_{ij}) MA\,Closeness_{ij} + \beta_2(t_{ij})\,Friend\,Support_{ij} \\ + \beta_3(t_{ij})(MA\,Closeness \times Friend\,Support)_{ij} + \beta_4(t_{ij})Gender_i \\ + \beta_5\,Two\,Parent_{ij} + e_{ij}$$

Gender differences in age-varying associations.—In Step 5, gender differences in age-varying associations between mother-adolescent closeness and adolescent depressive symptoms across ages 12.5 to 19.5 were estimated, accounting for friend support and two-parent household. The same model was also examined for father-adolescent closeness. A sample model equation (e.g., mother-adolescent closeness) is:

$$Dep_{ij} = \beta_0(t_{ij}) + \beta_1(t_{ij}) MA\,Closeness_{ij} + \beta_2(t_{ij})\,Gender_i \\ + \beta_3(t_{ij})(MA\,Closeness \times Gender)_{ij} + \beta_4(t_{ij})\,Friend\,Support_{ij} \\ + \beta_5\,Two\,Parent_{ij} + e_{ij}$$

Similarly, gender differences of age-varying associations between friend support and adolescent depressive symptoms across ages 12.5 to 19.5 were estimated, accounting for

mother-adolescent closeness, father adolescent closeness, and two-parent household. The model equation is:

$$Dep_{ij} = \beta_0(t_{ij}) + \beta_1(t_{ij}) \, Friend \, Support_{ij} + \beta_2(t_{ij}) \, Gender_i$$
$$+ \beta_3(t_{ij})(Friend \, Support \times Gender)_{ij} + \beta_4(t_{ij}) \, MA \, Closeness_{ij}$$
$$+ \beta_5(t_{ij}) \, FA \, Closeness_{ij} + \beta_6 \, Two \, Parent_{ij} + e_{ij}$$

In Steps 3 to 5, all interpersonal predictors were standardized across all observations (i.e., raw scores were grand-mean centered and then divided by the standard deviation). Also, adolescent gender was included as a time-invariant covariate with a time-varying effect because of our central interest in age-varying gender moderation. In contrast, the indicator for two-parent household was included as a time-varying covariate but specified to have a simple time-invariant effect.

Results

Age-Varying Mean Levels of Depressive Symptoms and Interpersonal Factors

First, mean levels of depressive symptoms, mother-adolescent closeness, father-adolescent closeness, and friend support were estimated across age using TVEM intercept-only models. Depressive symptoms increased with age from an estimated mean score of 8.73 (95% CI [7.99, 9.48]) at age 13.1 to a score of 11.48 (95% CI [11.06, 11.91]) at age 16.4, remained relatively stable until age 18.1 and increased again through age 19.5 to a score of 12.62 (95% CI [11.09, 14.14]; Figure 1a). The mean level of mother-adolescent closeness showed a U-shape pattern with age such that it decreased from an estimated score of 4.73 (95% CI [4.65, 4.81]) at age 12.5 to a score of 4.21 (95% CI [4.18, 4.25]) at age 17.0 and then increased through age 19.5 to a score of 4.39 (95% CI [4.29, 4.49]; Figure 1b). The mean level of father-adolescent closeness was generally lower than mother-adolescent closeness and showed a similar U-shape pattern with age such that it decreased from an estimated score of 4.58 (95% CI [4.45, 4.71]) at age 12.5 to a score of 3.94 (95% CI [3.89, 3.99]) at age 17.4 and then increased through age 19.5 to a score of 4.14 (95% CI [3.98, 4.30]). In contrast, estimated mean friend support was generally stable across all ages and the score ranged between 4.18 (95% CI [4.07, 4.29]) at age 19.5 and 4.34 (95% CI [4.23, 4.46]) at age 12.5.

Gender Differences in Mean Levels

In Step 2, gender differences in depressive symptoms, parent-adolescent closeness, and friend support across ages 12.5 to 19.5 were examined. For both adolescent boys and girls, mean depressive symptoms scores were lowest in early adolescence and highest in late adolescence (Figure 2a). For adolescent boys, mean depressive symptoms were lowest at age 13.6 (estimated mean score: 8.25; 95% CI [7.65, 8.85]) and increased to a score of 10.25 (95% CI [9.83, 10.67]) at age 16.6. It remained stable until age 17.7 and increased again through age 19.5 to a score of 12.28 (95% CI [10.68, 13.87]). For adolescent girls, depressive symptoms increased from an estimated score of 8.81 (95% CI [7.08, 10.54]) at age 12.6 to a score of 12.73 (95% CI [12.14, 13.31]) at age 16.3 and remained relatively stable through age 19.5. Adolescent girls reported significantly higher depressive symptoms

than adolescent boys between ages 13.3 and 18.9 and there were no significant gender differences at the youngest and oldest ages.

Regarding mother-adolescent closeness, adolescent boys reported decreasing mean closeness starting at an estimated mean score of 4.66 points (95% CI [4.55, 4.78]) at age 12.5 decreasing to a score of 4.29 (95% CI [4.25, 4.33]) at age 17.7, where it remained relatively stable until age 19.5 (Figure 2b). In contrast, adolescent girls reported a steeper decrease in mother-adolescent closeness from an estimated mean score of 4.79 (95% CI [4.67, 4.92]) at age 12.5 to a score of 4.12 (95% CI [4.07, 4.18]) at age 16.6, then closeness increased through ages 19.5 to a score of 4.40 (95% CI [4.22, 4.58]). Adolescent boys reported significantly higher mean levels of closeness with mothers than adolescent girls between ages 13.6 and 18.2. For father-adolescent closeness, adolescent boys reported decreasing closeness, starting at an estimated mean score of 4.43 (95% CI [4.24, 4.62]) at age 12.5 to a score of 4.00 (95% CI [3.92, 4.08]) at age 17.9, where it remained relatively stable until age 19.5 (Figure 2c). Again, adolescent girls reported a steeper decrease in mean father-adolescent closeness, starting at an estimated mean score of 4.72 (95% CI [4.56, 4.88]) at age 12.5 to a score of 3.85 (95% CI [3.79, 3.91]) at age 17.0 and then an increase through ages 19.5 to a score of 4.14 (95% CI [3.93, 4.35]). Adolescent boys reported higher mean levels of closeness with fathers than adolescent girls between ages 13.8 and 17.9. No significant gender differences were observed at the youngest and oldest ages for closeness with either parent. Friend support was generally stable across all ages for both adolescent boys and girls; the estimated mean score at age 16.0 was 4.16 (95% CI [4.11, 4.20]) for adolescent boys and 4.40 (95% CI [4.35, 4.44]) for girls and these estimates were representative across age. Girls reported significantly higher average friend support than boys from ages 12.5 to 19.0 (Figure 2d).

Age-Varying Associations Between Interpersonal Factors and Depressive Symptoms

In Step 3, the age-varying associations of mother-adolescent closeness and friend support with depressive symptoms, accounting for gender and two-parent household, were examined. At ages when the 95% confidence intervals do not include the value of zero, the association between a predictor and an outcome is statistically significant at that specific age. Controlling for friend support, mother-adolescent closeness was significantly negatively associated with depressive symptoms from age 12.6 ($\hat{\beta} = -1.92$; 95% CI [−3.68, −0.15]) through age 19.5 ($\hat{\beta} = -2.09$; 95% CI [−3.49, −0.69]); this negative association was generally stable across age (Figure 3a). Controlling for mother-adolescent closeness, friend support was significantly negatively associated with depressive symptoms from age 12.8 ($\hat{\beta} = -1.15$; 95% CI [−2.25, −0.05]) through age 19.1 ($\hat{\beta} = -0.85$; 95% CI [−1.69, −0.01]) and the association was generally stable across all ages. Similarly, controlling for friend support, father-adolescent closeness was significantly negatively associated with depressive symptoms from age 12.9 ($\hat{\beta} = -1.21$; 95% CI [−2.36, −0.05]) to age 19.5 ($\hat{\beta} = -1.81$; 95% CI [−3.27, −0.35]); this negative association was generally stable across age (Figure 3b). Controlling for father-adolescent closeness, friend support was significantly negatively associated with depressive symptoms from age 13.0 ($\hat{\beta} = -1.05$; 95% CI [−2.03, −0.06]) to age 19.3 ($\hat{\beta} = -1.29$; 95% CI [−2.51, −0.07]) and the association was stable across all ages.

Parent-Adolescent Closeness and Friend Support Interaction

In Step 4, the age-varying association between mother-adolescent closeness and adolescent depressive symptoms, as a function of friend support, was examined. Specifically, the negative association between mother-adolescent closeness and depressive symptoms was significantly stronger for adolescents with higher versus lower friend support from ages 14.0 to 15.0 (Figure 4). The association between father-adolescent closeness and depressive symptoms also was examined; this association did not significantly differ as a function of friend support at any age.

Gender Differences in Age-Varying Associations

In Step 5, gender differences in the age-varying association between mother-adolescent closeness and depressive symptoms, controlling for friend support and two-parent household, were examined. Results indicated that the association between mother-adolescent closeness and depressive symptoms did not significantly differ by gender at any age. Similarly, gender differences in the age-varying association between father-adolescent closeness and depressive symptoms, controlling for friend support and two-parent household, were examined. For adolescent boys, father-adolescent closeness was negatively associated with depressive symptoms from age 12.5 ($\hat{\beta} = -2.40$; 95% CI [-4.16, -0.63]) to 19.4 ($\hat{\beta} = -1.62$; 95% CI [-3.23, -0.01]) and the association was relatively stable across age (Figure 5). For adolescent girls, the association was negative and was significant across age 13.4 through age 19.5. The strength of this negative association increased from age 13.4 ($\hat{\beta} = -1.24$; 95% CI [-2.34, -0.14]) to age 15.3 ($\hat{\beta} = -2.55$; 95% CI [-2.97, -2.13]), with relatively little fluctuation through age 19.5. This association was significantly stronger for adolescent girls than for boys from ages 14.6 to 16.7.

Finally, gender differences in the age-varying association between friend support and depressive symptoms, controlling for mother-adolescent closeness, father-adolescent closeness, and two-parent household, were examined. Results indicated that gender did not significantly moderate the age-varying association between friend support and depressive symptoms at any age.

Discussion

The present study extended prior research to examine how the *strength of associations* of parent-adolescent closeness and friend support with depressive symptoms varies across continuous age. There were at least five key findings. First, depressive symptoms increased somewhat curvilinearly across adolescence with girls reporting more depressive symptoms than boys across the majority of this developmental period. Second, levels of mother-adolescent and father-adolescent closeness decreased across early to mid-adolescence and slightly rebounded toward late adolescence. Interestingly, girls reported greater decreases in closeness with parents from early- to mid-adolescence than boys. Also, levels of friend support were generally consistent across adolescence; however, girls reported higher levels of friend support than boys for the majority of adolescence. Third, the magnitude of the associations of mother-adolescent closeness, father-adolescent closeness, and friend support with depressive symptoms were generally stable across adolescence. Fourth, a significant

interaction between mother-adolescent closeness and friend support in relation to adolescent depressive symptoms emerged between ages 14 to 15. Probes of this interaction revealed that the negative association between mother-adolescent closeness and depressive symptoms was stronger when friend support was higher. Finally, the negative association between father-adolescent closeness and depressive symptoms was stronger for adolescent girls than for boys at ages 14.6 to 16.7.

Mean Levels of Depressive Symptoms and Interpersonal Factors

Regarding the age trends in depressive symptoms, consistent with existing research, mean depressive symptoms increased with age across adolescence (Lewinsohn et al., 1998; Merikangas et al., 2010). However, the increase was curvilinear such that mean levels in depressive symptoms increased more rapidly between ages 13 and 16 and between ages 18 and 19.5 than at other ages, suggesting that these may be particularly relevant periods for depression risk. The increase in mean depressive symptoms beyond age 18 is somewhat inconsistent with existing findings that did not limit the sample to high school students (Schuler et al., 2015). A possible explanation was that adolescents older than 18 who were still in high schools (i.e., our sample) were more likely to have repeated one or more grades and they may experience more emotional distress than those who have not repeated grades (Resnick et al., 1997). Further examination of gender differences showed that the increase of depressive symptoms appeared to be steeper for adolescent girls than for adolescent boys between ages 13 and 16 and this difference in slopes contributed to the emergence of gender differences in depressive symptoms around age 13, the age at which gender differences in depressive symptoms generally emerge (Twenge & Nolen-Hoeksema, 2002). However, gender differences in depressive symptoms dissipated by the end of age 18 in the present study, which differed from existing findings showing that gender differences in depressive symptoms are maintained in late adolescence (Ge et al., 2006; Schuler et al., 2015). One possible explanation might be adolescents older than 18 who were still in high school may experience similar levels of distress regardless of gender.

The maturation models of adolescent development suggest that mean level of parent-adolescent closeness decreased from early to mid-adolescence and rebounded in late adolescence (Laursen & Collins, 2009), which seemed to be the case mostly for adolescent girls in the current study. For adolescent boys, the mean levels of closeness decreased steadily across adolescence with minimal rebound in late adolescence. In the present study, adolescent boys reported higher level of closeness with both mothers and fathers than adolescent girls across the majority of adolescence. One possible explanation is that adolescent girls generally have more intimate friendships than boys and intimacy with friends increases across adolescence (Hunter & Youniss, 1982), thus, they may set a higher standard for relationships to be considered close. It is possible then, that girls may have greater expectations for intimacy when evaluating their relationship with parents. In fact, early adolescent girls' conversations with friends were rated as similarly affectionate as that with their mothers, but middle adolescent girls' conversations with friends were rated as more affectionate and involved than that with their mothers (Beaumont, 1996). Nevertheless, our findings run contrary to prior studies, where adolescent girls and boys report similar levels of parent-adolescent closeness and support (Ma & Huebner, 2008; Raja et al., 1992;

Rueger et al., 2010). This inconsistency may in part be due to differences in measures. Our measure focused more on adolescents' subjective evaluation of the relationship and feelings of closeness to their parents, whereas prior work has used measures that focused on a combination of warmth behaviors and communication.

The mean level of friend support was generally stable across age in adolescence, which is different from existing evidence that adolescents tend to report increase in mean level of friend support across adolescence (Helsen et al., 2000). This inconsistency may be due to different measures of friend support used. The prior study focused on examining emotional support for social problems and our measure focused on general perceived support. It may be that adolescents increasingly rely on friends for emotional support for social problems (e.g., peer problems), but their perception of general support from friends may be similar across adolescence. Adolescent girls consistently reported higher mean level of friend support than adolescent boys across almost the entire adolescence. This is generally consistent with existing research although existing research has not examined gender differences through the entire period of adolescence (Ma & Huebner, 2008; Raja et al., 1992; Rueger et al., 2010).

Strength of Associations Between Interpersonal Factors and Depressive Symptoms

Consistent with theories placing attachment and needs for belonging as key predictors of mental health (Baumeister & Leary, 1995; Bowlby, 1969; Joiner, 2005), parent-adolescent closeness and friend support were consistent beneficial factors against adolescent depressive symptoms across adolescence. Indeed, the magnitude of the association between parent-adolescent closeness and depressive symptoms was generally stable across adolescence, as expected. However, contrary to expectation, the strength of association between friend support and depressive symptoms also was stable across age. This finding diverges from past work suggesting that the magnitude of association between support from general peers and depressive symptoms declines over adolescence but is consistent with findings focusing on support in close friendships (Rueger et al., 2016). Altogether, this suggests that support in friendships (including friends and best friends) may operate differently than support in general peer relationships (e.g., classmates) in reducing adolescent depression risk. Nevertheless, the divergence could also be due to measurement as friend support was only measured by one item in the current study, which might have limited the sensitivity to detect changes in different aspects of friend support.

Although it may be tempting to compare the strength of association between parent-adolescent closeness and depressive symptoms with that between friend support and depressive symptoms, we caution against such a comparison for the following reasons. First, closeness and support refer to different aspects of relationships. Although our measure of closeness mostly refers to individuals' feeling of intimacy and satisfaction in a relationship, our measure of support focused on individuals' perceived care from friends. The two aspect of relationships are different such that high perceived support does not necessarily means high closeness, though they are likely to be positively correlated to some degree. Second, the use of a single item to measure friend support may result in a construct with lower reliability

and lower variability (compared to closeness with mothers or fathers), thereby potentially attenuating the estimated association with depression.

The association between mother-adolescent closeness and depressive symptoms was stronger for adolescents with higher friend support for a brief period from ages 14 to 15, suggesting that the benefits of mother-adolescent closeness for depressive symptoms among adolescents are enhanced with higher friend support at those ages. Nevertheless, mother-adolescent closeness is still related to lower risk of adolescent depression at lower level of friend support. Although some prior studies show that parent-adolescent relationships and friendships may operate in a compensatory manner influencing adolescent internalizing symptoms such that good relationships in one domain may compensate poor relationships in the other domain. Compensatory models are often found when examining positive aspect (e.g., support) of one relationship and negative aspect (e.g., conflict) of the other (Sentse & Laird, 2010; Sentse et al., 2010). Our study focuses on positive aspects (i.e., closeness and support) of both relationships and our findings are consistent with existing evidence that support from one source reinforces the benefits of support from the other against emotional problems (Helsen et al., 2000; Sentse & Laird, 2010; Young et al., 2005).

Gender Differences in Strength of Associations

Our findings suggest that parent-adolescent closeness provides important mental health benefits for boys and girls across adolescence, with some differences in magnitude emerging during mid-adolescence such that father-adolescent closeness is more strongly correlated with depressive symptoms for girls than for boys. This finding is consistent with prior research documenting stronger associations for overall social support with general well-being for adolescent girls than for adolescent boys (Chu et al., 2010) but are inconsistent with other work that found minimal gender differences in the association between family support and depression (Rueger et al., 2016). However, it should be noted that family support could encompass a broad range of support behaviors such as emotional support, instrumental support, informational support, or companionship from any family members whereas our study focused on the feeling of closeness toward each parent. Finally, it may also be that more nuances emerged through the use of our TVEM analyses. Our findings indicate that there was a circumscribed period in which gender differences in the association between closeness and depressive symptom was significant and was only observed in father-adolescent closeness; whereas existing work evaluated this association over the entire adolescent period and across various family relationships, perhaps "washing out" the effect (Rueger et al., 2016). It is also important to note that the period in which father-adolescent closeness had a stronger association with depressive symptoms for adolescent girls than for boys was accompanied by lower levels of both mother-adolescent and father-adolescent closeness reported by adolescent girls. Therefore, the lower level of parent-adolescent closeness accompanied by a stronger association between father-adolescent closeness and depressive symptoms may partially explain why adolescent girls experience more depressive symptoms than boys. This is consistent with Cyranowski et al.'s (2000) proposition that gender differences in adolescent depression could be due to the combination of more interpersonal stress (e.g., lower parent-adolescent closeness) as well as higher reactivity to these stress (due to greater affiliative needs) in adolescent girls.

Friend support was consistently negatively associated with depressive symptoms for both boys and girls across adolescence. However, contrary to expectation, there were no significant gender differences in the *strength of association* between friend support and depressive symptoms, suggesting that friend support is equally beneficial against depressive symptoms for both adolescent boys and girls. Nevertheless, this is consistent with some existing evidence that friend support and friendship quality generally have similar implications for adjustment for boys and girls (Bagwell & Schmidt, 2011; Rueger et al., 2016).

Implications for Prevention and Intervention

The current findings may inform prevention and intervention efforts for adolescent depression in a few ways. First, as parent-adolescent closeness and friend support exhibited stable negative associations with depressive symptoms across the adolescent period, our findings suggest that interventions targeting these interpersonal factors should be equally effective in reducing depressive symptoms at any point in adolescence. However, it should be noted that although the strength of association is relatively consistent across age, the mean levels of mother-adolescent and father-adolescent closeness decrease most steeply between early to middle adolescence (especially for girls) and it corresponds in age to the steep increase in depressive symptoms for both boys and girls during this period. This suggests that improving parent-adolescent closeness may reduce adolescent depressive symptoms. This may be particularly important for families with decreasing parent-adolescent closeness across adolescence. Currently, the most common treatment or intervention for depression focuses on depressed individuals. Our findings suggest that family-based interventions targeting the improvement of parent-adolescent closeness in the middle-school to high-school years may be particularly needed. In fact, existing research has found family-based interventions effective in reducing depressive symptoms in adolescents (Connell, Stormshak, Dishion, Fosco, & Van Ryzin, 2018; Fosco, Van Ryzin, Connell, & Stormshak, 2016). In clinical settings, attachment-based family therapy aimed at improving relationships between adolescents and their families has been shown to be effective in reducing adolescent depressive symptoms and suicidal ideation (Diamond, Reis, Diamond, Siqueland, & Isaacs, 2002; Diamond et al., 2010). Adolescents with good parent-adolescent relationships are also more likely to demonstrate better social skills and report closer attachment with friends and higher perceived social support from peers (Engels, Dekovi , & Meeus, 2002), another beneficial factor in the present study.

Second, interventions that target increasing friend support could be effective in reducing adolescent depression. School-based interventions could target teaching social and emotional skills in children and adolescents; universal social and emotional learning (SEL) programs has consistently been shown to be effective in improving social, emotional, and relationship skills as well as reducing emotion distress (e.g., depression and anxiety) in children and adolescence (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Taylor, Oberle, Durlak, & Weissberg, 2017). Furthermore, SEL programs are likely to improve school climate so that it becomes more inclusive and therefore conducive for developing more supportive friendships (Elias, DeFini, & Bergmann, 2010). Also, there is evidence that these programs also reduce bullying in schools, another factor related to

depression (Espelage, Rose, & Polanin, 2015; Hawker & Boulton, 2000; Reijntjes, Kamphuis, Prinzie, & Telch, 2010; Smith & Low, 2013).

Limitations

There are several limitations in the present study. First, the age-varying associations represent age trends in the population and should not be interpreted as development across time because inferences were made between rather than within persons. Second, friend support was measured using one item, which was the only measure available for friend support in Add Health. This may limit the reliability of the measure as well as its variability and therefore, may have obscured more nuanced age trends. Furthermore, the measure is limited in that it likely captures an overall evaluation of perceived support rather than various aspects of support (e.g., instrumental support, emotional support). Third, it is important to note that the findings of the present study regarding age-varying associations are aimed to be generalized to in-school students only, but not adolescents who have graduated from high schools; adolescents beyond age 18 who have not graduated from high school may experience higher levels of depressive symptoms and the association of parent-adolescent closeness and friend support with depressive symptoms may differ from those who have graduated. Fourth, the coefficient functions of the present study represent associations only and should not be regarded as causal effects. For instance, it is not necessarily that closeness and support predict depression, it is also possible that adolescent depressive symptoms may predict lower levels of closeness and support. Fifth, based on the design of Add Health, age-varying associations may be partially confounded by cohort differences within each wave of data. Sixth, our findings were based on adolescents from the Add Health study in which adolescents' data were collected between 1994 and 1996, and thus may not generalize to today's adolescents. Recent studies indicate that depressive symptoms in adolescents and young adults have increased in recent years, which could be linked to the increase in social media use among young people (Twenge, Cooper, Joiner, Duffy, & Binau, 2019; Twenge et al., 2018). Given that the use of social media may impact adolescents' relationships with friends and parents, future studies should examine whether the current findings hold for recent cohorts of adolescents. Finally, only positive aspects of relationship such as closeness and support were examined, it is possible that more negative aspects of relationships such as conflicts are more associated with adolescents' depressive symptoms. However, these negative relationship features were not measured in Add Health. Thus, the current findings may be an incomplete picture of close relationships contributing to adolescent depressive symptoms.

Conclusion

This study, by providing a developmentally sensitive analysis, improves our understanding of the levels of interpersonal closeness and support as well as their associations with depressive symptoms across adolescence, including gender differences. Depressive symptoms appear to bear unique significance in adolescence, especially for girls. Closeness with parents and support from friends provide important benefits against depressive symptoms and the strength of associations remains relatively stable across age. The decrease in the level of parent-adolescent closeness, especially from early to mid-adolescence, is

accompanied by increased adolescent depressive symptoms for both boys and girls. Further, the lower levels of closeness with parents, together with adolescent girls' stronger association between father-adolescent closeness and depressive symptoms, may partially explain gender differences in depression at these critical ages. Finally, the benefits of mother-adolescent closeness against depressive symptoms seem to be enhanced in the context of higher friend support during mid-adolescence. Our findings offer insights on possible explanations for the increase in depressive symptoms across adolescence, the emergence of gender differences, and implications for prevention and interventions of adolescent depression.

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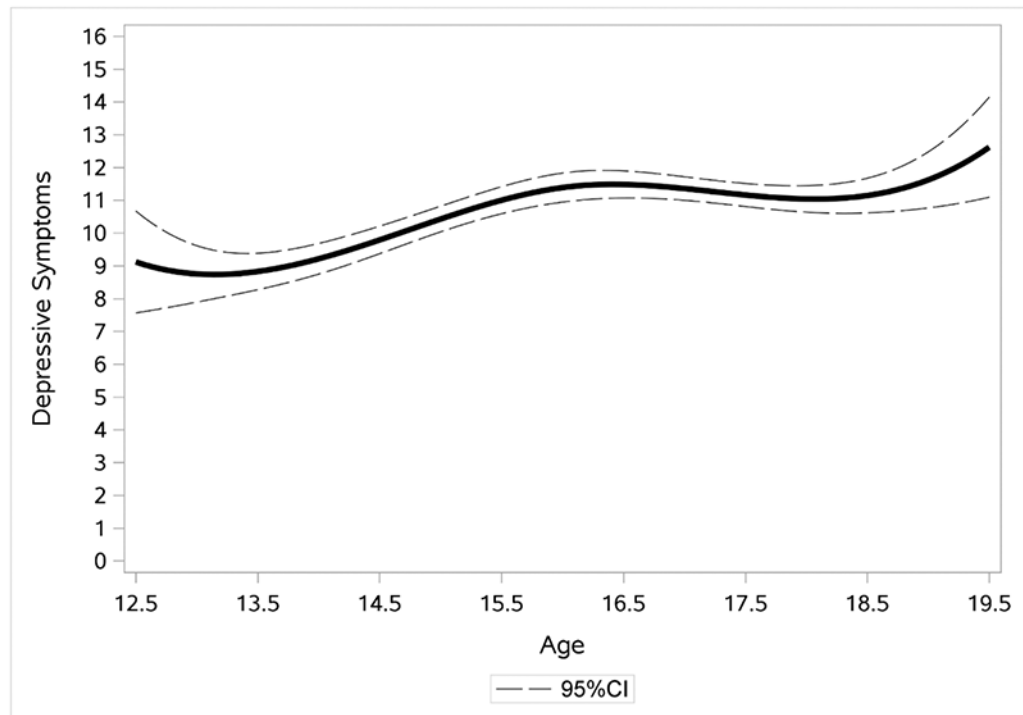
Figure 1a.

Estimated mean level of depressive symptoms across age.
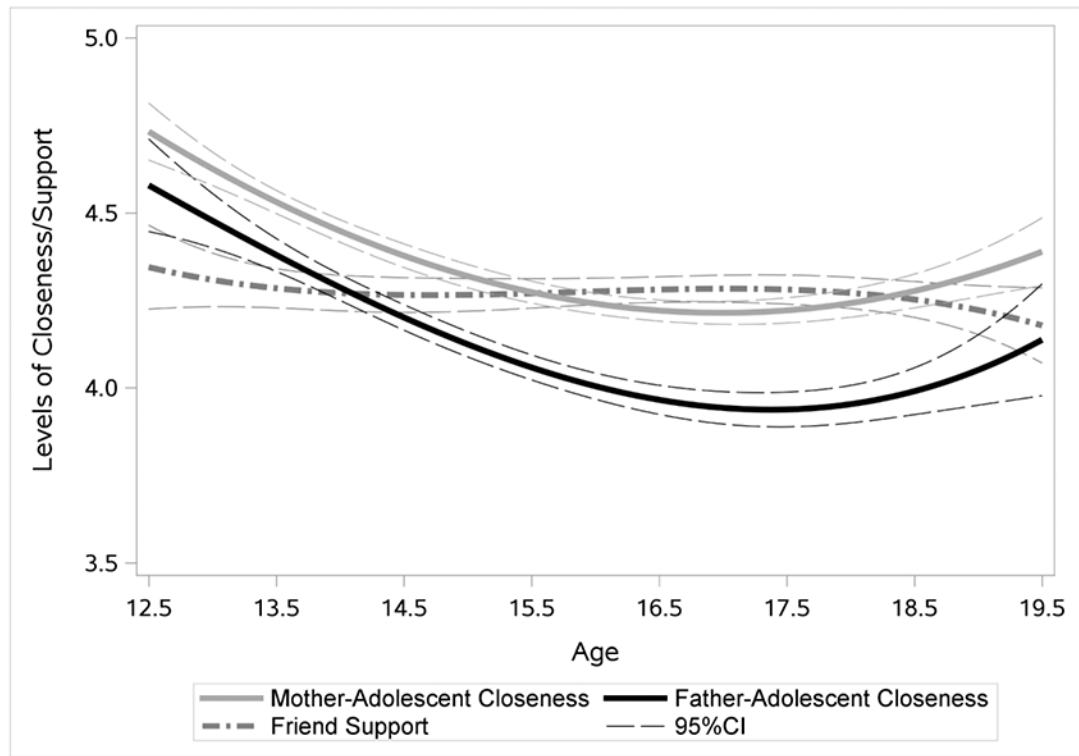
Note. $N_{observations}$ = 9538.

Figure 1b.

Estimated mean levels of mother-adolescent closeness, father-adolescent closeness, and friend support across age.

Note. Mother-adolescent closeness: $N_{observations}$ = 9028; father-adolescent closeness: $N_{observations}$ = 6865; friend support: $N_{observations}$ = 9503.
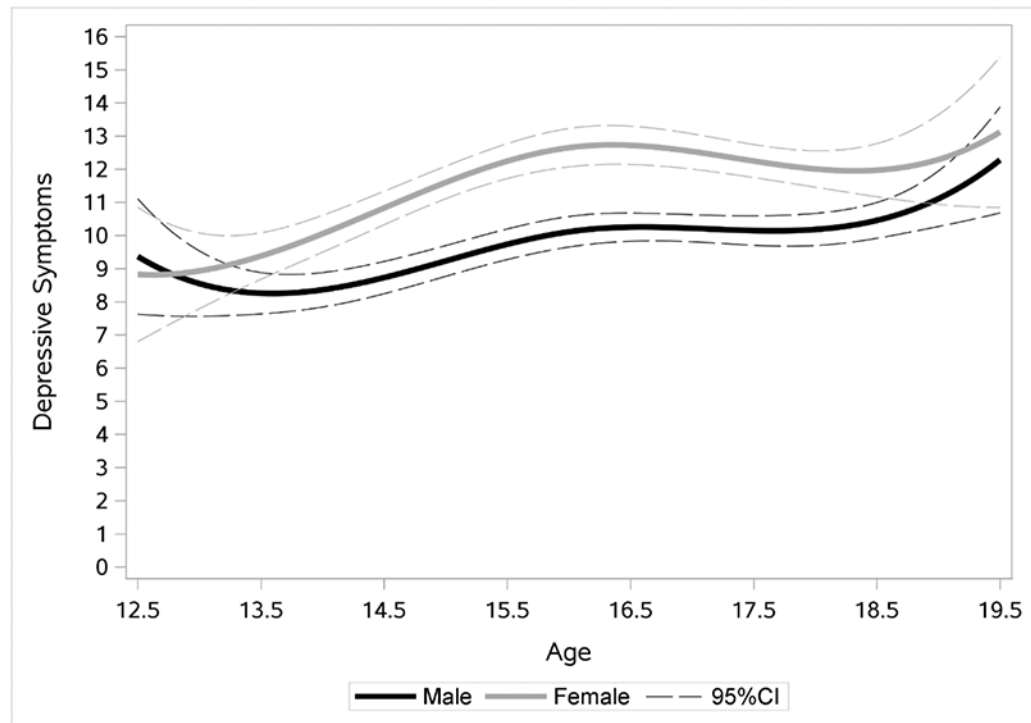
Figure 2a.

Estimated mean level of depressive symptoms across age, by gender.

Note. $N_{observations} = 9538$.
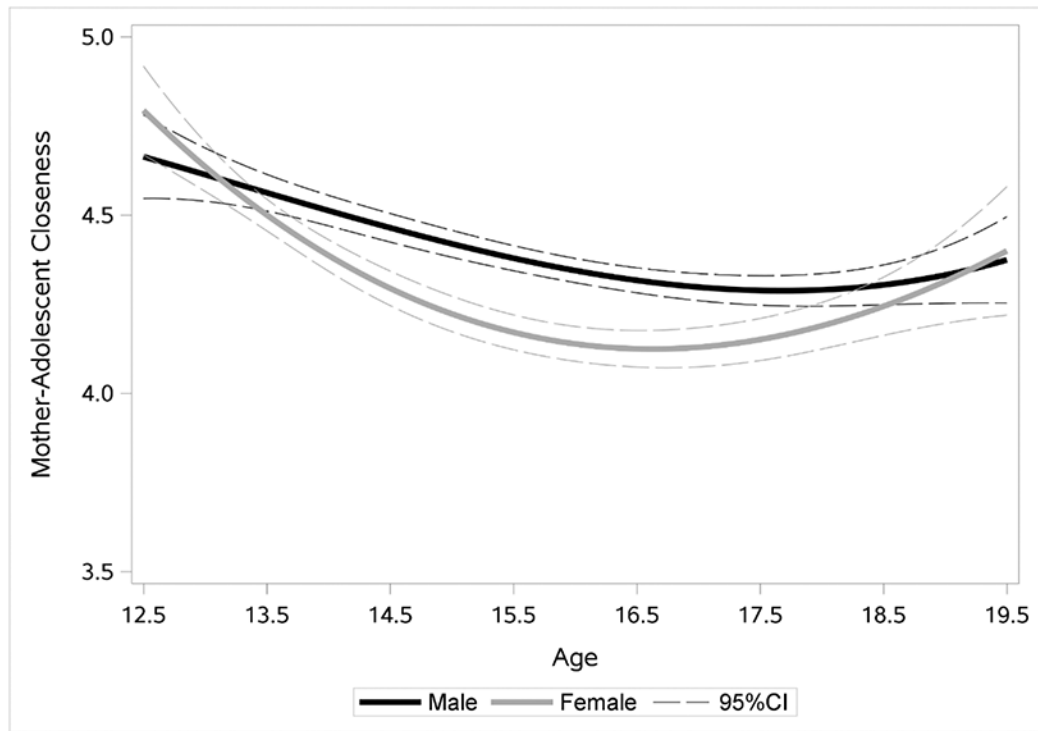
Figure 2b.
Estimated mean level of mother-adolescent closeness across age, by gender.

Note. $N_{observations}$ = 9028.
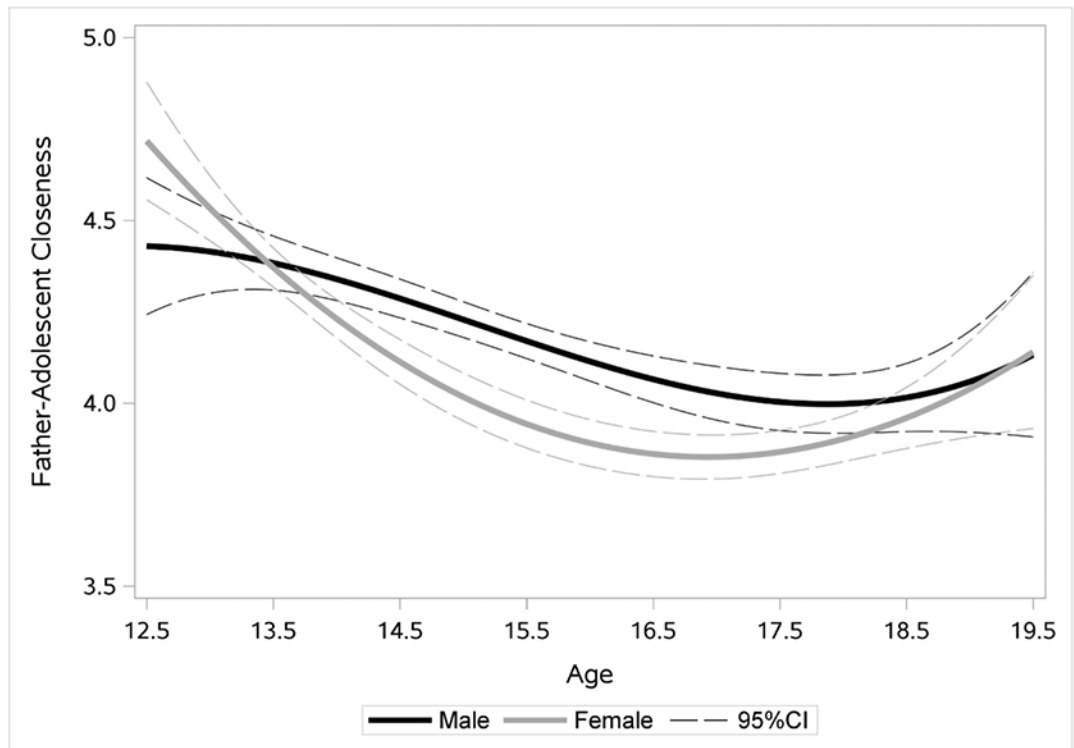
Figure 2c.
Estimated mean level of father-adolescent closeness across age, by gender.

Note. $N_{observations} = 6865$.
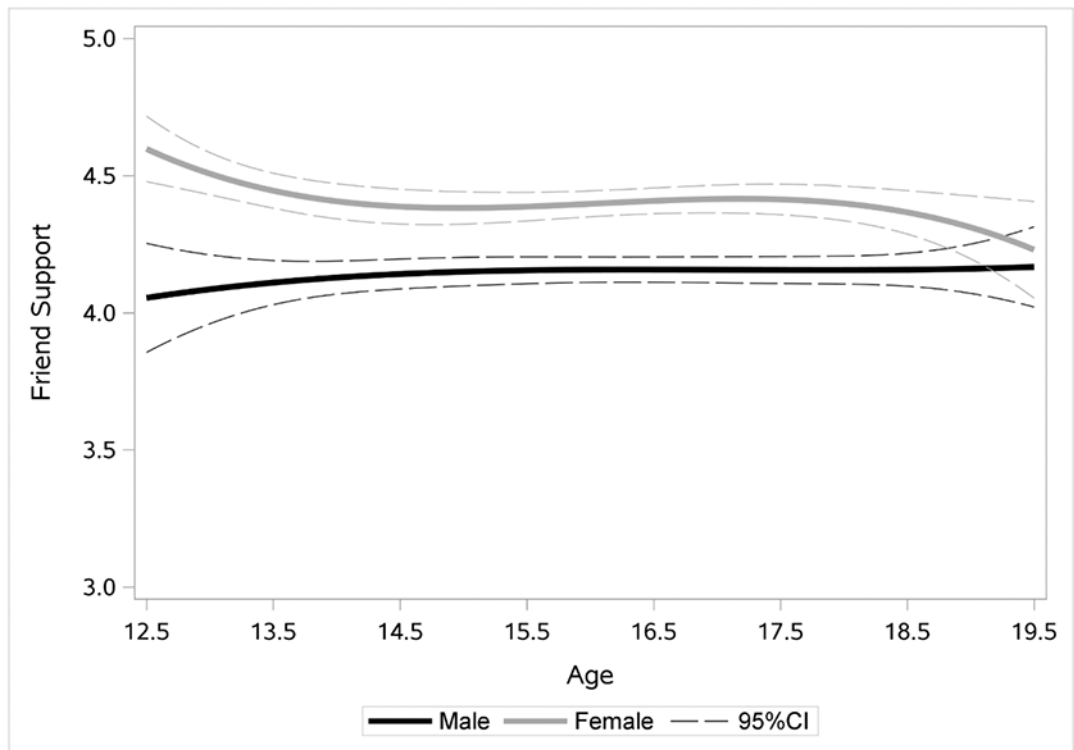
Figure 2d.

Estimated mean level of friend support across age, by gender.

Note. $N_{observations} = 9503$.
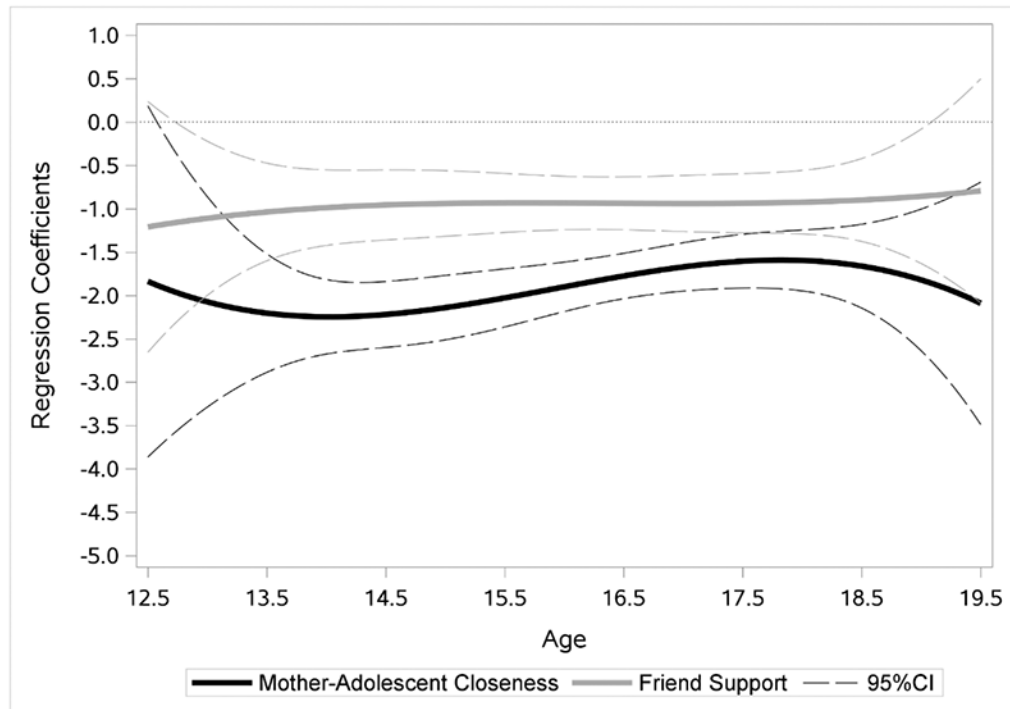
Figure 3a.
Age-varying associations of mother-adolescent closeness and friend support with depressive symptoms.
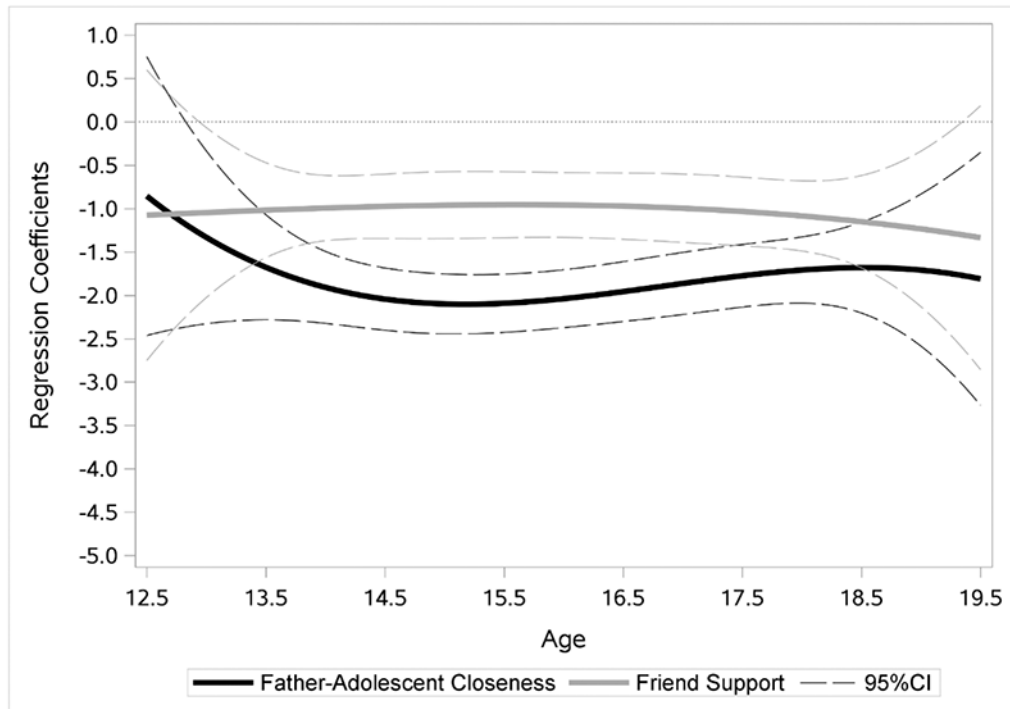
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Figure 3b.
Age-varying associations of father-adolescent closeness and friend support with depressive symptoms.
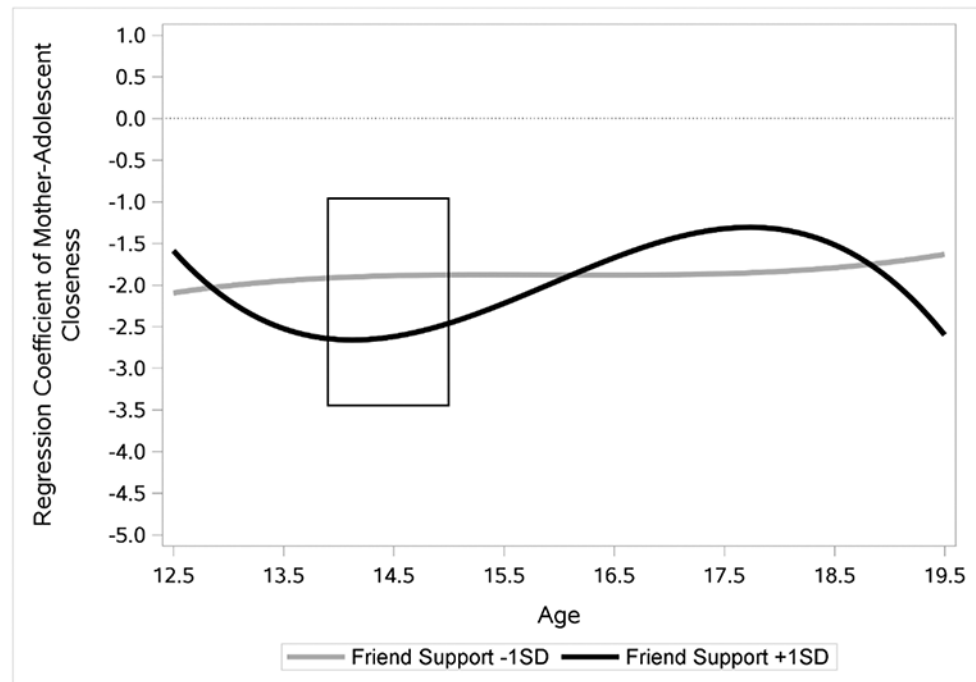
Note. $N_{observations}$ = 6845.

Figure 4.

Age-varying association between mother-adolescent closeness and depressive symptoms as a function of friend support.

Note. Box indicates age range (ages 14.0 to 15.0) of significant moderation. $N_{observations}$ = 8995.
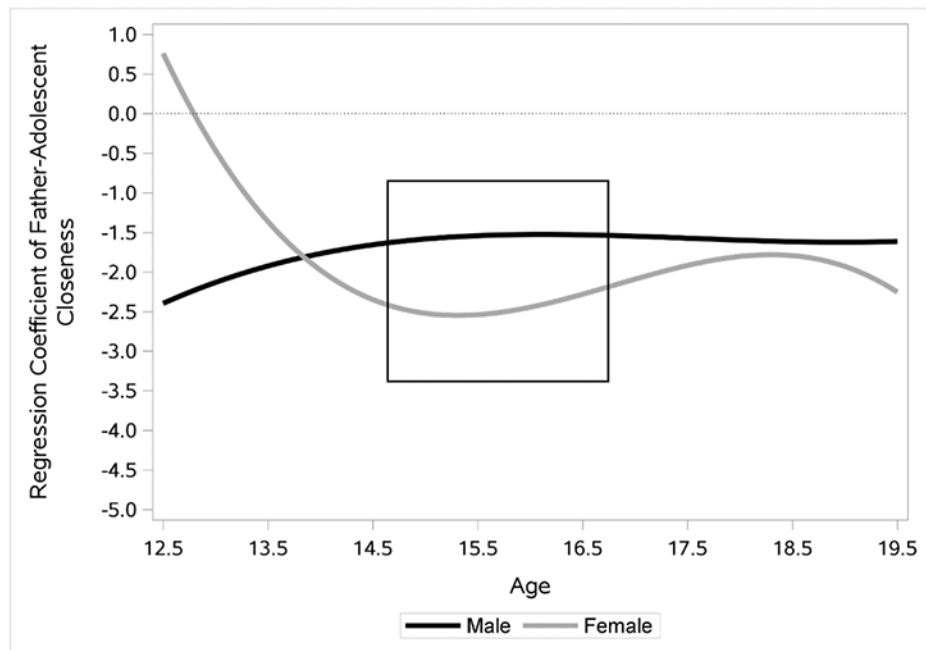
Figure 5.
Age-varying association between father-adolescent closeness and depressive symptoms by gender.

Note. Box indicates age range (ages 14.6 to 16.7) of significant gender moderation.

$N_{observations}$ = 6845.