The Role of Multilayered Peer Groups in Adolescent Depression: A Distributional Approach[1]

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Much literature on peer influence has relied on central tendency–based approaches to examine the role of peer groups. This article develops a distributional framework that (1) differentiates between the influence of depressive peers and that of a majority group of nondepressive peers; and (2) considers the multilayered nature of peer environments. The authors investigate which segments of the distribution of peer depressive symptoms drive peer effects on adolescent depression across different layers of peer groups. Results from the Add Health data show that, for institutionally imposed peer groups, exposure to depressive peers significantly increases adolescents' depressive symptoms. For self-selected peer groups, the central tendency of peer depression largely captures its impact on adolescent depression. High parent-child attachment buffers the deleterious consequence of exposure to depressive grademates. The implications of these findings are discussed for research and policy regarding peer effects on adolescent well-being.

Over the last several decades, the development of adolescent depression has gained in public health significance. National estimates indicate that about

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25% of youth experience moderate to severe depressive symptoms (Rushton, Forcier, and Schectman 2002; Kessler et al. 2005; Mojtabai, Olfson, and Han 2016). An increase in depressive symptoms in adolescence is linked to recurrent and severe depressive episodes in later life stages (Belsher and Costello 1988); to suicidal ideation and attempts (Kandel and Davies 1982); and to poor academic performance, engagement in risky behaviors, strained family relationships, and unfavorable labor market outcomes (Nolen-Hoeksema and Hilt 2009; Fletcher 2010). Given the prevalence and social consequences of adolescent depression, understanding its social etiology is an urgent issue (Cicchetti and Toth 1998; Horowitz and Garber 2006).

The role of peers in adolescent mental health has long been of interest among social scientists, policy makers, and the public (e.g., see Smith and Christakis 2008; Schrobsdorff 2016). The absence of friends and the presence of depressive peers in one's peer relations are crucial risk factors for adolescents' mental health problems (Ueno 2005; Perry and Pescosolido 2015). Identifying the influence of depressive peers could be challenging, however, given that they are small in size and often isolated in most peer groups (Bearman and Moody 2004; Schaefer, Kornienko, and Fox 2011). In this article, we propose a novel framework to identify the impact of exposure to depressive peers on the development of adolescent depression by taking the distribution of peer composition into account.

This study extends existing research on peer influence on adolescent mental health in three ways. First, our central aim is to reorient attention from the central tendency of peer composition to its distributional attributes. Much research has relied on the linear-in-means approach to elucidate how peers affect adolescents' depressive symptoms. Such an approach, however, is based on an untested assumption about symmetric effects of peer groups (e.g., see Lieberson 1985). Namely, if a higher level of peer depression leads to more depressive symptoms among adolescents, its lower level should result in fewer depressive symptoms. Although intuitively appealing, the veracity of this assumption has yet to be tested. In addition, the focus on central tendency is likely to obscure the role of peer depression as it confounds the number of depressive peers with the severity of their depressive symptoms. In this study, we distinguish fractional changes in the tails of peers' depressive symptom distribution from its central tendency. Our approach thus can provide a general framework where central tendency becomes a

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special case of distributional attributes of peer depression. Specifically, we examine which segments of the distribution of peer depressive symptoms drive peer effects on adolescent depression.

Second, we theorize scope conditions in which our distributional approach provides a better understanding of peer effects on adolescent mental health across multiple levels of peer grouping, compared to the central tendency approach. A burgeoning body of literature has expanded peer group definitions from friendship networks to friends of friends, to familiar others, to coursemates, and to extracurricular activity group members (Frank et al. 2008; Baller and Richardson 2009; Suh, Shi, and Brashears 2017). These studies highlight that adolescents are exposed to multiple levels of peer groupings from micro- to mesolevels. However, little attention has been given to grademates as a relevant peer group. Unlike most other peer groups that are constituted partly on the principle of self-selection, grade peers are an institutionally imposed peer group based on birth cohort membership. Social interactions among grademates are more likely to be indirect, irregular, and less routinized. Compared to self-selected peer groups, these properties of grade-level peer groups may make the role of peers in the tails of the depressive symptom distribution more salient for adolescent depression. Applying our distributional approach to multiple levels of peer groups, we show how peer influence from grademates differs from that from peer groups at other layers.

Third, we address why it is imperative to consider multiple interpersonal contexts simultaneously for explicating the mechanisms by which peer depression impacts adolescent mental health. It has long been recognized that adolescent socialization and development are embedded in multiple social environments (Bronfenbrenner 1979). In particular, adolescents' relationships with parents and peers are two major interpersonal contexts for adolescents, and their interactions well characterize social embeddedness in adolescence (Dornbush 1989; Elder 1998). Although relationships with parents and peers have been widely documented to affect adolescents' depressive symptoms, most studies examine their influence separately as if they work in isolation (Allen, Porter, and McFarland 2007). We ask whether grade-level peer effects are independent of or contingent on how youth navigate their relationship with parents. Specifically, we assess the extent to which parent-child attachment moderates the impact of peer depression on adolescents' depressive symptoms.

To these ends, this article draws on data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). Given its school-based, longitudinal design, Add Health is well-suited for our study objectives outlined above. When it comes to identification of peer effects, inferential threats arise due to endogenous sorting into peer groups: (1) peer group formation is likely governed by adolescents' homophilic propensity ("Birds of a feather

flock together") and parental choices about residence and school; (2) peer effects may occur simply because all members of the peer group are exposed to common shocks; and (3) an adolescent and his/her peers can influence each other simultaneously and reciprocally (Manski 1995). The school-based clustering design of Add Health, in this regard, helps us address these potential threats that bias our inference about peer effects on adolescent depression. To account for endogenous sorting processes, we deploy within-school across-grade models. As will be described below, our data indicate that selection into different grades is as good as random, validating the quasi-experimental nature of grade-to-grade variation in peer depression within schools. Our analysis therefore provides a rigorous assessment of the impact of peer depression on adolescent mental health.

A DISTRIBUTIONAL FRAMEWORK ON PEER DEPRESSION

Adolescence is characterized by rapid changes in physical, cognitive, and socioemotional development as well as by increasing autonomy from parents. Importantly, as adolescents spend most weekday and out-of-school time with their age-equivalent peers in school, their senses of self and belonging are closely linked to the school they attend (Rohrbeck 2003; Mueller and Abrutyn 2016; Abrutyn and Mueller 2018). Against this backdrop, peer groups emerge as one of the major interpersonal contexts for adolescent well-being. The structure of peer contexts conditions the susceptibility of social influence and the availability of social support. Under varying levels of opportunities and constraints given in peer contexts, adolescents navigate their lives through social psychological adjustments. Previous scholarship on adolescent mental health has articulated how depressive symptoms are socially diffused among peers.

Peer depression may affect adolescent depressive symptoms through social contagion, which pertains to a process of interpersonal influence by which a person's or group's emotions and behaviors trigger similar emotions and behaviors among related others (Hatfield, Cacioppo, and Rapson 1993; Hogue and Steinberg 1995). For example, corumination may facilitate transmission of negative cognition and emotion. As depressive peers tend to rehash problems and dwell on negative affect, peer interactions reinforce negative interpretations of distressful events by providing alternative scripts and repertoires for coping with distress (Joiner and Katz 1999; Prinstein, Cheah, and Guyer 2005; Mueller and Abrutyn 2015). As a result, adolescents are more likely to mimic and synchronize depressive peers' emotions and behaviors (van Zalk et al. 2010).

Understanding the diffusion of depressive symptoms, however, also requires incorporating the distributional features of peer contexts. An increase in the fraction of depressive peers is likely to make the distribution of peer

depression uneven. In this heterogeneous peer environment, adolescents are more likely to be exposed to peer relations where depression arises as a salient issue, and their attitudinal and behavioral models to cope with depression are more likely to diverge (e.g., Östberg 2003; Harding 2007). As "the advantages and disadvantages of various options are more poorly defined" (Harding 2007, p. 349), adolescents have to make continual social psychological adjustments. A relative lack of consensus on how to deal with depression likely manifests in the form of overreaction, disengagement, and isolation, resulting in a heightened level of relationship stress (La Greca and Harrison 2005; Gotlib and Hammen 2014). Thus, heterogeneous peer interactions regarding depression are likely to facilitate its diffusion.[2]

In exploring the diffusion of depressive symptoms among peers, a predominant approach has been to rely on numeric measures of peer influence, such as the number of peers or the number of depressive peers, or on fractional measures, such as the proportion of depressive peers (Ueno 2005; Perry and Pescosolido 2015). While informative, this approach is mainly concerned with the presence of social ties or peers with depression. More recent research has attended to differences in the central tendency of depressive symptoms among peers (Rosenquist, Fowler, and Christakis 2011). By capturing the average level of peer depression, the central tendency approach allows all peers with differing levels of depression to play a role (e.g., see Centola and Macy 2007). Using this approach, previous studies have reported that a higher central tendency of depressive symptoms among peers increases adolescents' own level of depressive symptoms (Prinstein et al. 2005; van Zalk et al. 2010).

Despite its contributions to our understanding of peer influence on adolescent mental health, the central tendency approach (e.g., linear-in-means model) poses several challenges. To illustrate what is at stake, figure 1 displays the observed distributions of depressive symptoms across grades within selected schools from the Add Health data. Because these distributions are positively skewed, we improve readability by drawing vertical lines that denote the median as a measure of central tendency and the fractions of grade peers at the tails of each distribution.[3] First, the central tendency approach seems able to identify the effect of peer depression in school A, as the medians properly capture differences in peer composition.

[2] We do *not* imply, however, that any form of within-group heterogeneity has negative consequences for adolescent well-being. Many influential studies have documented its beneficial impacts on students' outcomes, especially academic achievement (e.g., see Hoxby and Weingarth [2006] and Lyle [2009] on the role of high achieving peers). To our knowledge, this study is the first to investigate the influence of peer group heterogeneity in mental health in taking a similar approach.

[3] Our inspection of other schools suggests that, in general, grade-level depressive symptoms also have a positively skewed distribution (results available upon request).

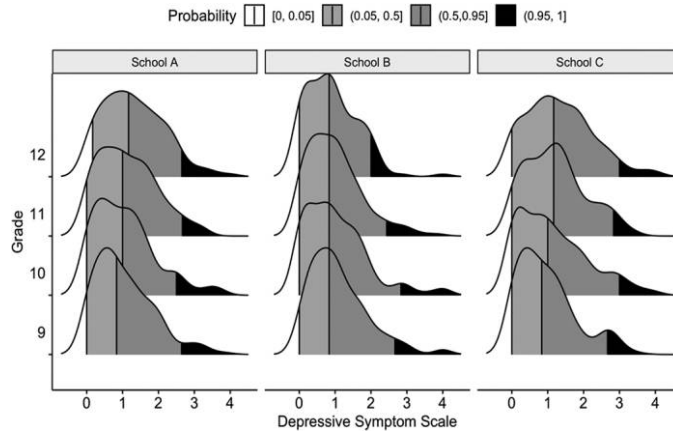

FIG. 1.—Different configurations of peer composition by depressive symptoms.

Students in 12th grade have a higher median value and a larger fraction of peers with higher levels of depressive symptoms compared with students in other grades. In this case, a key assumption underlying the central tendency approach is that, if a higher level of peer depression leads to the development of more depressive symptoms among adolescents, its lower level should result in fewer depressive symptoms. Although intuitively appealing, the validity of the assumption about symmetric effects of peer depression—with opposite signs—remains unknown. As Lieberson (1985, p. 69) noted, "Rarely are propositions stated in an asymmetrical fashion such that changes of X in one direction generate changes in Y that are not merely the mirror image of what is expected if X changes in the opposite direction." Indeed, existing approaches seldom distinguish peer effects due to fluctuations in the fraction of peers with a higher (or lower) level of depression from those due to changes in the overall level of peer depression.

Second, the central tendency approach would not be able to detect an effect of peer depression in school B, because all grade-level distributions of depressive symptoms have the same median. However, the fractions of depressive peers differ across grades in school B. That is, ninth and tenth graders are more likely than twelfth graders to have peers with higher levels of depressive symptoms. If peer effects arise from fractional changes at the top tail of the distribution even in the absence of changes in the central tendency, the central tendency approach may yield a misleading conclusion about peer effects. Third, the grade-level distributions of depressive symptoms in school C show that differences in the central tendency of peer depression would not be in sync with those in the fractions of depressive peers. Compared with tenth graders, twelfth graders have a higher central tendency but with a smaller fraction of depressive peers. In cases like this, it would be

premature to rely solely on the central tendency approach without taking into account the fractional differences at the top tail of the distribution.

Taken together, figure 1 highlights why the central tendency approach may fall short of illuminating the social diffusion of depressive symptoms among peers. A main reason for this gap is lack of attention to different configurations of peer depression. It is the distribution, not merely the central tendency, of peer depression that likely influences the development of adolescent depression. In this article, we propose a distributional approach that accounts for the proportions of peers with a higher or lower level of depression alongside the central tendency of peer depression. In this sense, the central tendency approach is a special case of the distributional approach we apply. Examining peer influence throughout the distribution of peer depressive symptoms affords us the ability to directly test for the assumption of symmetric peer effects. By simultaneously investigating the roles of highly depressive, mildly depressive, and nondepressive peers, this study aims to provide a robust assessment of peer effects on adolescent depression.

THE ROLE OF GRADE PEERS IN ADOLESCENT DEPRESSION

In defining adolescents' peer groups, much research has focused on adolescent report on friendships (Haynie 2001; Moody and White 2003). Studies based on adolescents' egocentric friendship network provide a number of insights into peer influence on adolescent development. Adolescents typically form their social networks on the basis of sociodemographic, behavioral, and attitudinal similarity (homophily), along with spatial proximity (propinquity) and triadic connectivity (transitivity; McFarland et al. 2014). Attending to these local and strong personal relationships informs how one's selected and constructed environment influences his/her outcomes (Bandura 1997). However, researchers have increasingly turned to broader interpersonal contexts of which one's egocentric friendship network is a part (Brown and Larson 2009; Crosnoe and Johnson 2011). They include friends of friends, "familiar others," and "coursemates" (Frank et al. 2008; Baller and Richardson 2009; Carbonaro and Workman 2016; Suh et al. 2017).

Scholarly interests in intermediate peer groups in adolescence are driven by the recognition that daily interactions in school occur not only through direct and intimate relationships but also through indirect contacts and casual encounters (Frank et al. 2008; Brashears, Genkin, and Suh 2017). Social interactions in school are often organized in structurally arranged settings, such as course taking and extracurricular activities. Through a shared environment, or "focus," adolescents are likely to be exposed to other students who are not directly connected to them and yet whose presence is easily perceived (Feld 1981). For example, students in the same "local position," defined as a cluster of students who take a set of common courses, are likely

to share a similar social and academic space in school (Frank et al. 2008). Another example is extracurricular activity groups organized in school, where students spend a significant amount of time together during the school year. While some students in those peer groups are not part of individuals' "close-knit" friendship circles, they may serve as references on which adolescents maintain and modify their preferences, value orientations, and behaviors through repeated exposures (Suh et al. 2017).

A central insight from this literature is that, besides selected and constructed peer groups, organizationally arranged peer groups also play an important role in adolescent developmental processes. In this study, we consider adolescents at the same grade level within school to be one of such peer groups. "Grademates" represent a relevant group of peers for adolescents in the U.S. secondary educational system. While students spend a greater proportion of time in school outside of their homeroom class, they participate in curricular and extracurricular activities mostly with their grade peers (Moody 2001; Zeng and Xie 2008). Moreover, as they are promoted to the next grade level, they have more chance to be directly and indirectly connected to their grademates through classroom reshuffling (Crosnoe et al. 2008; Lavy and Schlosser 2011).

While grademates share many properties with other organizationally arranged peer groups, they are distinct from other peer groups in that they constitute an *institutionally imposed* peer environment. Because grade peers are defined primarily by their birth cohort membership, adolescents have little control over assignment to their grade level and consequently exposure to their grade peers. Grademates thus constitute an ecological boundary within which organizationally arranged activities take place, making a wide range of attitudinal and behavioral scripts and repertoires available to and shared by students. Meanwhile, although other intermediate peer groups at the levels of local positions and clubs are also formed on the basis of opportunities arranged in school, they are still governed by the homophily principle. For example, coursemates in the same local position are more likely to have similar academic standings, and clubmates in the same extracurricular activity group likely have a common interest and taste for a certain sport or art. It is thus critical to take both dimensions—organizational arrangement and self-selection—into account in delineating peer groups at multiple levels.

The distinction made above has important implications for our distributional approach to examining the role of peer depression in adolescent mental health. As an institutionally imposed peer group whose formation is not driven by self-selection, grade peers are less insulated and more loosely connected than other peer groups. Peer relations among grademates can be regarded as what Granovetter (1973) calls "negligible ties," where irregular contacts and activities are prevalent. Yet, given their sheer size and range, such peer interactions serve as a conduit for the diffusion of outside

information—through gossip, for example—that may not be immediately available among peer groups at other levels. Grademates are part of the "wider network of one's peers," which are "more apt to encompass elements of distance and difference" (Giordano 2003, p. 277), leading to an increase in heterogeneous interactions in peer groups. These contexts present a structural condition in which depressive peers, who are in the tail of the depressive symptom distribution, affect adolescent depression. When peer depression is more unevenly distributed, the contents and tendencies that depressive peers—albeit often isolated from most grade peers—exhibit can induce the continuation of social psychological adjustment among adolescents.

In contrast, these mechanisms may not be applicable to other types of peer groups shaped through course taking and coparticipation in extracurricular activity. It is because their formation is largely driven by self-selection, such as homophily and propinquity, although being afforded structural opportunities via transitivity and organizational arrangement. As an important pool of potential friends (Frank et al. 2008), such peer groups readily transform indirect and incidental social interactions into direct and routinized interpersonal relationships. With respect to peer depression, then, its effect is likely to transpire through the normative climate of the peer group of interest. That is, the influence of depressive peers in one's chosen group is intimately reflected in the general tendency of peer depression. For peer groups where self-selection has a critical function, we expect that the impact of peer depression on adolescent depression is better captured by its central tendency.

In applying our distributional approach, we distinguish the roles that multilayered peer groups play. We extend the scope of peer influence to institutionally imposed peer groups such as grademates, and contrast patterns from grade peers with those who share local position, extracurricular activity, and friendship. Because individuals typically share many similar characteristics with peers they choose to interact with, they are likely to be surrounded by homogeneous peer environments. In such an environment, the gap between the central tendency and the tails of the depressive symptom distribution may be small enough that depressive peers are unlikely to have an independent influence on adolescent depression. In an institutionally imposed peer environment where peer interactions are more likely to be heterogeneous, however, greater exposure to depressive peers may have a distinct influence as the central tendency of peer depression is unlikely to capture its distributional characteristics.

DIFFERENTIAL EFFECTS OF PEER DEPRESSION

Any assessment of peer influence on adolescent mental health entails a question of who is more or less sensitive to peer stressors. Strategies for coping with depression likely vary among adolescents, depending on the susceptibility

of social influence and the availability of social support. In this respect, studies have repeatedly found relationships with peers and parents to be the two most critical interpersonal contexts for adolescent development (Laible, Carlo, and Raffaelli 2000). A common view was that a defining feature of adolescence was the increasingly isolated and independent influences of parents and peers, with diminishing roles of parents and amplifying roles of peers (Coleman 1961; Kandel and Lesser 1972). However, researchers have challenged this view, pointing out that the roles of a microsystem such as the family and peer group are contingent on a mesosystem, namely, interconnections among those microsystems (e.g., Bronfenbrenner's ecological systems theory [1979]). They have accumulated evidence for a renegotiation of parents and child roles, rather than adolescent detachment from parents; and for a reciprocal, rather than separate, relation between parent-child attachment patterns and peer interactions (Bogenschneider et al. 1998; Crosnoe and Johnson 2011). Accounting for multiple interpersonal contexts simultaneously, therefore, offers a unique opportunity to address heterogeneity in the effects of peer depression.

The close link between parent-child attachment and adolescent mental health is well documented (Sund and Wichstøm 2002; Brumariu and Kerns 2010). The parent-child relationship provides a basis for adolescents to build representational models of the self and significant others and develop a sense of belonging (Bretherton and Waters 1985; Cooper and Cooper 1992). A positive relationship with parents facilitates a favorable learning environment where adolescents gain effective interpersonal skills and the feeling of self-worth. In the presence of peer stressors, such a relationship may provide adaptive coping strategies through emotional and appraisal support. In contrast, a negative relationship with parents generates cognitive biases such that adolescents are more likely to perceive their surrounding environments as unpredictable and uncontrollable. With little parental support, they may feel incompetent and helpless. Consistent with this perspective, studies have reported that higher levels of attachment, closeness, and affective ties between adolescents and their parents reduce adolescent depression (Clark and Ladd 2000; Sund and Wichstøm 2002; Ge et al. 2009; Thoits 2011).

This literature suggests that the quality of the parent-child relationship is a major factor for adolescents' resiliency and vulnerability to distress. This points to the possibility that parent-child attachment plays a moderating role in the impact of peer depression on adolescent depressive symptoms. However, much research has too often focused on the roles of these two interpersonal contexts in isolation as if they were operating independently of each other (Allen et al. 2007).[4] In this study, we address this issue by investigating

[4] A small body of studies examines the joint effects of relationships with parents and peers on adolescent mental health (e.g., Armsden et al. 1990; Laible et al. 2000), but it is mostly

the extent to which grade-level peer depression has differential effects on adolescent depression by parent-child attachment. To do so, we draw upon the stress-buffering hypothesis (House, Umberson, and Landis 1988; Ge et al. 2009; Hazel et al. 2014). An uneven distribution of peer depression may generate a mismatch between the needs of adolescents and the opportunities afforded to them by their peer environment (Eccles et al. 1993). In this circumstance, social and emotional support from parents elicits the provision of relevant coping strategies for adolescents, enhancing their adaptive efficacy in the presence of peer stressors. We thus hypothesize that higher levels of parental attachment are more likely to buffer the impact of grade-level peer depression on the development of adolescent depression.

DATA AND METHODS

Data

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is an ongoing longitudinal study of a nationally representative sample of adolescents in grades 7–12 in the United States during the 1994–95 school year (Harris et al. 2009). Using school-based, multistage, and stratified sampling, Add Health sampled 80 high schools and their 52 feeder schools as a representative sample of American schools with respect to region of country, urbanicity, size, type, and ethnicity. Between September 1994 and April 1995, the in-school survey was administered to 90,118 adolescents who were present on the day of the survey. Based on school rosters, a random sample of adolescents from each high school and feeder school pair was collected between April and December 1995, yielding the core wave 1 in-home sample of about 12,000 adolescents. Adding special oversamples that included racial/ethnic minorities, physically disabled adolescents, and a genetic sample, the wave 1 in-home sample produced a total sample size of 20,745 adolescents. Their parents also participated in the wave 1 in-home survey. The wave 2 in-home survey took place approximately one year after wave 1 (from April through August 1996). With the exception of adolescents who graduated from high school since wave 1, the wave 2 in-home sample consists of 14,738 adolescents.[5]

based on adolescents' subjective assessment of their attachments to parents and peers, not on the actual configuration of peer depression with which our study is concerned.

[5] Given our study objective, missing high school dropouts in the in-school survey may be of concern to the extent that dropping out of high school is positively associated with depression. Udry and Chantala (2003), however, show that annual dropout rates are very low at the national level. Furthermore, they note that the school rosters, from which the in-home sample was selected, were collected approximately a year before the wave 1 in-home interviews, so only those who dropped out of school two years prior to the wave 1 in-home interviews were missing.

Add Health is well suited for our study for a number of reasons. With its emphasis on the role of social environments in adolescent development, Add Health combines data on adolescents' social, economic, psychological, and physical well-being with rich contextual data on the family, neighborhood, school, and peer groups. First, its school-based design enables us to observe multiple grade cohorts within the same schools and thus construct all peer group measures at the grade level within schools. Second, Add Health asked adolescents to nominate five female and five male best friends in school, which we use to construct egocentric friendship networks. Third, based on the complete high school transcript for over 12,000 respondents in the wave 3 survey, the Adolescent Health and Academic Achievement study provides measures of coursemates (Frank et al. 2008). Fourth, adolescents' report on their extracurricular activity allows us to identify their clubmates. Lastly, its longitudinal design allows us to construct a lagged measure of adolescents' depressive symptoms, which ensures correct causal ordering.

Our analysis applies the following sample restriction criteria to construct our study sample. The baseline sample consists of adolescents who were interviewed for both the waves 1 and 2 in-home surveys ($N = 13{,}568$). From this baseline sample, we exclude respondents who (1) did not participate in the in-school survey ($n = 3{,}277$); (2) did not have information on school or grade indicator ($n = 94$); (3) were missing on the outcome variable ($n = 30$); (4) did not report own depressive symptoms in the in-school survey ($n = 651$); and (5) were missing on other explanatory variables ($n = 1{,}226$). These sample restrictions yield the total study sample size of 8,290.

To evaluate potential attrition bias, we compare the study sample with the baseline sample with respect to our study variables by computing standardized difference in means, which is given by (baseline sample mean – study sample mean)/baseline sample standard deviation. As seen in figure A1, we find that the respondents in the study sample are more likely to be white, more likely to live with two biological parents, less likely to live in other family types, and more likely to have a higher Add Health Picture Vocabulary Test (AHPVT) score, compared with those in the baseline sample. However, the differences between the two samples are small in magnitude as the differences in means on most study variables are less than one-tenth of a standard deviation unit. These results suggest that attrition bias may be of potential concern but is unlikely to drive our findings.

Measures

Dependent variable.—This study uses the Center for Epidemiologic Studies-Depression (CES-D) index to measure adolescents' depressive symptoms (Radloff 1977). As one of the most widely used screening measures to identify individuals at risk of clinical depression (Roberts, Lewinsohn, and Seeley

1991), the CES-D index comprises a series of items that ask respondents about symptoms associated with depression. At wave 2, adolescents were asked to respond to the question, "How often was each of the following things true during the past week?" with four response categories ranging from 0 ("never or rarely") to 3 ("most of the time or all of the time"). Nineteen items are available at wave 2, including those on sadness, loss of interest, poor appetite, feeling depressed, fatigue, agitation, and suicidal ideation. In the analysis, we sum adolescents' scores on these items to construct a composite index of adolescent depression, with higher scores indicating greater depressive symptoms ($\alpha = .87$).

Peer depression.—Our main explanatory variables in the analysis are based on the distributional features of peer depressive symptoms, all of which are measured at the same grade within the same school. In the in-school survey, six items on depressive symptoms were asked of respondents with five response categories ranging from 0 ("never") to 4 ("everyday"). These items measure poor appetite, trouble in sleeping, feeling blue, trouble in relaxing, being moody, and crying, respectively. We then compute the mean level of depressive symptoms for each adolescent, with higher scores indicating greater depressive symptoms ($\alpha = .82$).[6]

Next, we create three measures for peer depression. For its central tendency, we calculate the median levels of depressive symptoms across grade peers since, as shown earlier, they have a positively skewed distribution. To capture the upper and lower tails of the distribution of peer depression, we assign each adolescent to a percentile on the whole distribution of depressive symptoms from our study sample. Then, for each grade cohort, we compute the percentage of peers above the 95th percentile (top 5%) or below the 5th percentile (bottom 5%) of this whole distribution of depressive symptoms.[7] In the analysis, we treat peers at the top 5% and bottom 5% as highly depressive peers and nondepressive peers, respectively, although we also find that using different thresholds (e.g., 10%) does not alter the results. With this specification, our study differentiates the impacts of peers with varying degrees of depressive symptoms on adolescent depression.

For peer groups at other levels, we construct peer depression measures in the analogous fashion to those for grademates. As mentioned earlier, we consider local positions, extracurricular activity groups, and egocentric friendship networks. We identify coursemates if adolescents belong to the same

[6] Note that the Add Health in-school survey does not provide comparable items on depressive symptoms to those available in the wave 2 in-home survey. We construct our measures of peer depression from these six items, as they closely reflect the original items that are used to create the CES-D index.

[7] The mean levels of depressive symptoms for top 5% and bottom 5% are 2.67 and 0, respectively.

local position for the school years 1994–95 or 1995–96. We employ the unweighted local position with reassignment of students whose original local position contained one or no other students and transfer students who were missing an original local position (Frank et al. 2008). For extracurricular activity groups, we apply a similar strategy to identify clubmates if students participated in the same extracurricular activity group across 33 different activities at least one time. We drop those who did not participate in any club activity in their schools in the analysis because their peer depression measures are missing. Finally, we use self-reported friendship nominations from the in-school survey to construct friendship groups, considering both in- and out-degree friendship nominations. Note that, unlike grademates and coursemates, clubmates and friendship groups are egocentric and vary across adolescents. In the analysis, we contrast effects of peer depression on adolescent depressive symptoms across these multiple layers of peer groups.

Parent-child attachment.—Another main explanatory variable in our analysis is adolescents' attachment to parents, measured in the in-school survey. Parent-child attachment is measured with the mean level of the responses, ranging from 1 ("not at all") to 5 ("very much"), to two items (a = .66): "How close do you feel to your parents?"; and "How much do you think parents care about you?" Adolescents living with two parents are assigned the average scores on both parents, whereas adolescents living with one parent are assigned the score on that parent. Higher scores indicate greater attachments.

Covariates.—We construct a rich array of individual-, family-, and peer-level covariates, measured either in the wave 1 in-home or in the in-school survey. Our empirical models include these covariates for two reasons: (1) they represent key sociodemographic differences in adolescent depression, and (2) peer-level covariates control for compositional differences across peer groups that may confound the effects of our peer depression measures. Inclusion of these covariates thus increases the precision of our estimates for the effects of the main explanatory variables.

Individual-level covariates consist of gender (1 if female; 0 if male), race/ethnicity (white, black, Hispanic, or other), immigration status (first, second, and third or higher generation), the AHPVT score, lagged depressive symptom score, and school grade (7–12). The AHPVT is an abridged, age-standardized version of the Peabody Picture Vocabulary Test-Revised, which has been used as a measure of cognitive ability. Adolescents' lagged depressive symptom score is based on the same items used to construct our peer depression measures. For consistency with our peer depression measures, we convert it to a percentile rank in their peer group. Family-level covariates include family structure (two biological parent family, stepparent family, single-mother family, or other family types [e.g., single-father, foster, or

surrogate parent families]), parental education, public assistance receipt (1 if yes; 0 if no), and sibship size. We measure parental education by the highest number of years of education completed by either parent.

For peer-level covariates, we construct within-school grade-level characteristics including gender (female), racial/ethnicity (white, black, Hispanic, and other), immigration status (firs, second, and third or higher generation), and family structure (two-parent family, single-mother family, and other family type), all of which are measured in percentages; mean years of parental education; and grade cohort size. We also construct these peer-level covariates in the same manner when considering peer groups defined at other levels as described earlier. Table 1 reports descriptive statistics of the main study variables used in the analysis.

Analysis Plan

In the literature on peer influence, making valid inferences about peer effects has been of utmost concern as observed peer effects may be driven by nonrandom selection, common shocks, and simultaneity (Manski 1995). First, adolescents typically form and maintain their peer groups on the basis of homophily, that is, the similarities between them (McPherson, Smith-Lovin, and Cook 2001). Students' sorting into classrooms and schools is also likely to be nonrandom. In the U.S. educational system, there is ample evidence that school administrators, teachers, and parents exercise authority over classroom assignment, which results in nonrandom mixing or grouping of students (Hoxby 2000*a*; Epple and Romano 2011; Sacerdote 2011; Legewie and DiPrete 2012). Moreover, families' residential and school choice demarcates the range of adolescents' relationship with peers.

Second, peer effects may arise from common shocks. For example, when adolescents attend the same school, they are exposed to the same school-specific policies (e.g., discipline policy) and share the same demographic composition (e.g., gender, race/ethnicity, social class) of the school. In such cases, peer effects may stem from the observed and unobserved attributes of the common environment in which adolescents and their peers are embedded, rather than from peer influence per se. Third, simultaneity refers to the reciprocal and simultaneous processes of interpersonal influence among adolescents. This means that peer effects may be due in part to a reflection of one's effects on peers, not the other way around.

All these inferential threats point out that estimates from conventional models ought to be interpreted with caution. Against this background, we deploy within-school across-grade models to account for these issues. The premise of our models hinges on the assumption that variation in peer depression, which arises from grade-to-grade fluctuations within schools, is likely

TABLE 1
DESCRIPTIVE STATISTICS FOR STUDY VARIABLES

Variable	Mean/%	SD	Min	Q1	Median	Q3	Max
Dependent variable:							
CES-D index	10.35	7.41	0	5	9	14	50
Main independent variables:							
Peer depression:							
Median	.85	.21	.33	.67	.83	1	1.67
% of top 5%	5.16	2.79	0	3.45	4.95	6.67	23.81
% of bottom 5%	11.97	5.11	0	8.33	11.21	15.46	33.33
Parent-child attachment	4.73	.59	1	5	5	5	5
Individual- and family-level covariates:							
Female	.53	.50					
Race/ethnicity:							
White	.72	.45					
Black	.13	.34					
Hispanic	.09	.29					
Other	.05	.23					
Immigrant generation:							
First	.05	.22					
Second	.09	.29					
Third+	.85	.35					
Family structure:							
Two biological parents	.60	.49					
Stepparent	.17	.38					
Single mother	.19	.39					
Other type	.04	.20					
Parental education	14.00	2.37	0	12	14	16	18
Public assistance receipt	.09	.29					
Sibship size	2.51	1.33	1	2	2	3	14
AHPVT score	103.15	13.59	14	94	104	113	138
Prior depression: percentage rank in peer group	48.49	30.00	.17	23.08	48.89	73.91	100
School grade:							
7	.20	.40					
8	.19	.39					
9	.20	.40					
10	.20	.40					
11	.17	.37					
12	.04	.19					
Peer-level Covariates:							
% female	49.88	7.48	0	47.38	50.10	53.41	83.33
% white	69.16	27.62	0	48.70	81.38	91.21	100.00
% black	16.11	23.01	0	.87	5.37	24.62	100.00
% Hispanic	12.23	15.42	0	3.21	6.25	15.15	97.53
% other	7.57	8.00	0	2.27	5.02	9.96	50.00
% first generation	4.52	8.76	0	.00	1.33	3.85	64.74
% second generation	8.59	9.67	0	2.38	4.92	10.23	46.58
% third+ generation	86.89	17.24	1.9	85.65	93.59	96.92	100.00
% two-parent family	72.87	11.06	37.1	67.29	74.66	79.62	100.00
% single-mother family	22.49	8.90	0	17.36	21.18	26.95	53.19
% other family type	6.36	4.24	0	3.05	5.76	9.00	50.00
Mean parental education	13.95	.85	10.5	13.40	13.84	14.41	17.39
Grade cohort size	211.21	136.86	3	115	187	263	697

NOTE.—N = 8,290. Weighted means and percentages are shown.

random.[8] In other words, students' assignment into a school grade is not driven by individual-, family-, and school-level attributes. Studies demonstrate that students' and their families' preference for schools is grounded in the characteristics of the school as a whole, rather than in those of the grade cohorts in that school (Hoxby 2000*b*; Angrist and Lang 2004). In addition, by comparing grade peers within the same school, our models effectively account for the bias due to common shocks. Finally, our models address the problem of simultaneity by treating adolescents' current depressive symptoms as a function of their peers' and own prior depressive symptoms.[9]

Despite these analytical strengths, several concerns about the within-school across-grade approach could remain as it is a variant of fixed-effects models.[10] One concern about fixed-effects models is that measurement error—and unusual variations by extension—regarding peer depression may lead these models to produce biased estimates (e.g., see Angrist and Pischke 2009; Angrist 2014). We note, however, that information about students' grade-level characteristics is obtained from official school rosters, and in particular, peers' depressive symptoms are constructed directly from peers' own reports, not from ego's reports. Feld and Zölitz (2017) also demonstrate that classical measurement error does not give rise to overstating peer effects in a setting where group assignment is random. As described above, we view assignment to a grade within schools as good as random. We further show that that is likely the case through a number of sensitivity checks, which are detailed below.

Another concern is the possibility that school-level common shocks may still render peer effects spurious. This can occur when both peer predictors and outcome are measured at the same time (Angrist and Pischke 2009). Angrist and Pischke (2009, p. 196), however, also clarify that "using a peer characteristic that predates the outcome prevents peer effect from being affected by group-level common shocks." Our approach fits this requirement, as all of the peer predictors in this study are measured in the in-school survey, which was conducted prior to the wave 2 survey when the outcome, adolescents' depressive symptoms, was observed.

In the analysis, we estimate two models, one based on multivariate regression models and the other based on within-school across-grade models. Our

[8] Some studies have adopted similar approaches to estimating peer effects on students' academic achievement and health behaviors (e.g., Hoxby 2000*a*; Angrist and Lang 2004; Bifulco, Fletcher, and Ross 2011; Fletcher 2012).

[9] We acknowledge that using lagged measures would not completely resolve the simultaneity problem. Add Health allows for examining only a relatively short time window (on average, 1 year apart), preventing us from fully exploring lag structure. Despite this limitation, our study makes temporal ordering explicit: controlling for one's prior behavior, his/her current behavior cannot affect their peers' prior behavior (Clark and Lohéac 2007).

[10] We thank an anonymous reviewer for bringing these issues to our attention.

models for the effects of peer depression on adolescents' depressive symptoms can be fully written as follows:

$$Y_{igs}^{t} = \beta_1 M_{gs}^{t-1} + \beta_2 T_{gs}^{t-1} + \beta_3 B_{gs}^{t-1} + \gamma A_{igs}^{t-1} + \boldsymbol{X}_{igs}^{t-1}\delta + \boldsymbol{P}_{gs}^{t-1}\pi + \lambda_g + \alpha_s + \varepsilon_{igs}. \quad (1)$$

In equation 1, the CES-D score at time t for adolescent i in grade g in school s (Y) is a function of the median level of peer depression (M), the fractions of grade peers in the top and bottom 5% in the whole distribution of depressive symptoms (T and B), parent-child attachment (A), a vector of individual and family-level covariates ($\boldsymbol{X}$), a vector of peer-level covariates ($\boldsymbol{P}$), all of which are measured at time $t - 1$, grade-fixed effects (λ), school-fixed effects (α), and the idiosyncratic error term (ε). The main parameter estimates of interest are β's, which capture the effects of mildly, highly, and nondepressive peers. Given equation 1, a main difference between the multivariate regression and within-school across-grade models lies in their treatment of the term for school fixed effects. Whereas the former omits the term so that it obtains estimates from comparisons across grades and across schools, the latter includes the term so that it obtains estimates from comparisons across grades but within schools. The discussion above about analytic strategy indicates that it is useful to compare estimates between multivariate regression and within-school across-grade models. The extent of agreement between the two models helps interpret the credibility of our estimates of the effects of peer depression.

Next, we estimate a series of models where all peer-level explanatory variables based on grademates are replaced with those based on peer groups at other layers, including local positions, extracurricular activity groups, and friendship networks. The contrast across these peer groups allows us to gain insights into the role of peer depression in adolescent mental health in the context of multilayered peer groupings. Our analysis then estimates the differential effects of grade-level peer depression by adolescents' attachment to parents. We run full interaction models where parent-child attachment (A) interacts with our peer depression measures (β's) and all other covariates. Throughout the analysis, we use sampling weights and standard errors adjusted for clustering to account for design effects in the sampling of Add Health (Chantala and Tabor 1999).[11]

We carry out a number of supplementary analyses to check the sensitivity of our estimates. First, Altonji, Elder, and Taber (2005) suggest that if a treatment effect changes substantially as more observed characteristics are introduced, then its effect is also likely sensitive to selection on unobserved characteristics. Drawing upon this idea, we evaluate changes in the effect of grade-level peer

[11] We use wave 2 weights for statistical models to predict the wave 2 CES-D index and wave 1 weights for the balancing tests, described below, for the in-school peer depression measures.

depression by increasing the number of covariates in a progressive fashion. Little change in its magnitude and statistical significance across different model specifications would indicate that unobserved heterogeneity is less likely to bias our results. Second, we conduct a balancing test to assess correlations between our peer depression measures and observed covariates. Insignificant correlations imply that selection into grades within schools is likely random with regard to those observed characteristics.

Third, we implement a falsification test that compares treatment effects with placebo effects. As explained above, the treatment effects are estimated using the measures of peer depression constructed from adolescents' true grade cohort within the same school. In contrast, the placebo effects are estimated by replacing our peer depression measures with the measures based on false grade cohorts. The idea behind these placebo effects is as follows: if there are unobserved common factors that simultaneously affect adjacent and/or other grade cohorts, then students will be influenced by peer depression in different grade cohorts to which they do not belong. We obtain these placebo peer depression measures (and all other peer-level covariates) from other grade levels within the same school. We generate 1,000 data sets and reestimate the effect of these false peer depression measures on adolescent depressive symptoms. Our falsification test thus allows us to assess the observed treatment effect estimates against the simulated distribution of the placebo effect estimates. If the treatment effect estimate is found within standard probability limits (e.g., 95% intervals), the effect of peer depression is likely driven by common unobserved factors across grades. However, if the treatment effect estimate is found well beyond such probability limits, unobserved selection factors would not drive our estimates based on adolescents' actual grade cohort.

RESULTS

Results for Main Effects

We begin by describing how the distributional characteristics of depressive symptoms among grade peers are linked to adolescents' subsequent depressive symptoms. Figure 2 presents binned scatterplots with linear fit lines and 95% confidence intervals, which show that exposure to nondepressive peers and the median level of peer depression are not associated with adolescents' CES-D scores. In contrast, exposure to highly depressive peers clearly increases their depressive symptoms. These descriptive findings suggest that an exclusive focus on the central tendency of peer depression is not likely to grasp its role in adolescent mental health. When adolescents are exposed to a broad and wide peer environment, the distributional features of peer depression become crucial for identification of peer effects.

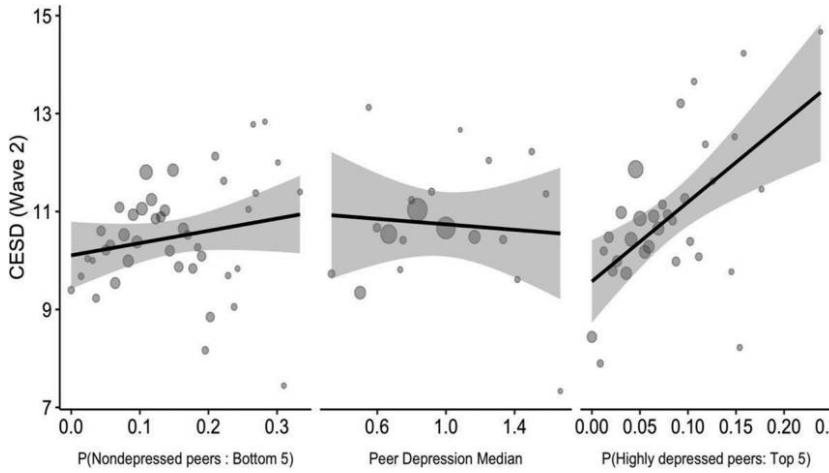

FIG. 2.—Bivariate relationships between peer depression measures and adolescent depressive symptoms. Binned scatterplots are drawn with linear fits and 95% confidence intervals.

Table 2 reports results from our multivariate regression models (models 1–3) and within-school across-grade models (models 4–6) that estimate the effects of grade-level peer depression on adolescent depressive symptoms (see app. table A1 for the full results). Throughout all models, we adjust for individual- and family-level covariates alongside grade dummy variables. Starting with our multivariate regression models, model 1 shows that the effect of the central tendency of peer depression is statistically insignificant and imprecisely estimated. This finding is consistent across all subsequent models. Meanwhile, we find that the effect of the fraction of peers at the top 5% in the distribution of depressive symptoms is significant and substantial. A 10% increase in the fraction of highly depressive peers results in a 1.04-point increase($= .104 \times 10$) in adolescents' subsequent depressive symptoms. Substantively, this effect estimate corresponds in size to approximately one-seventh of a standard deviation in CES-D score ($= 7.41$; see table 1). However, exposure to nondepressive peers (bottom 5%) is found to have little impact on adolescent mental health ($b = -.004, p = .901$). These results contradict the assumption of symmetric effects. While greater exposure to highly depressive peers leads to a higher level of depressive symptoms among adolescents, greater exposure to mildly and nondepressive peers neither changes nor reduces significantly the levels of adolescents' depressive symptoms. Additionally, model 1 suggests that a higher level of parent-child attachment is strongly associated with a lower level of adolescent depression ($b = -1.852, P < .001$), which is consistent with prior research.

TABLE 2
EFFECTS OF PEER DEPRESSION ON ADOLESCENT DEPRESSIVE SYMPTOMS

	MODEL					
	1	2	3	4	5	6
Peer depression:						
Median	−.274	−.123	−.461	−.157	−.038	−.205
	(.812)	(.764)	(.779)	(.990)	(.938)	(.999)
% of highly depressive peers (top 5%)	.104*	.106*	.110*	.151**	.144**	.164**
	(.048)	(.045)	(.045)	(.055)	(.053)	(.054)
% of nondepressive peers (bottom 5%)	−.004	−.002	.011	−.008	−.006	−.017
	(.031)	(.030)	(.032)	(.035)	(.033)	(.035)
Parent-child attachment	−1.852***	−1.115***	−1.112***	−1.831***	−1.060***	−1.078***
	(.198)	(.192)	(.191)	(.197)	(.190)	(.191)
Prior depressive symptoms (percentage rank in peer group)		.083***	.084***		.084***	.084***
		(.004)	(.004)		(.004)	(.004)
Individual and family covariates	✓	✓	✓	✓	✓	✓
Grade dummies	✓	✓	✓	✓	✓	✓
School dummies				✓	✓	✓
Peer covariates			✓			✓
Adjusted R^2	.103	.202	.205	.120	.220	.221

NOTE.—$N = 8{,}290$. SEs (in parentheses) are adjusted for school-level clustering.
* $P < .05$ (two-tailed tests).
** $P < .01$.
*** $P < .001$.

The findings from model 1 hold true even after adjusting for other confounders. As shown in model 2, not surprisingly, adolescents' predisposition to depression is significantly associated with their subsequent depressive symptoms ($b = .083$, $P < .001$). Still, highly depressive peers exert strong influence on adolescents' depressive symptoms ($b = .106$, $P < .05$). In model 3, we introduce peer-level covariates to examine whether the effects of peer depression are driven by differences in the socioeconomic composition and the size of grademates. We find that the effect of greater exposure to highly depressive peers persists ($b = .11$, $P < .05$).

Next, we turn to results from our within-school across-grade models. Models 4–6 show that the effects of the median level of peer depression and exposure to nondepressive peers are again weak and statistically insignificant. The impact of peer depression on adolescent mental health is largely driven by exposure to highly depressive peers. Compared to the estimates from the multivariate regression models, the estimates from the within-school across-grade models become slightly larger in magnitude and stronger in significance. Model 4 estimates that a 10% increase in the fraction of highly depressive peers raises adolescents' CES-D score by 1.51 points ($= .151 \times 10$), which is statistically significant at the .01 level. In model 5, we find that controlling for adolescents' depressive symptoms does not alter the effect of exposure to highly depressive peers ($b = .144$, $P < .01$). Finally, model 6 reports that greater exposure to highly depressive peers increases adolescents' depressive symptoms even after holding peer-level covariates constant ($b = .164$, $P < .01$). What is remarkable in these findings is that both multivariate regression and within-school across-grade models yield estimates substantively similar to one another. It is reassuring to find a high degree of consistency across models, as the estimates are robust against selection of statistical models. Throughout all model specifications, it is clear that exposure to highly depressive peers drives the impact of peer depression on adolescents' depressive symptoms.

To sum up, the results reported in table 2 illuminate the ways in which the distributional characteristics of depressive symptoms among grademates shape adolescent mental health. First, we find that the central tendency of peer depression has little impact on individual adolescents' depressive symptoms. Second, our results show that the effects of highly depressive and nondepressive peers are asymmetric with regard to adolescent depression. Greater exposure to highly depressive peers significantly increases adolescents' depressive symptoms, but this result does not mean greater exposure to nondepressive peers lowers them. Peer influence on adolescent depression is mainly attributable to the extent to which adolescents are exposed to highly depressive peers rather than to nondepressive peers. Taken together, these findings suggest that the distributional dimensions of peer depression are key to understanding how peers influence adolescent mental health.

Results from Multiple Layers of Peer Groupings

Adolescents are surrounded by multiple layers of peer groups, including not only grade peers but also other peers such as coursemates, clubmates, and friends. It is thus essential to examine how adolescents are affected by the central tendency and/or the tails of the distribution of peer depression across different layers of peer groups. Table 3 reports results from our within-school across-grade models in which the measures of peer depression are constructed from local positions, extracurricular activity groups, and friendship networks. For the purpose of comparison, we present in model 1 the estimates based on grademates shown in model 6 in table 2.

We first estimate the effects of the distributional characteristics of depressive symptoms among coursemates on adolescent depression. Model 2 in table 3 indicates that a one-unit increase in the median level of peer depression raises adolescents' CES-D score by 2.135 points, and its effect is marginally significant ($P < .10$). On the other hand, a 10% increase in the fraction of highly depressive peers is insignificantly associated with a 0.3-point increase

TABLE 3
EFFECTS OF PEER DEPRESSION ON ADOLESCENT DEPRESSIVE SYMPTOMS, BY TYPE OF PEER GROUP

Type of Peer Group	Grade	Local Position	Extracurricular Activity	Friendship
Peer depression:				
Median	−.205	2.135+	2.260***	1.650***
	(.999)	(1.269)	(.660)	(.354)
% of highly depressive peers (top 5%)	.164**	.030	.020	.044*
	(.054)	(.056)	(.028)	(.018)
% of nondepressive peers (bottom 5%)	−.017	−.050	.005	−.011
	(.035)	(.040)	(.016)	(.010)
Parent-child attachment	−1.078***	−.917**	−1.001***	−1.173***
	(.191)	(.284)	(.216)	(.197)
Prior depressive symptoms (% rank in peer group)	.084***	.083***	.070***	.065***
	(.004)	(.006)	(.004)	(.004)
Individual and family covariates	✓	✓	✓	✓
Grade dummies	✓	✓	✓	✓
School dummies	✓	✓	✓	✓
Peer covariates	✓	✓	✓	✓
Adjusted R^2	.221	.197	.209	.206
N	8,290	3,854	6,445	7,831

NOTE.—SEs (in parentheses) are adjusted for school-level clustering.
+ $P < .10$ (two-tailed tests).
* $P < .05$.
** $P < .01$.
*** $P < .001$.

in adolescents' depressive symptoms ($P = .592$). Exposure to nondepressive peers has a small and insignificant impact on adolescent depression ($b = -.05$, $P = .208$). These findings, however, should be interpreted with caution because the sample on which the estimation is based is substantially smaller in size ($n = 3{,}854$) than other estimation samples, which range from 6,445 to 8,290. The results suggest that the central tendency of peer depression may play a greater role than exposure to highly depressive peers among the same local positions.

Next, we estimate the impacts of peer depression from extracurricular activity groups. We find that the influence of peer depression on adolescent mental health operates mostly through its central tendency. A one-unit increase in the median level of peer depression increases adolescents' depressive symptoms by 2.26 points, which is highly significant at the .001 level. However, exposure to highly depressive or nondepressive peers does not affect adolescent depression ($b = .02$, $P = .459$ and $b = .005$, $P = .744$). Lastly, model 4 reports the results based on friendship networks, showing that the central tendency of peer depression and, to a lesser degree, exposure to highly depressive peers are positively associated with adolescents' mental health. A one-unit increase in the median level of peer depression and a 10% increase in the fraction of highly depressive peers bring about a 1.65-point ($P < .001$) and a .44-point ($P < .05$) increase, respectively, in adolescents' depressive symptoms. Greater exposure to nondepressive peers, meanwhile, has little impact.

In summary, the findings from table 3 elucidate how the impacts of peer depression across multiple layers of peer groups unfold according to the intersection of organizational arrangement and self-selection. On the one hand, the results from grademates show that peer influence from an institutionally imposed peer group, over which adolescents exert little control, is due to greater exposure to highly depressive peers. On the other hand, the results from peer groups at other levels pinpoint that the normative tendency of peer depression is a better predictor of adolescent depression in cases where adolescents are able to self-select into a peer group under structural constraints. One exception is the significant influence of exposure to highly depressive peers in friendship networks. We note that friendships are formed not only through out-degree nominations but also through in-degree nominations. In-degree friendships are, by definition, ones that are not directly nominated by a focal adolescent but still part of his/her friendship network, which partly reflect a potential influence of peers whose attitude and behavior are beyond the focal adolescent's affinity. Taken together, our distributional approach reveals a unique role of grade peers vis-à-vis peer groups at other levels in the link between exposure to depressive peers and adolescent mental health.

Results for Differential Effects

Earlier, we contended that for adolescents, parent-child relationship may be activated as one of the crucial coping strategies for peer stressors. Findings from our main analysis (table 2) suggest that adolescents' attachment to parents has a strong impact on their depressive symptoms alongside exposure to highly depressive grademates. We further investigate a buffering role of parent-child relationship to better understand the processes by which grade peers affect adolescent mental health. We reestimate our within-school across-grade models separately for adolescents whose parental attachment is high (above the median) and for adolescents whose parental attachment is low (below the median).[12]

Results appear in table 4 (see app. table A2 for the full results). We find that there are significant interaction effects between exposure to highly depressive peers and parent-child attachment, whereas the effects of the median level of peer depression and exposure to nondepressive peers remain statistically insignificant. Specifically, exposure to highly depressive peers has a greater impact for adolescents whose attachment with parents is low ($b = .356$, $P < .01$). For this group of adolescents, a 10% increase in the fraction of highly depressive peers results in a 3.56-point increase ($= .356 \times 10$) in their subsequent depressive symptoms. This effect estimate is similar in magnitude to about a half standard deviation in CES-D score (see table 1). In contrast, exposure to highly depressive peers has little impact for adolescents whose attachment with parents is high ($b = .092$, $P = .131$).

Figure 3 presents a graphical representation of our interaction models in table 4. We contrast the average margins of subsequent depressive symptoms among adolescents whose exposure to highly depressive peers is high (10%) with those among adolescents whose exposure is low (1%), by high- and low-levels of parent-child attachment. Consistent with the results in table 4, the adverse impact of exposure to highly depressive grademates is significantly greater for adolescents whose parental attachment is low (i.e., 95% confidence intervals do not overlap between high and low exposures to highly depressive peers). The depressive symptoms of these adolescents are more than three points higher when they experience greater exposure to highly depressive peers. However, for adolescents whose parental attachment is high, there is little gap in their subsequent depressive symptom levels regardless of whether exposure to highly depressive grademates is high or low (i.e., 95% confidence intervals overlap).

[12] Given that the majority of adolescents report a high level of attachment to parents (range, 1–5; see table 1), we alternatively define high (above 4) vs. low (below 4) parent-child attachment. A score of 4 corresponds to its 15th percentile value. This measurement does not change our findings (results available upon request).

TABLE 4
Effects of Peer Depression on Adolescent Depressive Symptoms, by Parent-Child Attachment

	Parent-Child Attachment[a]	
	Low	High
Peer depression:		
Median	1.343	−.732
	(2.168)	(1.123)
% of highly depressive peers (top 5%)	.356**	.092
	(.110)	(.061)
% of nondepressive peers (bottom 5%)	.021	−.019
	(.085)	(.039)
Prior depression (% rank in peer group)	.087***	.085***
	(.008)	(.004)
Individual and family covariates	✓	✓
Grade dummies	✓	✓
School dummies	✓	✓
Peer covariates	✓	✓
Adjusted R^2	.214	.218
N	1,935	6,355

Note.—SEs (in parentheses) are adjusted for school-level clustering.
[a] The study sample is split into two groups, one whose parent-child attachment is above the median (high) and the other below the median (low).
* $P < .05$ (two-tailed tests).
** $P < .01$.
*** $P < .001$.

These findings highlight an important way through which the effect of peer depression arises with respect to adolescent mental health. The impact of greater exposure to highly depressive peers is far less pronounced for adolescents who have supportive and intimate relationships with parents. Our findings are thus in accordance with the stress-buffering hypothesis, which posits that higher relationship quality with parents buffers the deleterious impact of peer stressors. The differential effects of peer depression by parent-child attachment illuminate that the influences of peer and family contexts on adolescent mental health are not operating in isolation but in conjunction with one another.

Results from Sensitivity Analysis

In the final step of our analysis, we assess the credibility of our main findings. We are concerned with the assumption underlying our within-school across-grade models: How robust is the assumption that differences in peer depression generated by grade-to-grade variations within schools are exogenous? And how sensitive are our estimates for the effects of peer depression

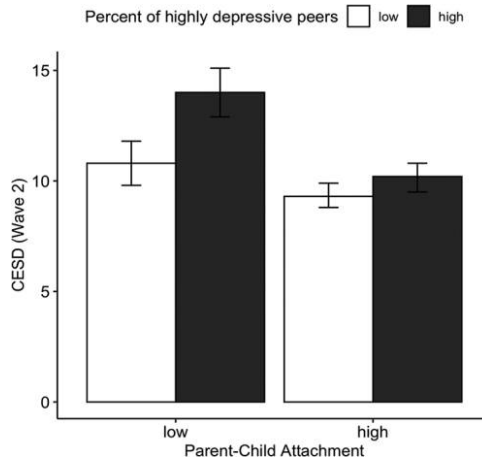

FIG. 3.—Differential effects of exposure to highly depressive peers on adolescent depressive symptoms, by parent-child attachment. Exposure to highly depressive peers is treated as high if their proportion in one's grade peers is 10% and as low if 1%. Parental attachment is treated as high if above the median and as low if below the median.

to various model specifications? To address these issues, we conduct an array of sensitivity analysis.

First, as already shown in table 2, our treatment of a diverse set of covariates does not substantively change the estimate for the effect of exposure to highly depressive peers. To the extent that these covariates are representative of all observed and unobserved covariates (Altonji et al. 2005), the consistency of the estimate in terms of magnitude and statistical significance implies that varying exposures to highly depressive peers are less likely to occur due to unobserved heterogeneity. Indeed, we find that effect sizes and standard errors are similar across models. Second, we deploy a balancing test designed to formally evaluate the randomness of our grade-level peer depression measures. Here we regress each of the peer depression measures on all individual-, family-, and peer-level covariates in the within-school across-grade model, adjusting standard errors for clustering. Appendix table A3 shows that none of the covariates considered in our analysis is statistically significantly associated with our peer depression measures. This finding demonstrates that the distributional characteristics of peer-level depressive symptoms are not governed by selection due to measured attributes.

Third, we investigate potential bias due to unmeasured confounding in estimating the effect of grade-level peer depression on adolescent mental health. As described earlier, our falsification test creates false measures of peer depression. Adolescents are randomly assigned to any other grade cohort than their actual grade cohort within the same school. Based on these false assignments, we reconstruct our peer depression measures as well as all other

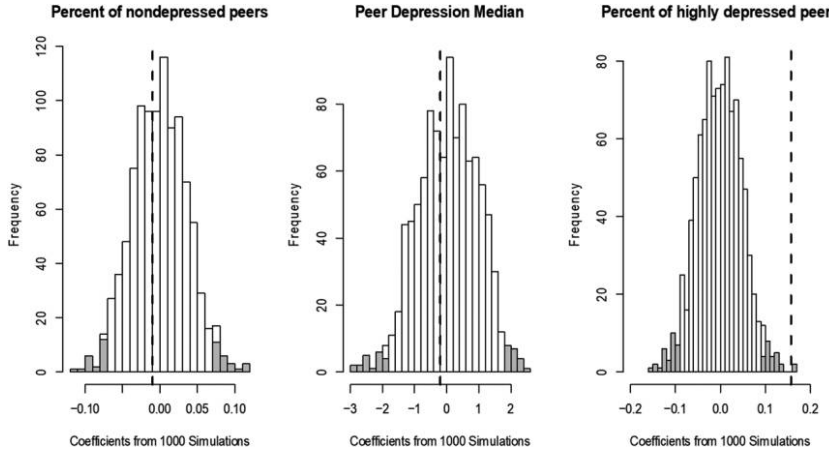

FIG. 4.—Falsification test for effects of peer depression on adolescent depressive symptoms. For each peer depression measure, the estimate based on assignment into actual grade cohort (*vertical line*) is drawn against the distribution of the estimates based on assignments into false grade cohort from 1,000 simulations. Shaded regions denote the estimates outside the 95% probability limit.

peer-level covariates. We generate 1,000 data sets and fit our within-school across-grade model to each of them, thereby producing the distributions of the placebo effect estimates. Figure 4 reveals two important findings. On the one hand, these placebo effect estimates are largely normally distributed with a mean of zero. This suggests that, on average, falsely assigned peer groups do not exert significant influence on the development of adolescent depression. On the other hand, we find that the treatment effect estimates (vertical lines) for the fraction of nondepressive peers and the median level of peer depression are not statistically distinguishable from the placebo effect estimates. In contrast, the treatment effect estimate for the fraction of highly depressive peers is well beyond the 95% probability interval centered around the mean of the placebo effect estimate. These results indicate that, unlike the effects of exposure to nondepressive peers and the central tendency of peer depression, the effect of exposure to highly depressive peers is robust to bias due to common unmeasured factors across grades within schools.[13]

Collectively, our sensitivity analyses indicate that the main findings documented earlier are robust to a variety of inferential threats. We find no evidence that adolescents' sorting across grades within schools occurs systematically according to their observed characteristics. Likewise, the quasi-experimental

[13] The results also suggest that if there still exist spillover effects across grades within schools, our estimate for the effect of exposure to depressive grademates can be deemed conservative. We thank an anonymous reviewer for offering this interpretation.

nature of within-school grade-level variation ensures that the effect of exposure to highly depressive peers is unlikely to be driven by unobserved heterogeneity. The discordance between the treatment and placebo effects corroborates our interpretation that exposure to highly depressive peers is causally related to adolescent depression.

We further run a series of supplementary analyses to address several concerns regarding our model specifications. Table 5 summarizes the results.

TABLE 5
Additional Sensitivity Checks

	Peer Depression		
Specification	Central Tendency	% of Highly Depressive Peers	% of Nondepressive Peers
A. Model 6, table 2	−.205	.164**	−.017
	(.999)	(.054)	(.035)
B. Linear probability model	−.053	.006**	.001
	(.036)	(.002)	(.001)
C. Mean of peer depression	1.229	.129†	−.002
	(1.904)	(.071)	(.038)
D. Top 10% and bottom 10%	−.811	.113**	−.018
	(1.101)	(.043)	(.035)
E. Top 5% and bottom 10%	−.205	.164**	−.017
	(.999)	(.054)	(.035)
F. Top 5% and bottom 15%	−.261	.163**	−.014
	(1.033)	(.053)	(.029)
G. Top 5% and bottom 20%	−.672	.162**	−.027
	(1.177)	(.053)	(.029)
H. Top 5% and bottom 25%	−.672	.162**	−.027
	(1.177)	(.053)	(.029)
I. Excluding focal adolescents	.081	.128*	−.022
	(.992)	(.052)	(.035)
J. Grade or school distribution:			
Grade	−.627	.205***	−.017
	(1.013)	(.053)	(.035)
School	.024	.103+	−.011
	(1.002)	(.053)	(.035)
K. Trimming on grade cohort size:			
Drop large schools[a]	−.272	.122	−.033
	(1.303)	(.066)	(.049)
Drop small schools[b]	−.184	.155**	−.023
	(1.007)	(.054)	(.035)

Note.—SEs (in parentheses) are adjusted for school-level clustering. All models are estimated with grade and school fixed effects and individual, family, and peer covariates (including parent-child attachment and prior depression).

[a] Schools where any grade cohort size is above the 95th percentile (545 students) are dropped.

[b] Schools where any grade cohort size is below the 5th percentile (29 students) are dropped.

+ $P < .10$ (two-tailed tests).

* $P < .05$.

** $P < .01$.

*** $P < .001$.

For the purpose of comparison, we present our main results—model 6 in table 2—in panel A. In panel B, we estimate a linear probability model where the dependent variable is dichotomized in order to identify adolescents who are diagnosed as being clinically depressed.[14] We consider the mean, rather than the median, level of peer depression as its central tendency (panel C). In panels D–H, we examine whether our estimates inadvertently capture outlier effects and are biased by inadequately accounting for the skewness of the distribution of peer depression. We measure the percentages of peers above the 90th percentile (top 10%) or below the lower percentiles (bottom 10%, 15%, 20%, and 25%) of the whole distribution of depressive symptoms from the study sample and reestimate our model accordingly. In our main analysis, we include a focal adolescent when constructing his/her peer group's depression measures. Because this measurement may cause simultaneity, we reconstruct our peer depression measures while excluding the focal adolescent (panel I).

In addition, when measuring the fractions of highly and nondepressive peers in one's peer group, we refer to the whole distribution of depressive symptoms from our study sample. Given the possibility that the ways in which peer depression is distributed may be more context specific, we use the grade- or school-specific distributions of depressive symptoms for gauging the sizes of highly and nondepressive peers in one's grademates (panel J). Lastly, we evaluate the sensitivity of our estimates for the effects of peer depression to grade cohort size by excluding schools with either large or small grade cohort sizes. A grade cohort size is defined as large if it is above the 95th percentile of the distribution of grade cohort size and as small if it is below the 5th percentile (panel K).

The results from table 5 suggest that the estimates from these extensive model specifications are well aligned with our main findings. In all cases, the effects of the central tendency of peer depression and exposure to nondepressive peers have little impact on adolescent depression. However, we are able to reject the null hypothesis that the effect of exposure to highly depressive peers is statistically indistinguishable from zero. Our sensitivity checks make clear that the main findings are robust to challenges such as alternative model specifications and measurements.

DISCUSSION

In this article, we draw upon the scholarship on peer influence and adolescent development to advance our understanding of peer effects on adolescent mental health. The primary objective of this study is to provide a distributional

[14] We follow Roberts et al. (1991)'s recommendation that for male and female adolescents, the cutoff points for depression be 22 and 24, respectively.

framework for linking peer depression to adolescents' depressive symptoms while identifying grade peers as a relevant peer group. Our secondary objective is to articulate the multiplicity of interpersonal contexts during adolescence in order to investigate adolescents' differential responses to peer depression by parent-child relationship. To give greater analytic leverage in estimating peer influence on adolescent depression, we deploy within-school across-grade models and conduct an extensive set of sensitivity analyses.

A central finding of our analysis is that depressive symptoms among grademates have asymmetric effects on adolescent mental health. The results show that the impact of peer depression is entirely driven by adolescents' exposure to highly depressive peers. By contrast, the central tendency of peer depression and exposure to nondepressive peers have little effect on adolescent depression. These nonlinear results turn the central tendency approach on its head: increases in adolescents' depressive symptoms resulting from greater exposure to highly depressive peers do not mechanically translate into a decrease in their depressive symptoms resulting from greater exposure to nondepressive peers. Our findings offer caution against the approach based solely on the central tendency of peer depression. When the shape of the distribution of peer depression varies significantly across peer groups, one needs to recognize its central tendency in the context of the configuration of peer composition.

Our results clarify the role of depressive peers in relation to other peers with lower levels of depressive symptoms. While rates of adolescent depression have been rising, there is a still relatively small number of adolescents who are highly depressed in any given peer environment (Mojtabai et al. 2016). Moreover, previous research has shown that highly depressive adolescents are often isolated and rejected from their peers (Schaefer et al. 2011). How then do depressive peers affect other students' mental health despite their small size and social remoteness? Social diffusion processes point out that an increase in the fraction of depressive peers leads to more heterogeneous peer interactions by making alternative attitudinal and behavioral models readily available. Greater exposure to depressive peers thus may induce continual social psychological distress among adolescents, reinforcing negative affect and cognition regarding routine and unforeseen events. However, greater exposure to nondepressive peers would not counteract the impact of exposure to depressive peers. Given the preponderance of nondepressive peers in most peer environments, their influence is likely to be proportionately smaller than that of depressive peers. Our findings from grade peers are congruent with these social diffusion processes.

In addition, this study contributes to broadening the conceptualization and operationalization of peer groups by specifying the role of grademates in adolescent mental health vis-à-vis peer groups at other layers. Our results underscore that peer groups to which adolescents are exposed are inherently

multilayered. In this respect, understanding how the intersection of organizational arrangement and self-selection governs peer group formation is crucial for disentangling the influence of peers at multiple levels. The comparison of grademates with peer groups at other layers makes this point clear. Grade peers are unique in the sense that they are an institutionally imposed peer group where self-selection is not responsible for its formation. We find that highly depressive grademates play a more salient role in adolescent depression in this peer environment and that this effect transpires within the actual grade cohort of which a focal adolescent is a part. In the meantime, intermediate peer groups such as course taking and extracurricular activity groups are typically shaped on the basis of self-selection under the constraint of organizational arrangement. For such peer groups, we find that the effect of peer depression is largely manifest through its central tendency. This indicates that the influence of depressive coursemates and clubmates is likely to be reflected in the normative climate among these peer groups. Taken together, our study suggests that the impacts of peer depression are predicated on peer group formation and maintenance in terms of organizational arrangement and self-selection.

Finally, we show that the impact of exposure to highly depressive grade peers is contingent on adolescents' relationship with their parents. For adolescents whose parental attachment is low, greater exposure to highly depressive grade peers significantly increases their depressive symptoms. However, for adolescents whose parental attachment is high, their level of depressive symptoms is consistently low irrespective of the degree of exposure to highly depressive grade peers. Adolescents' attachment with parents therefore plays a buffering role in the link between peer depression and their mental health. These findings highlight that the influences of peer and family contexts on adolescent depression are complementary rather than competing. An important ramification of our results is that they specify the cumulative nature of disadvantage in adolescent mental health. Existing evidence documents that socioeconomic disadvantages aggravate the quality of parent-child relationship, which in turn increases adolescents' depressive symptoms (Bradley and Corwyn 2002). The findings indicate that such a process is further magnified when adolescents respond differentially to peer stressor. By simultaneously considering multiple interpersonal contexts for adolescents, our analysis identifies an important condition under which peer depression amplifies inequalities in adolescent mental health.

There are several limitations of our study that warrant further discussion and future research. First, although the findings reported here are consistent with the proposed social diffusion processes described earlier, more research is needed to empirically uncover social psychological mechanisms by which the structure of peer configuration affects adolescent mental health. For example, it would be more than beneficial to collect reliable and valid

measures of discursive/nondiscursive contacts, corumination, and relationship disturbances as potential intervening factors. Second, our research builds on recent literature that goes beyond close-knit peer groups to demonstrate the importance of grade peers for adolescent mental health. What emerges from this line of research is a recognition that adolescents are embedded in peer groups at multiple levels as their primary identity is constructed in schools. Taking this recognition as a stepping-stone, researchers can address ways in which such multilayered peer groups interact with one another. Not only would a better understanding of dynamic interplay across multiple peer groups offer insight into peer influence on adolescent well-being in general, but it would also help identify which particular peer group plays a more pronounced role depending on the outcomes examined.

Third, these discussions ultimately call for more integrative research on peer effects. It is apparent that a more complete picture of peer influence on adolescent mental health is possible only if we can grasp both the distributional configurations of peer depression and the levels of integration within and across peer groups. Given our current knowledge base, little is known about how the configurations of peer composition at multiple levels are linked to the structure of peer networks. Does peer depression matter more for adolescents' mental health when their network structure is integrated and synchronized, fragmented and segregated, or in between? Given the distributional characteristics of peer depression, how can we handle positional attributes of peers in broader networks? Probing questions like these will shed light on how the processes of social influence on adolescent mental health arise on the spectrum of integration and regulation (Bearman 1991; Pescosolido 1994). Obviously, data requirements for this integrative approach should be demanding; nonetheless, gathering and analyzing such integrative data is a promising venue for gaining a fuller picture of peer influence on adolescent development.

With these limitations and future directions in mind, this study has important implications for research and policy on adolescent mental health. Our study extends the burgeoning literature on peer influence by providing a distributional framework for investigating the role of grade peers as an institutionally imposed peer group. Our distributional approach to identifying peer effects on adolescent depression through multilayered peer groups provides new insights into research on emotional contagion. The extant literature mostly relies on linear approximations of social influence, which helps understand how an emotion can spread like a disease. However, when the symmetry assumption of peer effects is not warranted as we have shown, it is critical to tease out the influence of peers at both tails of the distribution in peer groups. Adolescents are often surrounded by peer groups at multiple levels, which consist of a mixture of happy and unhappy, depressive and nondepressive students. For example, the heterogeneity of peer relations may become particularly

salient for online peer groups formed through social media sites and online communities. This article presents a unified framework for studying the role of such heterogeneous peer environments in emotional contagion processes.

In addition, our analysis attests to the significant impact of exposure to depressive grade peers on adolescent depression. This result suggests that direct treatment interventions for highly depressive students would have a social multiplier effect. Our findings further indicate that such interventions would be more fruitful if combined with a focus on students who are socially and emotionally detached from their family. Concerted interventions for the "doubly disadvantaged" youth can provide an effective way to reduce health inequalities in adolescence by enhancing their overall health status and at the same time by benefiting the entire student bodies.

APPENDIX A

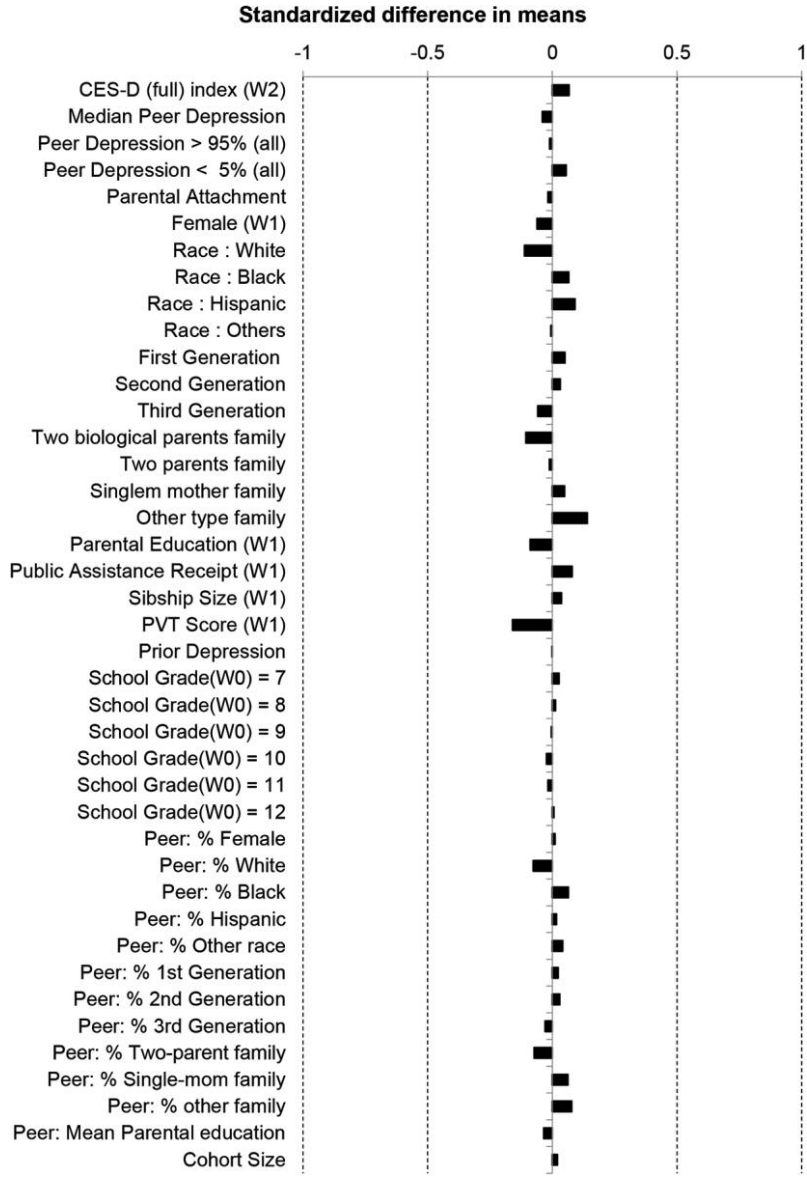

FIG. A1.—Standardized difference in means for baseline and study samples.

TABLE A1
EFFECTS OF PEER DEPRESSION ON ADOLESCENT DEPRESSIVE SYMPTOMS

	MODEL					
	1	2	3	4	5	6
Peer depression:						
Median	−.274	−.123	−.461	2.157	−.038	−.205
	(.812)	(.764)	(.779)	(.990)	(.938)	(.999)
% of highly depressive peers (top 5%)	.104*	.106*	.110*		.144**	.164**
	(.048)	(.045)	(.045)	(.055)	(.053)	(.054)
% of nondepressive peers (bottom 5%)	−.004	−.002	.011	−.008	−.006	−.017
	(.031)	(.030)	(.032)	(.035)	(.033)	(.035)
Parent-child attachment	−1.852***	−1.115***	−1.112***	−1.831***	−1.060***	−1.078***
	(.198)	(.192)	(.191)	(.197)	(.190)	(.191)
Prior depressive symptoms (% rank in peer group)		.083	.084***		.084***	.084***
		(.004)	(.004)		(.004)	(.004)
Individual- and family-level covariates:						
Female	1.733***	.182	.188	1.736***	.151	.149
	(.214)	(.218)	(.217)	(.211)	(.216)	(.216)
White (ref.)						
Black	.470	.717*	1.288***	.935*	1.284***	1.300***
	(.341)	(.313)	(.373)	(.404)	(.374)	(.373)
Hispanic	1.789***	2.061***	1.942***	1.530**	1.871***	1.909***
	(.448)	(.422)	(.462)	(.492)	(.459)	(.458)
Other	2.338***	2.192***	1.836***	1.676**	1.551**	1.506**
	(.519)	(.491)	(.495)	(.559)	(.524)	(.522)
First generation	−.875	−.648	−.723	−.904	−.596	−.600
	(.536)	(.499)	(.507)	(.553)	(.517)	(.516)
Second generation	−1.029**	−1.108**	−1.198**	−1.139**	−1.161**	−1.149**
	(.391)	(.373)	(.375)	(.397)	(.376)	(.375)

Third+ generation (ref.)						
Two biological parents (ref)						
Stepparent	.626+	.540+	.497+	.580+	.459	.467
	(.320)	(.301)	(.300)	(.322)	(.301)	(.301)
Single mother	.648*	.351	.329	.641*	.330	.319
	(.326)	(.299)	(.298)	(.325)	(.299)	(.299)
Other type	1.120+	1.105*	1.007+	1.037+	1.028+	1.031*
	(.590)	(.534)	(.534)	(.579)	(.525)	(.525)
Parental education	−.203***	−.187***	−.189***	−.224***	−.208***	−.201***
	(.048)	(.045)	(.046)	(.049)	(.045)	(.045)
Public assistance receipt	.742+	.617	.638	.665	.576	.600
	(.445)	(.432)	(.428)	(.448)	(.432)	(.431)
Sibship size	.221*	.216**	.221**	.229**	.215**	.212**
	(.089)	(.084)	(.084)	(.087)	(.082)	(.082)
AHPVT score	−.077***	−.084***	−.086***	−.074***	−.082***	−.083***
	(.009)	(.008)	(.009)	(.009)	(.009)	(.009)
Peer-level covariates:						
% female			−.012			−.021
			(.014)			(0.24)
% white (ref.)						
% black			−.023*			.034
			(.009)			(.037)
% Hispanic			−.028			.053
			(.018)			(.049)
% other			.016			.029
			(.030)			(.050)
% first generation			−.033+			−.111+
			(.018)			(.065)
% second generation			.067***			−.004
			(.020)			(.051)
% third+ generation (ref.)						
% two-parent family (ref.)						

TABLE A1 (*Continued*)

	Model					
	1	2	3	4	5	6
% single-mother family			.023			−.010
			(.022)			(.031)
% other family type			.043			−.047
			(.034)			(.044)
Mean parental education			−.030			−.030
			(.142)			(.476)
Grade cohort size			.001			−.006+
			(.001)			(.004)
Constant	26.704***	20.345***	20.580***	26.418***	20.094***	22.836**
	(1.698)	(1.659)	(2.758)	(1.740)	(1.701)	(8.280)
Grade dummies	✓	✓	✓	✓	✓	✓
School dummies				✓	✓	✓
Adjusted R^2	.103	.202	.205	.120	.220	.221

NOTE.—$N = 8{,}290$. SEs (in parentheses) are adjusted for school-level clustering.

\+ $P < .10$ (two-tailed tests).

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE A2

EFFECTS OF PEER DEPRESSION ON ADOLESCENT DEPRESSIVE SYMPTOMS, BY PARENT-CHILD ATTACHMENT

	PARENT-CHILD ATTACHMENT[a]	
	Low	High
Peer depression:		
Median	1.343	−.732
	(2.168)	(1.123)
% of highly depressive peers (top 5%)	.356**	.092
	(.110)	(.061)
% of nondepressive peers (bottom 5%)	.021	−.019
	(.085)	(.039)
Prior depression (% rank in peer group)	.087***	.085***
	(.008)	(.004)
Individual- and family-level covariates:		
Female	−.453	.289
	(.523)	(.235)
White (ref.)		
Black	.867	1.599***
	(.907)	(.413)
Hispanic	2.010*	1.941***
	(.925)	(.531)
Other	2.491*	1.399*
	(1.101)	(.596)
First generation	−.142	−.660
	(1.136)	(.572)
Second generation	−1.116	−1.175**
	(.923)	(.400)
Third+ generation (ref.)		
Two biological parents (ref.)		
Stepparent	.346	.672+
	(.589)	(.362)
Single mother	1.326*	.102
	(.638)	(.342)
Other type	1.369	.771
	(1.205)	(.546)
Parental education	−.252*	−.195***
	(.109)	(.049)
Public assistance receipt	−.155	.810
	(.805)	(.510)
Sibship size	.252	.190*
	(.178)	(.092)
AHPVT score	−.089***	−.083***
	(.020)	(.010)
Peer-level covariates:		
% female	.093	−.045+
	(.056)	(.026)
% white (ref.)		
% black	−.048	.054
	(.088)	(.040)
% Hispanic	−.018	.089
	(.100)	(.056)

TABLE A2 (*Continued*)

	Parent-Child Attachment[a]	
	Low	High
% other	.077	.004
	(.100)	(.057)
% first generation	−.126	−.117
	(.140)	(.073)
% Second generation	.031	−.013
	(.094)	(.057)
% third+ generation (ref.)		
% two-parent family (ref.)		
% single-mother family	.052	−.035
	(.068)	(.036)
% other family type	−.044	−.072
	(.090)	(.051)
Mean parental education	−.531	−.088
	(1.036)	(.538)
Grade cohort size	−.007	−.007+
	(.010)	(.004)
Constant	18.682	20.569*
	(17.126)	(9.246)
Grade dummies	✓	✓
School dummies	✓	✓
Adjusted R^2	.214	.218
N	1,935	6,355

NOTE.—SEs (in parentheses) are adjusted for school-level clustering.

[a] The study sample is split into two groups, one whose parent-child attachment is above the median (high) and the other below the median (low).

+ $P < .10$ (two-tailed tests).

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE A3
BALANCING TEST

	Peer Depression		
	Median	% of Highly Depressive Peers	% of Nondepressive Peers
Individual- and family-level covariates:			
Parent-child attachment	−.011	−.075	.130
	(.017)	(.233)	(.251)
Female	−.005	.072	−.145
	(.012)	(.135)	(.411)
White (ref.)			
Black	.006	−.018	−.236
	(.089)	(.848)	(1.335)
Hispanic	−.005	−.114	−.040
	(.094)	(1.282)	(1.607)
Other	.005	−.009	.019
	(.124)	(1.486)	(2.269)

TABLE A3 (*Continued*)

	Peer Depression		
	Median	% of Highly Depressive Peers	% of Nondepressive Peers
First generation	.003	−.126	−.030
	(.085)	(1.253)	(1.472)
Second generation	.001	−.051	−.296
	(.060)	(.744)	(1.030)
Third+ generation (ref.)			
Two biological parents (ref.)			
Stepparent	.004	.046	−.237
	(.021)	(.207)	(.422)
Single mother	.005	−.013	.052
	(.026)	(.290)	(.453)
Other type	.009	.184	.028
	(.030)	(.356)	(.538)
Parental education	−.001	−.013	.017
	(.008)	(.091)	(.122)
Public assistance receipt	.003	.063	−.243
	(.040)	(.441)	(.687)
Sibship size	.001	.013	−.040
	(.009)	(.105)	(.163)
AHPVT score	.000	.002	−.006
	(.001)	(.015)	(.022)
Prior depression (percentage rank in peer group)	−.000	.000	−.001
	(.000)	(.003)	(.004)
Peer-level covariates:			
% female	−.002	.031	−.164
	(.006)	(.067)	(.294)
% white (ref.)			
% black	.003	−.072	−.019
	(.095)	(.930)	(1.492)
% Hispanic	−.002	−.089	.091
	(.050)	(.785)	(.888)
% other	−.011	−.052	−.036
	(.021)	(.231)	(.368)
% first generation	.006	.005	−.218
	(.113)	(1.478)	(2.385)
% second generation	−.004	−.064	−.022
	(.067)	(.787)	(1.227)
% third+ generation (ref.)			
% two-parent family (ref.)			
% single-mother family	−.001	.021	.107
	(.018)	(.218)	(.270)
% other family type	−.012	−.072	.190
	(.019)	(.237)	(.388)
Mean parental education	−.117	−1.176	.372
	(.409)	(4.734)	(7.789)
Grade cohort size	−.001	.000	.020
	(.005)	(.054)	(.094)

Note.—N = 8,290. SEs (in parentheses) are adjusted for school-level clustering. All estimates are obtained from within-school across-grade models.

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