The Effect of Context on Gender Differences in Adolescent Depression

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INTRODUCTION

Depression is a pervasive mental health problem among American youth that is not equally distributed among all adolescents. Replicating a well-documented pattern in adults, research from community samples of adolescents consistently demonstrates that females have higher rates of depression than males (Hasin, Goodwin, Stinson, & Grant, 2005), a disparity that emerges during the adolescent years and persists through adulthood (Kessler, Avenevoli, & Merikangas, 2001; Kessler & Walters, 1998). Theories explaining this gap abound, alternately suggesting that the gender difference in depression is due to a combination of developmental, genetic, social, and environmental factors. In particular, theories related to how individuals are organized in society suggest that disadvantaged groups—females, minorities, the poor, and the very young or very old—suffer a disproportionate exposure to stress in combination with a lack of social and financial resources to counteract the effects of negative life experiences that produce higher levels of depression (Aneshensel, 1992; Aneshensel, Rutter, & Lachenbruch, 1991).

Much of the work involved in translating these conceptual assertions to reality explores the effect of instrumental and psychosocial resources on the association between gender and depression at the individual level. However, such resources exist beyond the individual in the social environment; thus it is reasonable to presume that contextual level resources may similarly be used to understand inequalities in health outcomes (Diez-Roux, 1998). It has long been suspected that the broader social context—that is, the places where people congregate, work, and reside—influences mental health. In recent years, evidence has been gathered to sustain this supposition, particularly as it relates to adolescent depression (Anderman, 2002; Aneshensel &

Sucoff, 1996; Goodman, Huang, Wade, & Kahn, 2003; Torsheim & Wold, 2001; Watt, 2003). Much of this work is descriptive in nature, and assesses the impact of structural aspects of communities (i.e. neighborhoods, schools) such as poverty level (Goodman, Huang, Wade et al., 2003) and ethnic composition (Wight, Aneshensel, Botticello, & Sepulveda, 2005) on symptomatology. This study adds to this growing literature by systematically examining the role of selected contextual factors in understanding the gender disparity in depressive symptoms in order to further elaborate our understanding of the role that the social environment plays in relation to adolescent mental health.

ADOLESCENT DEPRESSION AND THE GENDER GAP

Epidemiological studies uniformly indicate that depression is a serious disorder among youths; the lifetime prevalence of major depressive disorder among adolescents in the general population is estimated as between 15-20% (Birmaher, Ryan, Williamson, Brent, Kaufman, Dahl et al., 1996a; Kessler, Avenevoli, & Merikangas, 2001; Kessler & Walters, 1998). Although depression may originate prior to adolescence, rates of disorder increase substantially during the teenage years (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003), suggesting that adolescence is critical to understanding the factors that place individuals at risk for the disorder—especially as negative experiences at young ages have developmental consequences for future functioning and health (Compas, Hinden, & Gerhardt, 1995). Furthermore, studies of adolescent depression consistently demonstrate that this state is not time-limited but persistent and likely to re-occur, at least through the transition to early adulthood (Birmaher, Ryan, Williamson et al., 1996a; Kandel & Davies, 1986; Kessler, Avenevoli, & Merikangas, 2001; Lewinsohn, Rohde, Klein, & Seeley, 1999; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000; Weissman, Wolk, Goldstein, Moreau,

Adams, & Greenwald, 1999). Evidence suggesting that adolescents experience depressive states that are similar if not identical to those experienced by adults intimate that these states are not only serious, but may be indicative of a lifelong struggle with depression and related impairment (Lewinsohn, Rohde, Klein et al., 1999; Lewinsohn, Rohde, Seeley et al., 2000; Wight, Sepulveda, & Aneshensel, 2004).

The literature also demonstrates that some groups of teens are at increased risk for experiencing depression and related symptomatology more than others. Among the different subgroups disproportionately affected are adolescent girls, with females typically twice as likely as males to be depressed (Birmaher, Ryan, Williamson et al., 1996a; Kessler & Walters, 1998; Nolen-Hoeksema, 1987, 2001). Many of the explanations of this difference implicate experiences from adolescence; particularly, differences in biological maturation between boys and girls as well as the increased importance of physical appearance, interpersonal relationships, and increased risk for stress-inducing negative life events for girls (Cyranowski, Frank, Young, & Shear, 2000; Nolen-Hoeksema, 1987; Siegel, 2002). Alternately, this discrepancy between males and females has been attributed to gender differences in particular symptoms (i.e. increased dysphoria, self-deprecation, and suicidality among females, and irritability among males), and the lack of congruence between symptoms classified as depression and traditional notions of masculinity. Data recently obtained from clinical and community samples, however, does not support these hypotheses related to gender differences in particular symptoms (Kovacs, 2001; Mirowsky & Ross, 1995).

Evidence from *stress process* and *gender role theories* posits that the interchange between stress, psychosocial resources, and traditional gender role responsibilities account for the gender difference in rates of depression, although explanations for adolescent gender

disparities have been extrapolated from models developed for adults and are in the process of being fully articulated (Avison & McAlpine, 1992). In general, these theories posit that higher rates of some disorders are due to the gender stratification of social roles which differentially expose certain groups of individuals to stressful life circumstances that generate distress (Aneshensel, 1992; Aneshensel, Rutter, & Lachenbruch, 1991; Horowitz & White, 1987; Mirowsky, 1996; Pearlin, 1989). Lower status groups such as females are more vulnerable to disorders such as depression because members more frequently encounter aversive life circumstances and have fewer resources to adequately cope. For adults, these "resources" are frequently conceived of as economic (Mirowsky, 1996) whereas models specific to adolescents have focused on the role of psychosocial resources as the mechanism driving the gender difference; for instance females are exposed to more stress (e.g. sexual abuse) and possess fewer psychosocial resources (e.g. self-esteem and mastery), generating depressive symptoms (Avison & McAlpine, 1992; Nolen-Hoeksema, 2001).

Interpersonal processes such as support from significant others, particularly parents, have often been cited as non-specific protective factors in the development of psychopathology over the lifecourse in these stress models (Robinson & Garber, 1995; Zucker, Fitzgerald, & Moses, 1995). Research consistently demonstrates that social support is inversely related to psychological disorder (Barber & Olsen, 1997; Beam, Gil-Rivas, Greenberger, & Chen, 2002; Scheer & Unger, 1998), although longitudinal research further specifies that the ebb and flow of this psychosocial resource (i.e. perceptions of support growth or decay) are more consequential to mental health than the general presence or absence of support (Cornwell, 2003). Research related to social stratification and mental health also suggests that social support is differently

experienced by males and females, thus contributing the gender disparity in emotional distress (Avison & McAlpine, 1992; Bearman & Burns, 1998).

Turning to a more tangible resource variable, stress theories also posit that economic deprivation produces the vulnerability that leads to increased risk for psychological problems. Socioeconomic status (SES) has a well-documented association with adult depression and is predictive of adolescent depression as well (Eamon, 2002; Kessler, Avenevoli, & Merikangas, 2001; Reinherz, Giaconia, Lefkowitz, Pakiz, & Frost, 1993; Siegel, Aneshensel, Taub, Cantwell, & Driscoll, 1998). In particular, low SES is consistently associated with increased levels of depressive symptoms and disorders (Costello, Compton, Keeler, & Angold, 2003). The linkage between socioeconomic advantage and the gender difference in depression has largely been developed to explain the symptom disparity among adults. Unlike social support, SES has been less assiduously applied to explicating the process through which males and females diverge in their risk for depression during adolescence. While SES is largely a conferred status as far as adolescents are concerned, the differences posed by the availability or lack of economic resources may affect male and female teens differently in terms of their vulnerability to psychological distress. More research is needed to fully understand if the processes that link gender, depression, and socioeconomic disadvantage operate in the same manner as observed in adults.

Implicit in theories related to stress and socialization is that stress accumulates in a variety of contexts, such as peer and family environments (Siddique & D'Arcy, 1984). Furthermore, these contexts not only play a role in stress generation and subsequent psychopathology but also act as resources that buffer the stressful influences of other contexts (Pearlin, 1989). Indeed, contextual-level research, guided by Bronfenbrenner's *ecological*

framework, illustrates that community factors uniquely contribute to individual health outcomes. A notable gap in the application of social stress theories to understanding the role of gender in the etiology of adolescent depression is that the empirical inquiries in this area are concentrated at the level of the individual; this study attempts to address this omission by assessing the association between gender and depression across communities as well as the characteristics of communities that may be involved in elaborating the etiology of the gender difference in depressive symptoms.

SOCIAL CONTEXT AND DEPRESSION

Bronfenbrenner's *ecological framework* provides the necessary structure for the complex interplay between intrapersonal, interpersonal, and environmental factors that affect development, or in this case, the development of adolescent psychopathology (Bronfenbrenner, 1979, 1995). In general, developmentalists assert that child and adolescent psychopathology results from difficulties encountered in negotiating developmental tasks (Cicchetti & Toth, 1995; Price & Lento, 2002) and that these difficulties are best understood in the context of the individual's physical and social milieu (Glantz & Leshner, 2000). Developmental theorists also predict stronger effects for communities as adolescents gain independence, spend more time out of the household, and are more influenced by peers (Bronfenbrenner, 1979; Sampson, Morenoff, & Gannon-Rowley, 2002).

Logically, schools are an organizing principle for contextual investigations of adolescent mental health given that schools are a conduit for adolescent development as teens transition to adulthood as well as institutions of socialization that contribute to adolescent identity development (Watt, 2003), influencing this process through reinforcement of, among other

things, gender roles and expectations. Schools are largely characterized by the resources available in the community that they serve—particularly community-level SES. Of the extant literature in this area, multilevel analysis has demonstrated that disadvantaged schools have an increased average level of depressive symptoms among students over and above individual effects such as race, sex, age, household income and family structure (Goodman & Huang, 2002). Evidence from multilevel analysis of neighborhood effects on depressive symptoms among adolescents is germane to this paper in that this work also demonstrates the detrimental influence of concentrated poverty, ethnic segregation, high levels of disorder, and low neighborhood cohesion on mental health (Ross, 2000; Sampson, Morenoff, & Gannon-Rowley, 2002; Wheaton & Clarke, 2003; Wickrama & Bryant, 2003; Wight, Aneshensel, Botticello et al., 2005; Wight, Botticello, & Aneshensel, 2006).

In the context of this study, schools are also viewed as sources of community support. Interest in the effects of the school climate parallels the notion of collective efficacy—the idea that a sense of cohesion among members of a group affects the general willingness to intervene on behalf of the common good (Sampson, Raudenbush, & Earls, 1997; Wight, Botticello, & Aneshensel, 2006). The idea of collective efficacy and social cohesion has been the subject of a growing body of work that notes the importance of the presence of social support at the community level—which is alternately referred as school connection, belonging, and attachment (Anderman, 2002; Bearman & Burns, 1998; Galliher, Rostosky, & Hughes, 2004; Jacobson & Rowe, 1999; McNeely, Nonnemaker, & Blum, 2002; Torsheim & Wold, 2001). Such studies have suggested that positive school experiences (i.e., a supportive environment, high achievement expectations) not only have direct effects on students' psychological well-being (Torsheim & Wold, 2001; Way & Robinson, 2003) but also may mediate the negative impact of

other influences (e.g. conflict with family and peers, stressful life events) on mental health (Barber & Olsen, 1997; Cheung, 1997).

Conceptual Framework of the Current Study

This study combines the organizing principles of Bronfenbrenner's ecological framework with the relationships and pathways suggested by the stress theories to assess gender differences in adolescent depressive symptoms across schools using multilevel analysis. This association between gender and depression is referred to as the *focal relationship* of the model—the specific causal connection essential to the integrity of the conceptual framework of the study (Aneshensel, 2002, 2005). The variables and relationships that influence the focal relationship represented in Figure 1. Two levels of analysis are specified in this model: the individual adolescent nested within the school environment. The focal relationship between gender and depressive symptoms occurs at the individual-level. This model incorporates the element of time in addition to multiple levels of analysis by using available measures of key constructs across two waves of data. Thus, the presence of prior depressive symptoms (T1 CES-D scores) is included as a key variable in order to demonstrate how the other variables in the model contribute to the development of depressive symptoms over time. Figure 1 also depicts the role of parental support (T1), change in support (T2-T1), and household income as intervening variables in the causal chain, that is, as variables that potentially explain the association between gender and depressive symptoms. The sociodemographic variables measured at the individual level are placed outside the focal relationship as control variables with an arrow connecting these factors to the dependent variable, Time 2 depressive symptomatology. And finally, the role of corresponding contextual level resource variables—school connectedness and socioeconomic disadvantage—are included. The arrows connecting these variables illustrate the intent of the

following analysis to examine the effects of school connectedness and socioeconomic disadvantage on depressive symptoms across schools (i.e. main effects on overall symptom levels) as well as whether or not the effect of gender is contingent upon school-level characteristics (cross-level interactions).

METHOD

Data: The National Longitudinal Study of Adolescent Health (Add Health)

Data used for this analysis are from the National Longitudinal Study of Adolescent Health (Add Health). The sampling frame for Add Health was comprised of all U.S. high schools, stratified by region, urbanicity, school type, ethnic composition, and enrollment size. The primary sampling unit was high schools, which was defined as including the 11th grade and enrolling at least 30 students. Eighty high schools were selected; 52 included only grades nine through 12 and were supplemented by 52 feeder schools (i.e., schools that contained grade seven and sent students to the selected high school) and 28 included grades seven through 12. Thus, a total of 132 schools comprising 80 school clusters or primary sampling units (PSU's) participated in the baseline survey. Seventy percent of the original schools sampled participated in the data collection; alternate schools within the same stratum replaced those schools that refused participation (Bearman, Jones, & Udry, 1997; Chantala & Tabor, 1999).

A sample of adolescents for in-depth ***in-home interviews*** was selected from the school rosters (78.9% response rate). The in-home sample included a core probability sample (n=12,105) of a nationally representative sample of teens in grades 7 through 12, and three supplemental over-samples: ethnic minorities—African Americans from well-educated families, Chinese, Cubans, and Puerto Ricans; saturated schools (i.e. 100% of the student body was

sampled); and disabled teens. The in-home interview was also administered to a supplemental "genetic" sample of siblings, which was not used for this analysis because these cases were not part of the original probability sample.

Adolescent data at both waves were collected using computer-assisted personal interviews (CASI) for purposes of confidentiality and accurate reporting of sensitive behaviors. Interviews were conducted in either English or Spanish. The first wave of in-home data collection (T1) occurred during the 1994-1995 school year and yielded an overall sample of **20,745** adolescents. The second wave of in-home data collection (T2) occurred during 1996 and involved all adolescents interviewed at T1, with the exception of those who were graduating seniors at T1 and not part of the genetic sample or the disabled subsample. Sixty-five siblings were also added to the genetic sample at T2. The second wave of in-home data collection yielded an overall sample of **14,736** cases.

Measures

Dependent Variable

Depressive symptomatology was assessed by the Add Health in-home survey at Time 1(T1) and Time 2 (T2) using a 19-item "feelings scale," which is comprised of 16 items from the original 20-item CES-D scale. The three additional items on the "feeling" section of the Add Health survey are not included in the measure used for this analysis. The adult version of the CES-D contains 20 symptoms and has demonstrated reliability in both population-based and clinical samples of adults (α=.85 & α=.90, respectively; (Radloff, 1977)). The appropriateness of the use of the CES-D to gauge levels of emotional distress in community surveys of adolescents, as well as the comparability of adolescent and adult CES-D scores, has also been established (Roberts, 1995b; Wight, Sepulveda, & Aneshensel, 2004). Add Health respondents reported the

frequency of experiencing each depressive symptom *within the previous week* with response categories from (0) "never or rarely" to (3) "most of the time." Positive symptoms were reverse scored. Mean substitution was used to impute data for missing values if the respondent had completed at least 75% of the 16 original CES-D items. Final scores were obtained by summing the items. Preliminary analysis of the overall baseline score of the 16 CES-D symptoms yielded a mean of 9.47 with standard deviation of 6.64 and good internal consistency reliability (α=.85). Similarly, at T2, the average level of CES-D symptoms was 9.28 with a standard deviation of 6.63 and good reliability (α=.85).

Individual-level independent variables

Information regarding adolescents' *sociodemographic characteristics* was collected for Add Health during the adolescent in-home interview conducted at Time 1. Respondents reported their gender, primary ethnic identity, and date of birth. Each of these constructs is represented by one or more dummy variables: gender is indicated by the variable "male;" race/ethnicity is indicated by dummy variables for non-Hispanic White, African American, Hispanic, Asian and "other" ethnicity; and age is classified into three categories of early (11-14 years), middle (15-16 years) and late adolescence (17 or more years). Family composition was derived from a detailed household roster and is operationalized here as a dummy variable, with 1 indicating a two-biological parent household.

A four-item *parental support* scale for both T1 and T2 was developed using items from a range of measures characterizing the adolescents' relationships with their parents or parental figures. Respondents were asked to report, "…how close do you feel with your mother/mother figure/father/father figure?" as well as the degree to which they agreed that "Most of the time, your mother/father is warm and loving toward you?" "…you are satisfied with the way your

mother/father and you communicate with each other?" and "…overall, you are satisfied with your relationship with your mother/father?" All item responses were coded on a Likert-type scale of one to five (1 = "strongly disagree" to 5 = "strongly agree"). The mode was imputed for cases missing less than half of the items in order to maximize the amount of useable information. The final support scores were computed by summing the items scores and dividing them by the total number of items. An average of perceived support from mothers and fathers was used as the final parental support score for adolescents from two-parent families, whereas parental support for adolescents from single-parent families represents support from only one parent. Results from a reliability analysis demonstrated very good inter-item consistency reliability at both timepoints ($\alpha = 0.87$ for Time 1 and $\alpha = 0.87$ for Time 2). Generally, perceived parental support was quite high; the average level of parental support was 4.24 (SD=0.70) and 4.18 (0.71). Given that this analysis utilized available longitudinal information, change scores were computed for parent support. Support scores at T1 were subtracted from scores reported at T2. *Change in support (T2-T1)* was included in all multivariate analysis to assess the effect of change over time but also to demonstrate that such psychosocial constructs represent dynamic rather than static social processes.

Operationalization of *socioeconomic status* (SES) is complex given that the families by and large confer adolescent SES (Aneshensel & Sucoff, 1996; Siegel, Aneshensel, Taub et al., 1998). Thus, data from the parents' survey regarding annual household income was used to convey the SES of the adolescents, with regression-based imputation of missing data. Given the typically skewed distribution of household income, a logged version of this variable was used in the multivariate analysis.

School-level independent variables

Information from the adolescent in-school survey was used to create an aggregate measure of the perceived *school connectedness* among the students within a given school. A scale was developed based on three items regarding the perceptions of school environment. Respondents were asked to score the items "*...you feel close to people at school…*" "*...you feel like you are part of your school…,*" and "*...you are happy to be at your school,*" using a Likert-type scale with responses ranging from 1 = "strongly agree" to 5 = "strongly disagree." The three items were reversed scored so that a higher score represented high perceptions of school connectedness. Modal substitution was used for cases missing data on one or two of the items. Results from a reliability analysis demonstrated very good inter-item consistency reliability at both timepoints ($\alpha = 0.78$ for both T1 and T2). Final scores were summated and divided by three (the number of items) so that the composite score was represented in the original response metric of each of the individual items. Student scores were collapsed to the school level (N=127) in order to represent an average school connectedness score. Overall, the average level of school connectedness perceived across schools was high (mean score = 3.60, SD = 0.22).

School socioeconomic disadvantage was used as the contextual-level SES indicator. Unlike the other resource measures used in this analysis, this variable signifies a lack of resources. This measure also differs in that socioeconomic disadvantage is represented as a factor score based on 5 indicators of economic deprivation derived from 1990 US Census tract data via a principal components analysis. These indicators include: proportion of households receiving public assistance, proportion of individuals living below the poverty level, proportion of individuals aged 25+ without a high school diploma, proportion of individuals aged 25+ without a college degree, and the unemployment rate. For this measure, Census tract data were

collapsed to level of the school, giving an aggregate representation of the level of socioeconomic disadvantage characterizing the immediate community served by the school.

Analytic Sample Characteristics

This analysis is restricted to those adolescents who reported complete information for the key variables in the analysis of the association between gender and depressive symptoms outlined in Figure 1. Each case had to have usable sample weight data so that results obtained may be generalized to the population. Additionally, participants had to have usable individual and group identifiers that accurately depict the location of each case within the level of nesting (i.e., individuals in schools), thus permitting hierarchical linkages. Linking the individual-level and school-level data necessitated limiting the analysis to those schools whose students were selected for the in-home data collection. Cases from one institution were dropped due to lack of variation by gender. In some instances, siblings were obtained in the data collection. In order to eliminate this additional level of nesting of teens within families, one child per family was sampled. As a result, data were retained for **17,556** adolescents at T1; the analytic N drops to **10,512** cases with complete data from both T1 and T2 nested in **127** schools.

Table 1 lists the weighted sociodemographic characteristics of the T1 and T2 analytic samples. Gender is evenly distributed across the two waves of data. Although the sample ages one year at the second wave of data collection, teens in the young and mid-adolescent age groups are disproportionately represented. Non-Hispanic White (NHW) teens comprise two-thirds of the sample with African American and Latino teens composing the next two largest race/ethnic categories. The median household income was approximately $42,000 annually at T1 and $43,000 at T2. Over half of the sample resides in a household with both biological parents at both timepoints.

--Table 1 here--

Table 1 also illustrates that adolescents with both waves of data did not differ dramatically from those participants lost to attrition, with two exceptions (attrition analysis not tabled). The attrition group was, on average, older at baseline ($\chi^2 = 3314.72$, df = 2, $p < .001$), which was expected because those participants who were graduating seniors at Time 1 were not re-interviewed at Time 2. A comparison of family structure indicated that adolescents who were in a two-biological parent family represented a larger percentage of the group participating in the follow-up data collection, whereas fewer adolescents residing in "other" family living arrangements were retained over time ($\chi^2 = 40.12$, df = 1, $p<.001$).

Analysis

In the current analysis, descriptive statistics are calculated using the SVY commands in STATA version 8 (StataCorp, 2003) that adjust variance estimates for the probability sample design and nested data structure as recommended for use with the Add Health data (Chantala & Tabor, 1999). All multivariate analysis employs hierarchical linear modeling and employs HLM version 6.01 (Raudenbush, Bryk, & Congdon, 2005). The nested data structure of Add Health necessitates multilevel modeling as analysis of hierarchically organized data demonstrates that observations of individuals within groups are dependent, violating the traditional assumption of independence in statistical analysis (Kreft & Leeuw, 1998; Raudenbush & Bryk, 2002). All analysis uses full maximum likelihood; the advantage of this approach is that the estimates produced are consistent with the true parameters, particularly when using large datasets, as well as unbiased and robust to non-normality (Raudenbush & Bryk, 2002). All continuous school-level predictors are grand-mean centered for purposes of interpretability. Grand sample weights adjust for the sample design and response rates are used in all analyses

Multilevel modeling allows for the estimation of the effects of variables from both the individual and contextual levels jointly by taking into consideration the nested structure that links the individual to his or her context. More specifically, multilevel modeling techniques simultaneously regresses within-group differences as a function of the differences between groups. The first goal of the multivariate analysis is to assess if depressive symptoms vary across schools by estimating a null or unconditional model. Multilevel analysis simultaneously models the outcome—depressive symptoms at T2—as a function of both the individual and the environment, as represented by the following equations:

$$Depress(T2)_{ij} = \beta_{0j} + r_{ij} \quad (1)$$

and

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

The notation *j* is used to index schools and *i* is used to index adolescents within schools. In equation 1, the intercept, β_{0j}, is defined as the average level of depressive symptoms for adolescents in school *j* and the term r_{ij} represents the deviation of the individual's symptom scores from the predicted school average. This deviation is assumed to be normally distributed with a mean of zero and a variance σ^2. The individual-level intercept is in turn a function of depression scores measured across a population of schools as represented in equation 2, where γ_{00} is the "grand mean" of depressive symptoms across a population of schools and u_{0j} represents the unique effect of school j or a random error term. The variance component of the school mean level of depressive symptoms, τ_{00}, captures the extent to which the school mean varies around the grand mean. This partitioning of the variance from both the individual and contextual levels enables estimation of the intra-class correlation coefficient Rho (ρ), or the variation in depressive symptoms across school contexts relative to the total variance in symptomatology.

The second goal in the analysis is to assess whether the influence of the focal independent variable—gender—also varies across schools. Controlling for baseline depressive symptomatology, this step is represented by the following equation; for simplicity, equation 2 has been substituted into equation 1 to yield a single analytic representation of the prediction of depressive symptoms across both levels of analysis:

$$Depress(T2)_{ij} = \gamma_{00} + \gamma_{10} Depress(T1) + \gamma_{20} Gender + (u_{0j} + u_{2j} + r_{ij}) \quad (3)$$

The coefficients γ_{10} and γ_{20} are the slopes for prior depressive symptoms and gender, and translate into the average effect of prior symptoms and the difference between males and females in T2 symptom levels in school j, respectively. The slope for Gender is random in this analysis, as indicated by the term u_{2j}. Specifically, u_{2j} represents the deviation of the gender difference for school *j* from γ_{20} holding T1 depressive symptoms constant. In multilevel modeling terms, the γ's represent the fixed effects portion of this model, whereas the error terms are the random effects. The latter elements of the equations signify the extent to which the variation in the outcome across schools is attributable to systematic differences across schools versus due to sampling error (Raudenbush & Bryk, 2002).

The third goal of this analysis is to ascertain the impact of two key individual-level constructs—parental support and household income—on the association between gender and depressive symptoms. Analytically, this step assesses the role of individual-level processes on the gender gap in depressive symptoms while the nesting of adolescents within school contexts is taken into account. Using the example of parental support:

$$Depress\,(T2)_{ij} = \gamma_{00} + \gamma_{10} Depress\,(T1) + \gamma_{20} Gender \quad (4)$$

$$+ \gamma_{30} Support\,(T1) + \gamma_{40} \Delta Support_{ij} + (u_{0j} + u_{2j} + r_{ij})$$

Equation 4 illustrates the effect of individual-level social support over time, as indicated by the terms for both Time 1 support and change in support from Time 1 to Time 2 (γ_{30} and γ_{40}). When all other coefficients in the model are zero, γ_{00} becomes the average level of depressive symptoms for adolescents with the average level of change in social support across schools. The absence of error terms in equation 4 conveys that only fixed effects are examined for these key individual-level variables for the sake of parsimony.

The next step of this analysis is to assess if school level differences—that is, the random effects in both the average level of depressive symptoms and the gap between males and females—persist in the presence of several individual-level control variables (i.e. age, race/ethnicity, and family structure). Upon determining that school-level variation in depressive symptoms and gender is maintained, this analysis proceeds by developing models to more specifically address the fourth goal of this analysis: the explanation of this contextual variation in the gender difference in depression, as well as in the average level of symptoms across schools. The school-level predictors in this case are chosen as measures of structural factors that characterize the school environment (i.e. socioeconomic disadvantage) and community psychosocial resources (aggregate school connectedness) that potentially contribute to the average mental health of the student body.

Equation 5 uses the example of the effect of school connectedness in illustrating the model used to analyze the effect of school characteristics on the random intercept; that is, the average level of depressive symptoms across schools. For simplicity, the individual-level factors are excluded from this example, although in actuality, this model builds upon the analytic steps outlined in equations 1.1-1.4:

$$Depress\,(T2)_{ij} = \gamma_{00} + \gamma_{01} CONNECT_{j} + \ldots + (u_{0j} + u_{2j} + r_{ij}) \qquad (5)$$

For this particular model, γ_{00} represents the expected mean depression score for a school with level of mean school connectedness equal to the grand mean and γ_{01} signifies the effect of school connectedness which has been measured for students within schools and aggregated to the school level.

The fifth and final goal of the multilevel analysis is to determine if school-level variation in the gender gap is contingent upon the two school-level factors. The inclusion of terms to predict the slopes is also referred to as a cross-level interaction and is a distinguishing feature of the combined models of a multilevel analysis (Raudenbush & Bryk, 2002). This is represented by the following equation and uses the example of school-level socioeconomic disadvantage:

$$Depress\ (T2)_{ij} = \gamma_{00} + \gamma_{10} DepressT\ 1_{ij} + \gamma_{20} Gender\ + ... +$$

$$\gamma_{21}(Gender_{ij} \times SES_j) + (u_{0j} + u_{2j} + r_{ij}) \qquad (6)$$

where the additional parameter, $\gamma_{21,}$ signifies that the gender gap depends on differences in the level of socioeconomic disadvantage that characterizes the school.

RESULTS

Bivariate Analysis

Bivariate associations of the individual-level depressive symptoms, parental support and household income measures by gender are presented in Table 2. Females report significantly higher depressive symptom levels at each timepoint. Although average levels of parental support are high for both sexes, males report perceiving significantly higher levels of support from their parents than females. And finally, the average level of household income reported by males and females adolescents in this sample does not differ. These associations not only illustrate the robust association between depressive symptomatology and gender reported in the literature, but

also convey that males and females differ in the extent that they feel cared about by significant others in their immediate social environment. In other words, these bivariate associations suggest that the sexes differ in this psychosocial resource that has been demonstrated to be quite protective against adolescent emotional distress.

Multilevel Analysis

The results of the hierarchical linear regression of depressive symptoms at Time 2 are presented in Table 3. The null model (Model 1) indicates that the average level of depressive symptoms varies significantly across schools ($\gamma_{00} = 9.13$, SE=0.15, $p < 0.001$) and that there is sufficient variation present at the school-level ($\tau_{00} = 1.79$, $p < 0.001$) to merit further investigation of contextual effects. The intraclass correlation coefficient ($\rho = 0.05$)[1] more specifically indicates that a small proportion of the variation in symptomatology is attributable to the school environment.

-- Table 3 here --

Individual Level Effects

Model II examines the effect of gender on depressive symptoms at T2, controlling for baseline symptom levels. The positive and significant effect of T1 CES-D score suggests that a one unit increase in prior symptom levels increases the depressive symptoms by approximately half a point one year later. In other words, controlling for the effect of baseline symptomatology demonstrates that depressive symptoms are quite stable over time; teens with high levels of prior symptomatology are likely to remain high. Moreover, the size of the variance component of the intercept decreases by approximately 45%, demonstrating that although symptom levels vary

[1] $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$

across school contexts, much of the variation in depressive symptomatology is captured by the stability of symptoms at the level of the individual adolescent.

The coefficient obtained for gender in Model II suggests that on average, males score almost one point lower on the 16-item CES-D scale than females at Time 2. This model also allows the slope of the gender gap to vary across schools (which analytically translates into assigning the variable a random error term), thereby additionally assessing whether or not the difference in symptomatology between males and females varies across school environments. This average 'gap' between male and female symptom scores varies, however, as suggested by the significant variance component (τ_{21} =0.67, $p < 0.001$) obtained in Model II. The results of this model imply that the gender difference in depressive symptomatology is more pronounced in some school contexts as opposed to others, thus warranting further investigation of school characteristics that may contribute to this macro-level variation in the effect of gender. The addition of both gender and T1 symptomatology significantly improved the fit of the model (χ^2 = 4191.81, df = 4, $p < .001$).

The effects of the focal individual-level resource variables are included in Model III net of prior symptomatology and gender (χ^2 = 660.50, df = 3, $p < .001$), further improving the fit of the model. The influence of perceived parental support is captured by two pieces of information: perceived support at T1 and change in connection based on data obtained one year later. The negative and highly significant coefficients for these measures suggest that high levels of support are protective against emotional distress insofar as high levels of support are stable or perceptions of support increase over time. Comparatively, lower levels of parental support that either decrease or remain unchanged confer only a slight decrease on levels of depressive symptoms net of the other variables in the model. The perception of low parental support is less

detrimental to adolescent mental health if the perceived relationship with parents improves over time. These findings suggest that the association between parental support and adolescent depressive symptoms is more complicated than associations reported using cross-sectional data. That is, the perceived closeness and quality of parental relationships is beneficial to adolescent mental health insofar as this resource is perceived to be high and consistent. A sense of diminishing closeness over time serves to erode any protective effects parental support may have related to depressive symptoms, a finding which is consistent with other studies involving in understanding the fluidity involved in the association between social support and emotional distress (Cornwell, 2003; Wickrama & Bryant, 2003).

Model III also illustrates that the second resource variable, household income, is inversely related to depressive symptoms, such that symptom levels are lower among teens from families with high income in comparison to teens from low income families. The addition of both of the resource constructs affects the coefficients for baseline symptom scores and gender. Separate analysis demonstrated that the coefficient for gender decreases with the addition of the parental support measures suggesting that the gap between male and female depression scores was partially attributable to differences in perceived levels of support from parents (model not shown). The change in the effect of gender was accompanied by a decrease in the variance component for gender, suggesting that some of the variation in the gender gap across schools was accounted for by perceived individual-level parental support. Further testing, however, revealed that interactions between gender and both T1 support and change in support were not significant (model not tabled).

Model IV adjusts for the sociodemographic characteristics of age, race/ethnicity, and family living arrangement. Depressive symptoms significantly increase among adolescents in

the 15-16 year age range relative to teens in the youngest age group, net of the other variables in the model. Contrary to expectations, adolescents in the older age groups do not experience higher symptom levels than younger teens at T2, a finding that is perhaps attributable to the fact that many of the Add Health participants in the oldest age group were graduating seniors and hence "aged out" of the data collection. Compared to Non-Hispanic White teens, levels of T2 depressive symptoms significantly increase over time among Latino and African American teens. The effect of residing with both biological parents in comparison in other types of family situations is not significant.

The coefficients for the focal independent variables, with the exception of household income, remain virtually unchanged in Model IV. Similarly, the random variance components, which signify that both the average level of depressive symptomatology and the gender gap vary across schools, are minimally affected when the analysis is adjusted for these sociodemographic characteristics. This suggests that although the inclusion of the sociodemographic characteristics improves the overall fit of the model ($\chi^2 = 60.32$, df = 7, $p < .001$), further analysis of the effects of school context is warranted to investigate the small but persistent random effects (i.e. intercept and slope).

School-level effects

The effects of two school-level variables are tested in Models V and VI. School connectedness characterizes the presence of psychosocial resources at the contextual level and corresponds to the use of parental support at level-one. School-level socioeconomic disadvantage captures the *lack* of financial resources at level-two and thus corresponds to the use of household income at level-one, albeit in the opposite direction.

First, the main effects of the school variables on the average level of depressive symptoms (i.e. the intercept) were tested in separate models. Contrary to expectations, the contextual-level psychosocial variable, school connectedness, did not attain statistical significance. However, a significant effect did emerge for socioeconomic disadvantage such that high levels of disadvantage increased the average level of depressive symptoms at T2 across schools (Model V). The addition of this school-level characteristic to the intercept in Model V also slightly decreased the variance component (from 0.84 to 0.81). Subsequently, this analysis progressed to explicating the random effects of the slope for gender observed across schools. As summarized in Model VI on Table 3, a contingency emerged between gender and socioeconomic disadvantage, such that the magnitude of the gender gap in depressive symptoms across schools is more pronounced under certain conditions of socioeconomic disadvantage in comparison to others. This cross-level contingency between gender and socioeconomic disadvantage is illustrated in Figure 2.

-- Figure 2 here --

Specifically, the gender gap in symptomatology is quite prominent in schools characterized by low socioeconomic disadvantage. However, as socioeconomic disadvantage increases, the protective effect of male gender is eroded such that boys attending schools in highly disadvantaged areas report levels of symptomatology at a level similar to levels of adolescent girls.

Thus, these results suggest that the gender difference in depression is partially attributable to contextual-level variation in socioeconomic status, and that male adolescents benefit particularly in terms of their mental health when they attend schools with low socioeconomic disadvantage. However, this emergence of a significant effect for socioeconomic

disadvantage was not accompanied by a change in the value of Tau, suggesting that while contextual-level socioeconomic differences may mitigate some of the gender difference in depressive symptoms, it does not fully account for the variation observed in the effect of gender observed across schools. A comparison of this model to Model VI suggests that the inclusion of this cross-level interaction presents an improvement in the fit of the overall model predicting depressive symptomatology at T2 (χ^2 =4.74, df = 1, p <.05). The gender gap in depressive symptoms was not conditional on school connection.

DISCUSSION

The purpose of this study was to examine the gender difference in depressive symptoms across multiple levels of analysis. At the individual-level, the findings obtained here confirm overall patterns demonstrated in the literature; namely, that levels of adolescent depressive symptoms are stable over time and that females have higher levels of symptomatology relative to males. Depressive symptomatology varies across schools even after accounting for several key individual-level constructs and processes. In addition to 'surviving' the control for individual-level processes, the main effect of school-level socioeconomic disadvantage on overall symptom levels suggests that the aggregate level of instrumental resource variables in the community affects mental health among adolescents. This is consistent with other reports that suggest compositional aspects of the environment contribute to adolescent depressive symptomatology (Goodman, Huang, Wade et al., 2003; Wight, Aneshensel, Botticello et al., 2005). The current analysis is unique in that it additionally adjusts the model for the stability of symptomatology over time whereas other models of contextual effects are cross-sectional. Previous symptoms remain the strongest predictor of depressive symptoms across two waves of data; that said, the

multilevel portion of this analysis demonstrates that the effect of school context on overall levels of symptomatology is robust in the face of key individual-level processes.

The investigation of the gender gap in symptoms across schools indicates that multilevel analysis can contribute to our understanding of persistent disparities in mental health. Specifically, the overall variation in the difference between males and females across schools as well as the contingency observed between gender and school-level socioeconomic disadvantage lend support to the idea that mental health disparities are impacted by characteristics of the larger social structure. In the context of depressive symptomatology, female adolescents in environments characterized by less socioeconomic disadvantage do not seem to be deriving the same protective effect conferred by the economic resources as their male peers. Future analysis is needed to explore the mechanisms guiding this effect more fully, particularly in relation to the pathways suggested by the stress models.

Parental support was quite consequential to mental health, confirming the finding that perceived supportiveness from others in the immediate social environments is salient to the development of psychological health in the adolescent years (Robinson & Garber, 1995). A caveat emerged for this protective effect in that support is only beneficial to adolescent mental health insofar as it is perceived as consistent or improving over time, a finding that is reported elsewhere in the literature (Cornwell, 2003). The individual-level processes examined here suggest that the gender difference in depressive symptoms is also influenced by—but not contingent upon—the perception of supportive parental relationships, suggesting that the gender difference in depression is not fully accounted for by the support constructs suggested by the stress models. Much of the conceptual work that addresses the relationship between the availability of both psychosocial and instrumental resources and psychological distress focuses

on the explication of subgroup differences in vulnerability to mental health problems among adults. Models that are more specific to adolescents are needed in order to obtain a more comprehensive understanding of the effects of social location on the etiology of depression early in the lifecourse.

The lack of impact for school connectedness observed here contradicts reports from studies of the effects of neighborhood social cohesion on mental health (Ross, 2000; Sampson, Morenoff, & Gannon-Rowley, 2002; Wickrama & Bryant, 2003). However, the fact that only individual-level parental support proved consequential to the focal relationship of this analysis bolsters the assertion that individual-level family support variables are more consequential to adolescent health outcomes in comparison to perceptions of support derived from the school environment (Bearman & Burns, 1998; Duncan, Boisjoly, & Harris, 2001) and illustrates the need to control for key individual-level processes when examining contextual effects. The fact that the school-level psychosocial resource measured in this analysis failed to attain significance might be related to the fact that contextual-level processes are much more distal to individual-level psychological outcomes than individual-level processes such as parental support. Furthermore, the mechanisms through which schools impact mental health may be more circuitous than the descriptive findings reported in other multilevel studies. For instance, school environments naturally have a more direct influence on variation in academic-related outcomes such as achievement (Anderman, 2002), which is also related to mental health. The examination of this type of relationship was beyond the scope of the current analysis, but future work aimed at investigating the direct and indirect effect of school environments might consider examining the connection between school context, academic achievement, and mental health.

Although technical advances in data analysis have greatly enhanced our ability to analytically model the impact of the environment on a variety of health outcomes, several key methodological and conceptual challenges to conducting this type of research remain. For instance, measurement of community resources, particularly more intangible concepts such as school connectedness, is difficult; that is, aggregating reports of school connectedness may be an inadequate proxy for assessing the level of community and supportiveness collectively experienced by adolescents within schools. Similarly, measures of the school climate derived from administrative sources may also fail to fully capture the aspects of the school environment that are most consequential to adolescent mental health (Duncan, Boisjoly, & Harris, 2001).

One of the major strengths of this study is the use of data from a large, nationally representative sample. However, the generalizability of these findings is limited by the fact that Add Health is a school-based sample. Thus, findings are only extrapolated to American adolescents who attend school; inferences cannot be made for teens who, for example, are home-schooled, institutionalized, or have dropped out. In addition to substantive considerations for this analysis of the effects of school context, the hierarchical structure of the Add Health dataset necessitated a multilevel approach. However, these adolescents also cluster into other organizational structures common in society. This analysis attempted to adjust for other instances of nesting such as siblings within families by selecting one adolescent per family. Accounting for other levels of nesting in society such as neighborhoods and classrooms were beyond the scope of this analysis.

Although this investigation emphasized contextual effects, the added dimension of time to the analysis represents a substantial advantage of the present work relative to other multilevel analyses of school effects, which largely concentrate on contextual-level variation in symptoms

using cross-sectional data. In particular, this analysis yielded that the modest variation in depressive symptomatology across school contexts withstands the robust effect for symptom stability at the individual-level across two waves of data. Additionally, although the availability of parental support data from two timepoints permitted analysis of the dynamics involved in the relationship between support and symptoms, multiple measures of similar constructs (i.e. family income, school socioeconomic disadvantage, and school connectedness) were not available. Other research has suggested that multilevel studies need to address the possibility that environments such as schools are transitory and have effects that accumulate and compound over time (Duncan, Boisjoly, & Harris, 2001; Wheaton & Clarke, 2003).

The issue of endogeneity is another problem that plagues this type of analysis. Endogeneity refers to fact that belonging to a certain school is a deliberate choice for some adolescents from families with the means of selecting a school or school district based on characteristics of the environment (e.g. academic excellence, good teacher to student ratio), and an inevitability for other adolescents whose educational options are constrained by limited family resources. Thus, the decision to attend a specific school is correlated with unobserved factors that are not included in the analysis but may nonetheless affect each outcome, thus potentially biasing results (Millimet, 2001).

Although this analysis illustrates that much of the variation in depressive symptoms is present at the individual level, the presence of contextual effects over and above individual-level risk factors indicates that the integration of population health and individual health is substantively advantageous. Particularly, the contingency between school-level socioeconomic disadvantage and gender differences in depressive symptomatology illustrates the need for multidimensional and multilevel approaches to understanding and eventually reconciling health

disparities. On a more practical level, analysis of contextual effects of schools on adolescent mental health is imperative given that much of the adolescent research is school-based and subsequent findings are used to develop and implement policies and interventions that are frequently implemented within these institutions. Thus, further consideration for the effects of social context is needed, particularly during the adolescent period of the lifecourse when individuals may be most amenable to the prevention of further distress and dysfunction.

Table 1. Sample Descriptive Characteristics [Weighted Percentages or Means (Standard Deviation)]

	Time 1	Time 2
	N = 17,556	N = 10,512
Gender (%)		
Male	50.60	49.92
Female	49.40	50.08
Age		
11-14 years	34.52	42.74
15-16 years	33.79	38.91
17+ years	29.69	18.35
Race (%)		
Non-Hispanic White (NHW)	66.21	67.47
African American	16.09	15.17
Latino	12.08	11.83
Asian Pacific Islander (API)	3.80	3.87
Other	1.82	1.66
Socioeconomic status (SES)		
Household income (thousands)	42.39 (42.08)	43.31 (43.30)
Family Composition (%)		
Two biological parents	54.47	58.34
Other	45.53	41.66

Table 2. Bivariate Associations between Focal Constructs: Gender Differences [Weighted Means] (N=10,512)

	Males	Females
CES-D (T1)	8.54 (5.87)	10.19 (7.01)***
CES-D (T2)	8.43 (6.06)	10.11 (7.03)***
Parental Support (T1)	4.35 (0.61)	4.21 (0.73)***
Parental Support (T2)	4.26 (0.63)	4.10 (0.76)***
Household Income	43.41 (45.76)	43.20 (41.19)

T- tests used to test differences between group means.
*** $p < .001$.

Table 2. Hierarchical linear regression of depressive symptoms (T2) [N=10,512 adolescents, 127 schools]

	MODEL					
	I B(SE)	II B(SE)	III B(SE)	IV B(SE)	V B(SE)	VI B(SE)[c]
Individual-level variables						
CES-D 16 (T1)		0.57(0.01)***	0.53 (0.01)***	0.52 (0.01)***	0.52 (0.01)***	0.52 (0.01)***
Male		-0.83(0.13)***	-0.67 (0.12)***	-0.69 (0.12)***	-0.69 (0.12)***	-0.70 (0.12)***
Parental support (T1)			-1.57 (0.13)***	-1.55 (0.13)***	-1.56 (0.13)***	-1.55 (0.13)***
Change in parental support (T1-T2)			-2.13 (0.15)***	-2.13 (0.15)***	-2.14 (0.15)***	-2.13 (0.15)***
Household income (log)			-0.62 (0.09)***	-0.49 (0.10)***	-0.45 (0.10)***	-0.47 (0.10)***
Age 15-16 years [a]				0.38 (0.17)*	0.39 (0.16)*	0.39 (0.16)*
Age 17+ years [a]				0.32 (0.25)	0.32 (0.25)	0.32 (0.25)
Latino [b]				1.21 (0.25)***	1.18 (0.25)***	1.20 (0.25)***
African American [b]				0.56 (0.23)*	0.47 (0.23)*	0.52 (0.23)*
Asian Pacific Islander [b]				0.63 (0.36)	0.64 (0.36)	0.65 (0.36)
Other ethnicity [b]				0.58 (0.57)	0.55 (0.57)	0.57 (0.57)
Lives with both biological parents				-0.26 (0.14)	-0.26 (0.14)	-0.26 (0.16)
Intercept	9.13(0.15)***	4.28(0.19)***	13.27 (0.76)***	12.50 (0.77)***	12.43 (0.77)***	12.48 (0.77)***
School-level Variables						
Socioeconomic disadvantage					0.37(0.17)*	--
Cross-level interaction						
Male x Socioeconomic disadvantage						0.32(0.16)*
Random variance components						
Intercept	1.79***	0.99***	0.84***	0.84***	0.81***	0.83***
Male		0.67***	0.47***	0.44***	0.44***	0.44***
Model comparison (to previous model)						
Chi-square		4191.81***	660.50***	60.32***	7.04**	4.74*
Degrees of freedom		4	3	7	1	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
[a]Reference group is age 11-14 years.
[b]Reference group is Non-Hispanic White.
[c]Compared to Model IV.

Figure 1. Conceptual Model

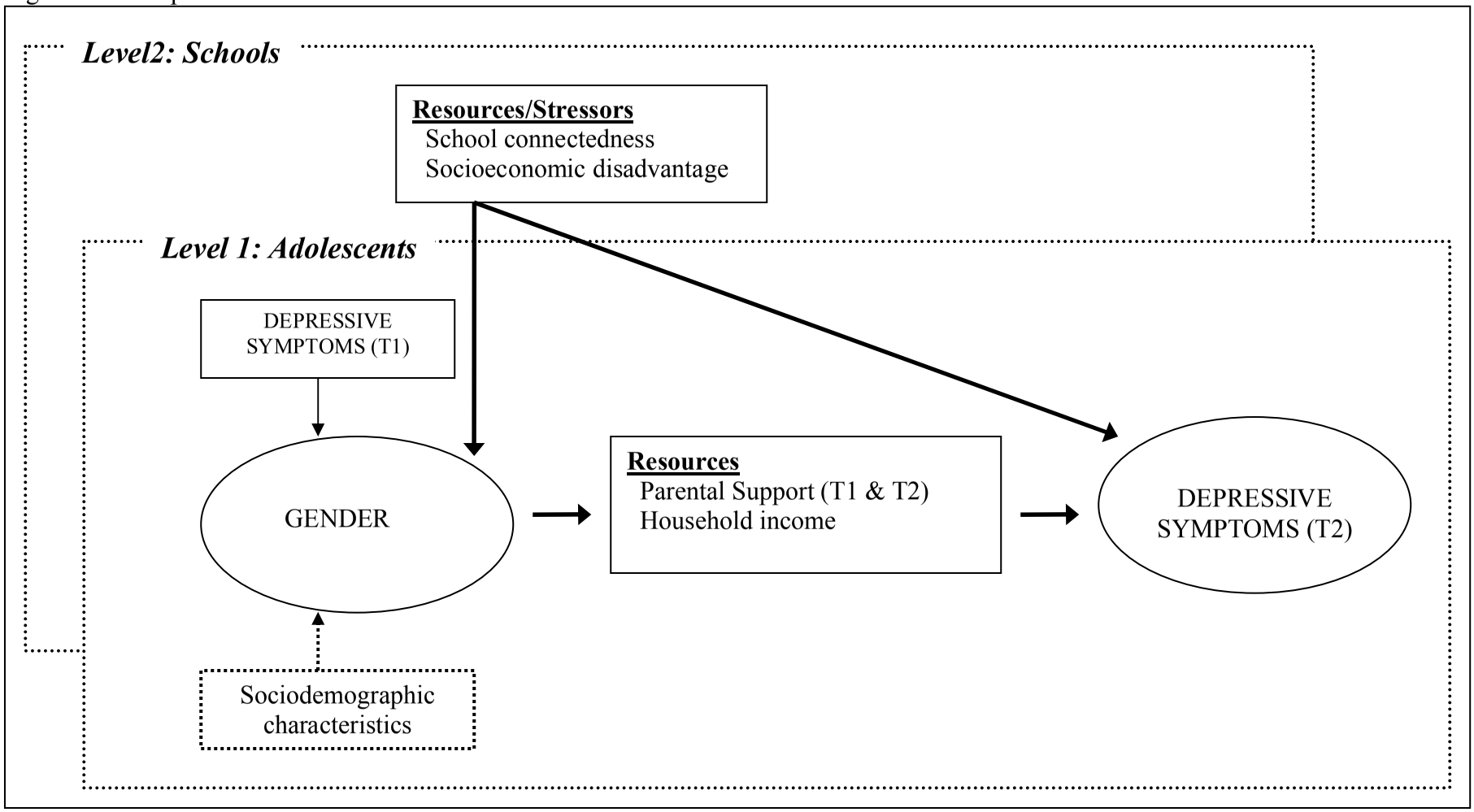
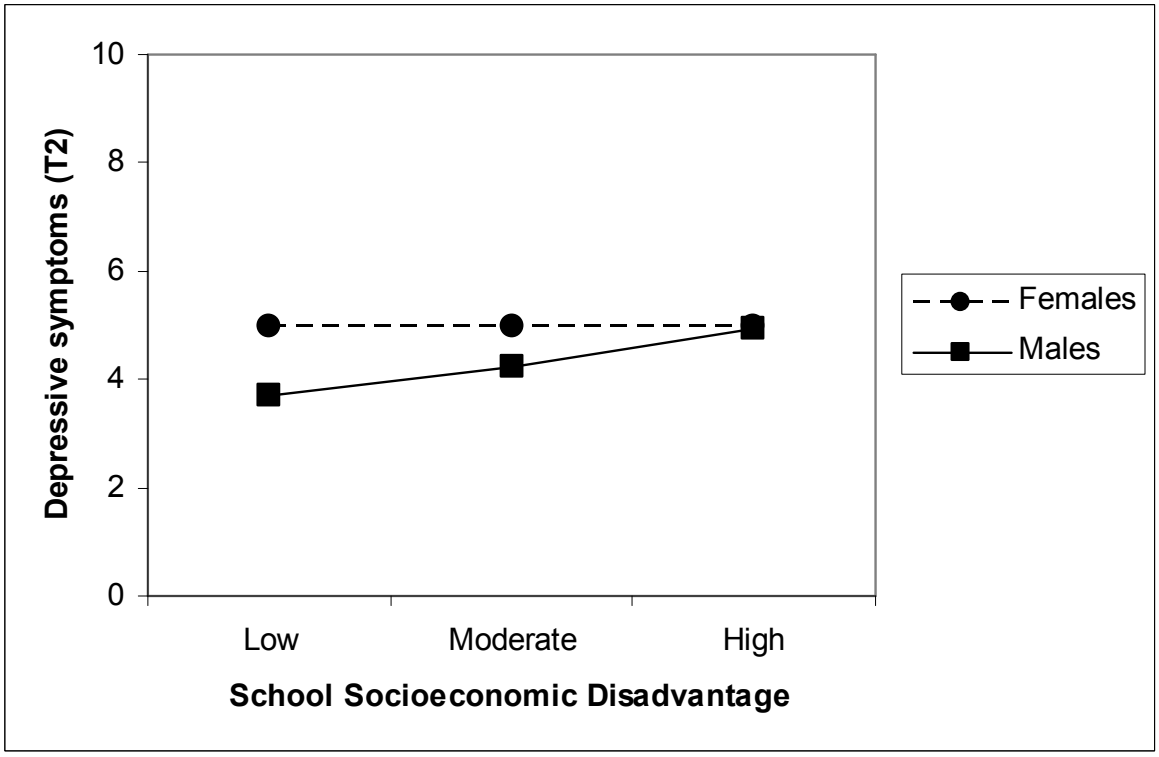


Figure 2. Cross-level interaction between gender and school-level socioeconomic disadvantage



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