Abstract

Our study investigates how school segregation, as measured by school-level racial/ethnic composition, influences depressive and somatic symptoms among a representative sample of U.S. adolescents, and whether the association differs by race/ethnicity. We analyzed data from Wave I of the National Longitudinal Study of Adolescent Health, resulting in a sample size of 18,419 students attending 132 junior and senior high schools in 1994/5. In our multilevel analyses we found that black students experienced more depressive symptoms and greater log-odds of high somatic symptoms as the percentage of white students at their school increased. These results were no longer significant, however, after we controlled for students' perceptions of discrimination and attachment to their school. Our findings suggest that attending predominately-minority schools may buffer black students from discrimination and increase their attachment to their school, which in turn may reduce their risk of experiencing depressive and somatic symptoms.

Introduction

Interest in understanding the potential health effects of the social and physical environment has been renewed in the past decade (Kaplan, 2004; Macintyre, Ellaway, & Cummins, 2002; Syme, 2008). Given this renewed interest, it is surprising that little research has been conducted investigating the direct health effects of school segregation, even though school segregation plays an important role in the production and perpetuation of racial and social inequities (Bourdieu, 1973; Wells & Crain, 1994). Indeed, schools are one of the strongest socializing forces in the United States (Hallinan, 2001) and wield considerable power over the educational opportunities and life chances of students. We seek to address this limitation in our study by investigating how school-level racial/ethnic composition influences depressive and somatic (i.e., physical) symptoms among a representative sample of U.S. adolescents.

Background

The school environment can have pronounced effects on students' worldviews, their sense of belonging and identity, and their educational opportunities (Hoffmann, 2006; Lewis, 2003; Yonezawa, Wells, & Serna, 2002). According to Bourdieu (1973), schools play a complex role in the cultural and social reproduction of social inequalities. They can also act as racializing agents, shaping the worldview of their students (Lewis, 2003). Schools convey information to their students in both subtle and overt ways in terms of what race and class mean, who holds power in this society, and whose knowledge and beliefs are valued and respected (Lewis, 2003; Oakes, Wells, Jones, & Datnow, 1997; Yonezawa et al., 2002). Such information is often conveyed through the power structure within the schools (e.g., whites in positions of power), the use of racial code words by school personnel and parents (e.g., "urban", "dangerous", "project kids"), the extent of attention teachers and administrators demonstrate when racial conflicts

occur, and the stereotypes held by school personnel and elite parents (Lewis, 2003; Mickelson, 2001; Rubin, 2008). Feagin, Vera, and Imani (1996) documented similar findings in their study of black college students attending predominately-white universities in the United States. These students reported differential treatment from professors, students, and campus police, including but not limited to harassment, verbal assaults, and chilly classroom environments.

School policies also impact students' perceptions of the school environment. Within racially-mixed and predominately-white schools, black and Hispanic students are more likely than whites to be tracked into less academically rigorous coursework even at equivalent levels of ability (Darling-Hammond, 2004; Mickelson, 2001; Mickelson & Everett, 2008). Students are often aware of tracking in their school, even if classes are not marked as high-ability (Oakes, 1985). Because of the interplay between social, cultural, and political processes involved in tracking decisions at the school level, tracking often results in the conflation of ability with race/ethnicity (Lewis, 2003; Oakes et al., 1997), which in turn may socialize students to accept their positions in their schools' social hierarchy (Mickelson, 2001). Even in schools which provide some opportunity for track mobility, students who have historically been tracked often do not enroll in "high-ability" courses as they have likely come to internalize the labels and status attached to them by their peers, teachers, and administrators (Yonezawa et al., 2002).

School segregation significantly impacts the distribution of key educational opportunities and advantages necessary for continued educational achievement. As compared to predominately-white schools, predominately-minority schools are more likely to suffer from overcrowded classrooms, utilize outdated books and supplies, offer fewer advanced placement courses, and employ less qualified teachers (Darling-Hammond, 2004; Darling-Hammond & Post, 2000; Orfield & Eaton, 1996). Students attending predominately-minority schools are also

more likely to be poor, resulting in higher levels of concentrated poverty in these schools (Orfield, 2001; Orfield & Lee, 2007).

It is therefore likely that school racial/ethnic composition may influence adolescent mental and physical health through at least three, potentially competing, mechanisms. First, because predominately-white schools often receive more funding through local property taxes (Rothstein, 2000), they are able to provide an array of educational opportunities that may not be available to students attending predominately-minority schools. To the extent that access to such opportunities keep students engaged and motivated, predominately-white schools, with their greater access to key resources, may enhance students' aspirations and achievement, and in turn, promote mental and physical health. Alternatively, because violence and disorder is often higher in predominately-minority schools (Massey, Charles, Lundy, & Fisher, 2003), students attending such schools are likely exposed to greater amounts of stress, which in turn could increase their risk for depressive (Mazza & Reynolds, 1999) or somatic symptoms (Christiansen, Copeland, & Stapert, 2008; Natvig, Albrektsen, Anderssen, & Qvarnstrom, 1999; Rhee, Holditch-Davis, & Miles, 2005).

Second, the racial/ethnic composition of the school may create an environment where some students feel valued and respected, whereas others feel marginalized and isolated because of their race/ethnicity (Feagin et al., 1996; Hoffmann, 2006; Lewis, 2003; Yonezawa et al., 2002). In predominately-white schools, for instance, black and Hispanic students may be exposed to a greater amount of discriminatory behavior (e.g., academic tracking into low-ability courses at equivalent levels of ability) or perceive more discriminatory behavior from teachers and peers. Discrimination, often considered a socially-derived stressor, may subsequently influence mental and physical health (Aneshensel, 1992). For example, perceived discrimination

has been associated with greater psychological distress (Brown et al., 2000; Williams, Yan, Jackson, & Anderson, 1997), depressive symptoms (Pavalko, Mossakowski, & Hamilton, 2003; Schulz et al., 2006), and health limitations (Gee & Walsemann, 2009; Pavalko et al., 2003). It is therefore possible that black and Hispanic students will experience more depressive symptoms in predominately-white schools than in predominately-minority schools. Indeed, research suggests that adolescents who perceive discriminatory treatment by teachers or staff are at greater risk of experiencing declining mental health (Roeser, Eccles, & Sameroff, 2000). Furthermore, stress and anxiety (Christiansen et al., 2008; Natvig et al., 1999; Rhee et al., 2005) appear to increase the risk of a variety of somatic symptoms, including headaches, stomachaches, backaches, and morning fatigue (Christiansen et al., 2008). Thus, among black and Hispanic students, perceived discrimination, which may occur more frequently at predominately-white schools, may also impact levels of somatic symptoms by regularly exposing them to stressful and anxiety-provoking events.

Finally, school racial/ethnic composition may influence students' attachment to their schools. In general, predominately-white schools often fail to adequately incorporate the values, interests, or history of people of color into the educational curriculum and mainstream school culture; such exclusions may lead to feelings of alienation and subsequent disengagement from school (Feagin & Sikes, 1994; Lewis, 2003). This may be one reason why black and Hispanic students often hold more optimistic and pro-school attitudes when they attend predominately-minority schools (Goldsmith, 2004). Indeed, for traditionally disadvantaged students of color, school connectedness appears to be relatively high in predominately-minority schools and relatively low in racially-mixed schools (McNeely, Nonnemaker, & Blum, 2002). Given that students who feel connected to their schools are less likely to initiate smoking, get drunk, smoke

marijuana, contemplate suicide, initiate sex, or engage in weapons related violence (McNeely & Falci, 2004), the racial/ethnic composition of a school could also influence their risk of experiencing depressive or somatic symptoms.

These insights motivate the current investigation. We examine three hypotheses. First, we hypothesize that the association between school-level racial/ethnic composition and depressive or somatic symptoms vary by student race/ethnicity; black and Hispanic students will experience higher levels of depressive and somatic symptoms in predominately-white schools than in predominately-minority schools. Second, we hypothesize that school-level SES will mediate this relationship. Third, we hypothesize that the differential relationship between school-level racial/ethnic composition and our dependent variables by student race/ethnicity will be attenuated once we account for students' perceptions of discrimination and attachment to school.

Methods

We analyzed Wave I (1994/5) restricted data from the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative sample of adolescents in grades 7 through 12 in 1994/5, and the Adolescent Health and Academic Achievement (AHAA) study (Riegle-Crumb, Muller, Frank, & Schiller, 2005; Udry, 2003). The Add Health sample is representative of U.S. schools with respect to region of country, urbanicity, school size, school type (private/public), and race/ethnicity. Our analysis utilized four data sources: (1) in-home interview of the student, (2) the parent, (3) a self-administered questionnaire completed by the school administrator; and (4) school demographic measures from AHAA.

We restricted our analysis to students and schools who were assigned probability weights. We excluded approximately 502 students from the analysis due to item-missingness, most of which was from missingness on the questions pertaining to perceived discrimination and

attachment to school (n=365). After exclusions, our final analytic sample consisted of 18,419 students (9,743 non-Hispanic whites, 3,909 non-Hispanic blacks, 3,127 Hispanics, 1,286 Asians, 148 American Indians, and 206 of other race/ethnicity) attending 132 junior and senior high schools in 1994/5.

Measures

Dependent Variables

We measured *depressive symptoms* using the 19-item Center for Epidemiological Studies Depression Scale (CES-D) available in Add Health (see Table 1). Although prior research using Add Health suggests that a reduced 5-item scale may be more applicable to studies of race/ethnicity and nativity (Perreira, Deeb-Sossa, Mullan Harris, & Bollen, 2005), in our study, we found that comparable conclusions could be made, regardless of the number of items used. Therefore, we used the 19-item scale, as much of the research on depressive symptoms uses the longer form of the CES-D, and because utilizing the 19-item scale resulted in more variability across schools and was more reliable than the 5-item scale. Per convention, positively worded items were reversed coded and the nineteen items were summed (Cronbach's α = .86). The distribution was skewed, so we used a square-root transformation to normalize the distribution.

We measured *somatic symptoms* using twelve indicators of physical symptoms (see Table 1). The items were extensively pilot tested by Add Health researchers and revised prior to full survey implementation (Udry, 2001). Scores on the summated scale ranged from 0 to 43 (Cronbach's α = .80). Exploratory analysis revealed a threshold effect at the 75th percentile. Thus, a binary variable was created such that respondents with scores greater than 12 were categorized as *high somatic symptoms* and coded 1 and all others were coded 0. Such dichotomization is consistent with prior research (Rhee et al., 2005), which has found that at

higher levels of somatic symptoms convergent validity with social impairment is achieved (Zwaigenbaum, Szatmari, Boyle, & Offord, 1999).

School Racial/Ethnic Composition

We measured school racial/ethnic composition as the *percent of non-Hispanic white students* at each school, henceforth "percent white students". Values ranged from 0 to 100. We explored other specifications of school racial/ethnic composition (e.g., different cut-points, percent non-Hispanic black). These analyses yielded similar results as those presented, thus for parsimony we present only the analyses using the continuous measure of the percent of white students at each school. Interaction terms between school racial/ethnic composition and student race/ethnicity were also created to allow us to investigate if the relationship between school racial/ethnic composition and each dependent variable varied by race/ethnicity.

Individual-Level Covariates

We included *age* of respondent as a continuous variable. Respondents self-reported their *race/ethnicity*, which we categorized as non-Hispanic white, non-Hispanic black, Asian/Pacific Islander, American Indian, Hispanic (any race), or other; non-Hispanic white served as the reference group. Respondents were categorized as *immigrants* if they reported being born outside of the U.S. to non-U.S. citizens. We created a measure of *family structure* categorized as nuclear (two biological parents), step-family (one biological and one step-parent), female-headed, extended/intergenerational family, and other; nuclear family served as the reference group. Students were asked how much they agreed that (1) "teachers at your school treat students fairly"; (2) "you feel you are part of your school"; (3) "you feel close to people at your school"; and (4) "you are happy to be at your school". For item one, students were categorized as disagreed/strongly disagreed versus all else. For the remaining items, students were categorized

as agreed/strongly agreed versus all else. We used the first item to capture *perceived discrimination* and the remaining items to capture *school attachment*. Finally, we constructed a composite measure of *family SES*, calculated as the mean of standardized (*z*-score) measures of family poverty, parental educational level, and parental occupational prestige, with positive values representing higher levels of SES (Cronbach's α =.66).

School-Level Covariates

We included *school SES* as a composite measure calculated as the mean of standardized (*z*-score) measures of school-level poverty, school-level parental education, school-level parental occupational prestige, and the proportion of students not on free or reduced lunch, with higher values representing higher levels of school SES (Cronbach's α=.83). Additional covariates included the *school community* (urban/suburban = CMSA or MSA with at least 2,500 residents, rural = all else) and *school type* (public versus private).

Sensitivity Analysis

We tested the sensitivity of our models to model specification as follows. First, we excluded schools with 0% and 100% white students to examine if students attending schools at the extreme ends of the distribution were altering our results. In these more conservative analyses the size and direction of the covariates were generally similar as those found in the full sample. Given issues of power, we chose to present the findings from the full sample only. Second, we included controls for region of the country and school size, which were not significant and did not alter our results. Thus, for parsimony we did not include these covariates in our models. Finally, given the nature of school segregation and potential non-overlap issues (see Figure 1), we ran analyses stratified by race/ethnicity. The stratified results mirrored what

we found in our combined analysis using interaction terms. Because the combined analyses allow us to test our hypotheses, we present the results from the combined analyses only.

Analytic Approach

First, we began with descriptive statistics to understand the data distribution. Next, two-level linear mixed models were examined to investigate the extent to which school racial/ethnic composition was associated with adolescent depressive symptoms. After examining an unconditional model (not shown), with no predictors, to assess between-school variation in depressive symptoms, we ran a model that examined the association between our primary predictor variable, school racial/ethnic composition, and depressive symptoms, after adjusting for race/ethnicity, age, gender, and immigrant status (Model 1). We ran two additional models to determine if the effects of school racial/ethnic composition were attenuated once other correlated school and family characteristics were included (Models 2 and 3). Finally, we added indicators that measured students' perceptions of discrimination and attachment to school (Model 4). Models 1 through 4 also included cross-level interaction terms for student race/ethnicity*percent white students. The equation from our final model (Model 4) for predicting depressive symptoms is presented below.

$$\mathrm{Y}_{ij} = \mathbf{X}_i'\beta + \mathbf{Z}_{ij}'\lambda + \mu_{0j} + \varepsilon_{ij}$$

Where Y_{ij} is the level of square-root depressive symptoms for student *i* in school *j* and assumes that conditional on μ_{0j}, Y_{i1} to Y_{in} are independent; $j = 1, \ldots \mathrm{J}_i$ is the number of schools included in our sample; $\mathbf{X}_i'\beta$ is a vector of individual-level covariates (e.g., race/ethnicity, family SES); $\mathbf{Z}_{ij}'\lambda$ is a vector of school-level covariates (e.g., percent white students) and cross-level interactions (e.g., black x percent white students); and μ_{0j} represents variation in intercepts between schools (i.e., between school variability) and is assumed to be randomly and

normally distributed with mean zero; and ε_{ij} is the random within-school variability for respondent *i* in school *j*. The assumptions associated with linear mixed models (i.e., normality and homogeneity of variance of level-1 and level-2 residuals) were evaluated using a SAS macro created by Bell, Morgan, Schoeneberger, Ferron, and Kromrey (2009) and no substantial violations were noted.

The same model building process was used for predicting high somatic symptoms, except that we specified a logit model using the following equation:

$$\text{logit}\,[P(Y_{ij}=1|\mathbf{X},\mathbf{Z},\mu_{0j})]=\mathbf{X}_i'\beta+\mathbf{Z}_{ij}'\lambda+\mu_{0j}$$

Where $\text{logit}\,[P(Y_{ij}=1|\mathbf{X},\mathbf{Z},\mu_{0j})]$ is the log-odds that student *i* in school *j* experiences high somatic symptoms and assumes that conditional on μ_{0j}, Y_{i1} to Y_{in} are independent; $j = 1, \ldots J_i$ is the number of schools included in our sample; $\mathbf{X}_i'\beta$ is a vector of individual-level covariates (e.g., race/ethnicity, family SES); $\mathbf{Z}_{ij}'\lambda$ is a vector of school-level covariates (e.g., percent white students) and cross-level interactions (e.g., black x percent white students); and μ_{0j} represents variation in intercepts between schools and is assumed to be randomly and normally distributed with mean zero. Other than the assumption of independence, which was not violated, based on the study design, no other assumptions needed to be evaluated given the non-linear nature of the models examined.

To make the interpretation of the intercept more meaningful, age was centered at 16, the approximate mean age of the sample, percent of non-Hispanic white students at a school was grand mean centered at 68%, and the individual items of perceived discrimination and school attachment were centered at their grand means. Next, to help with the interpretation of the regression coefficients for the variable percent of white students, data for this variable were transformed (original variable/10) such that the reported coefficients for this variable represent a

10% increase vs. a 1% increase. All analyses were weighted to adjust for the complex sample design utilized by Add Health. Descriptive statistics were weighted using the svy commands in Stata v10 (StataCorp, 2007). Next, the random-intercept models were weighted by using the Chantala, Blanchette, and Suchindran's (2006) SAS macro to generate appropriate two-level sample weights for use in linear and generalized linear multilevel models via Stata's GLLAMM program.

Results

Sample Characteristics

The sample consisted of 18,419 adolescents dispersed across 132 schools (density 20 to 1638). Overall, adolescents were primarily white (67%), lived in nuclear families (47%), and had slightly below-average family SES (M = -0.07, min = -2.23, max = 1.45; see Table 2). There were slightly more boys than girls (51% vs. 49%), the mean age was 15.9 years, and 5% were immigrants. The majority of adolescents reported feeling close to people at school (67%), part of their school (73%), and happy to be at school (66%), whereas 20% of students reported that teachers treated students unfairly. On average, the majority of adolescents were enrolled in urban/suburban (84%) and public schools (93%). On average, schools were primarily white (68%) in their student body composition and had slightly above-average SES (M = 0.12, min = -1.54, max = 2.15).

Black (M = 3.09), Hispanic (M = 3.31), and Asian (M = 3.32) adolescents reported higher levels of depressive symptoms than their white counterparts (M = 2.99), but fewer blacks (23%), Hispanics (20%), and Asians (18%) reported high levels of somatic symptoms than whites (29%). Minority students were more likely than whites to live in households with below-average SES. Approximately 55% of whites and Asians lived in nuclear families, compared to 22% of

blacks, 39% of Hispanics, 30% of American Indians, and 39% of others. Compared to whites, blacks and American Indians were more likely to indicate that teachers at their schools treated students unfairly. Consistent with national estimates of school segregation (Orfield & Lee, 2007),white students attended schools where the vast majority of students were white (83%), whereas the black, Hispanic, Asian, and American Indian students attended schools with notably lower proportions of white students (36%, 38%, 39%, and 54%, respectively).

Random Intercept Models

We first examined the influence of school racial/ethnic composition on depressive symptoms in Table 3. Model 1 tests the interactive effect between race/ethnicity and school racial/ethnic composition, adjusting for age, gender, and immigrant status. Results from this least restrictive model revealed a statistically significant interaction between race (black compared to whites) and the percent of white students in a school. Statistically significant interactions were not found for any other racial/ethnic group included in our study. Next, after adjustments for individual-level covariates (Model2), the interactive effect between black race and percent white remained significant (b=0.005). Further adjustments for school-level covariates (Model 3) did not attenuate these findings.

As shown in Figure 2, after controlling for student, family, and school characteristics included in Model 3, black students experienced increasing levels of depressive symptoms as the percentage of white students attending their school increased. However, as hypothesized, the interaction between black race and percent of white students in a school was no longer statistically significant after controlling for students' perceptions of discrimination and attachment to school (Model 4). Model 4 also revealed that students who perceived unfair

treatment by teachers experienced higher levels of depressive symptoms, whereas students who felt attached to their school experienced lower levels of depressive symptoms.

Next, we examined the influence of school racial/ethnic composition on high somatic symptoms (Table 4). Similar to our models for depressive symptoms, we first adjusted for age, gender, and immigrant status only (Model 1), then individual-level covariates (Model 2), school-level covariates (Model 3), and students' perceptions of discrimination and attachment to school (Model 4). Like depressive symptoms, after adjusting for individual, family, and school characteristics, the association between the percent of white students at a school and the probability of having high somatic symptoms varied for black students ($b=0.005$, $p<.05$),, but not for any other racial/ethnic groups included in our analyses.

As shown in Figure 3, after controlling for family, school, and student characteristics included in Model 3, the predicted probabilities of reporting high somatic symptoms increased for black students as the percentage of white students at their school increased. However, similar to depressive symptoms, after controlling for students' perceptions of discrimination and attachment to school (Model 4), the differential relationship between student race, percent of white students in a school, and predicted probabilities of high somatic symptoms was no longer statistically significant. Students' reports of perceived discrimination were associated with a higher log-odds of high somatic symptoms, whereas students' attachment to school was associated with lower log-odds of high somatic symptoms.

To further understand our findings in relation to our hypotheses we ran post-hoc analyses that examined the influence of school racial/ethnic composition on each of the four individual items of students' perceptions of discrimination and attachment to school and whether the association differed by race/ethnicity, controlling for all covariates present in Model 3 in Tables

3 and 4. The post hoc analysis revealed that as the percentage of white students at their school increased, black students were more likely to report unfair treatment by teachers, and less likely to report feeling close to people at school, feeling happy to be at school, or feeling part of the school (results available upon request). This finding, in conjunction with the direct relationships between our dependent variables and students' perceptions of discrimination and attachment to school, can help explain the attenuation of the association between black race*percent white students from Model 3 to Model 4, for both dependent variables..

Discussion

Our analysis of school racial/ethnic composition and depressive and somatic symptoms indicate three major findings. First, as hypothesized, black students experienced more depressive symptoms and were at greater risk of experiencing high somatic symptoms when attending predominately-white schools than when attending predominately-minority schools. The relationship was not significant among other racial/ethnic groups. Second, contrary to our hypothesis, school-level SES did not mediate this relationship. Indeed, school-level SES was not significantly associated with depressive symptoms, although increasing school-level SES was associated with a greater risk of high somatic symptoms. Third, as hypothesized, students' perceptions of discrimination and attachment to school attenuated the interactive associations between race (black vs. white), percent white at a school, and depressive and somatic symptoms.

Our findings are consistent with qualitative research suggesting that black students often feel alienated and isolated when attending predominately-white schools (Feagin et al., 1996; Lewis, 2003). The fact that our findings were explained by students' perceptions of discrimination and attachment to school lends additional support for this interpretation of our data. Although predominately-white schools are less likely to experience high levels of

concentrated poverty, violence, or disorder, and are more likely to have access to economic resources that allow them to provide more educational opportunities to their students, it is possible that the most salient aspect in terms of adolescent depressive and somatic symptoms is students' perceptions of how they are treated by peers and teachers. Adolescence is a time when peer acceptance is prominent, and as such, adolescents are highly likely to internalize the views of their peers and integrate these views into their own self-concepts (Crosnoe & McNeely, 2008).

Prior research documents a positive association between stress and high levels of somatic symptoms (Christiansen et al., 2008; Rhee et al., 2005). In models not adjusting for students' perceptions of discrimination and attachment to school, we found the predicted probability of experiencing high somatic symptoms increased for blacks with increasing percentages of white students at the school. However, after adjusting for these variables, this relationship dissipated. These findings suggest that one mechanism through which the racial/ethnic composition of the school might influence somatic symptoms among black students is through exposure to daily micro-aggressions that may occur more readily on predominately-white campuses. Feagin and Sikes (1994) define these micro-aggressions as "blatant, subtle, and covert actions taken by white people, willfully or half-consciously, to exclude, restrict, or otherwise harm black people" (p. 20). Given that racially mixed and predominately-white schools are more likely to resegregate black students into less rigorous coursework in an effort to appease white parents (Wells & Serna, 1996), school policies influenced by racial politics are one such micro-aggression that may increase the stress and anxiety of black students attending these schools.

It is plausible that predominately-white schools have short-term negative effects, but long-term protective effects for black students. Because a greater number of students who attend predominately-white schools are middle- and upper-class, these schools can often provide access

to greater educational and occupational networks that may help their students gain admission to colleges and well-paying jobs. These loose networks have been shown to increase the educational attainment of black students and decrease their occupational segregation in adulthood (Wells & Crain, 1994). As such, the potential long-term benefits of attending predominately-white schools on individuals' social and economic trajectories may not be fully perceived until adulthood. Given the cross-sectional nature of our study, we were unable to test this hypothesis, but such questions are an important next step in understanding the long-term effects of school racial/ethnic composition on mental and physical health.

Our findings for Hispanic students did not support our initial hypothesis that they would experience greater depressive and somatic symptoms in predominately-white schools as compared to predominately-minority schools. We also found that the percentage of white students at a school had a negligible effect on Asian or American Indian students' levels of depressive or somatic symptoms. It is possible that the school environment plays a less pronounced role in depressive and somatic symptoms among Hispanic, Asian, and American Indian students, than among black students and that other contexts and forms of support (e.g., family, peer groups) may be more important for these students. Given the unique history of school segregation experienced by blacks in the U.S., it is also plausible that black students experience greater levels of discrimination or are more negatively impacted by discriminatory school policies (e.g., academic ability grouping) than are other racial/ethnic minority students. Alternatively, Hispanic, Asian, and American Indian students may be affected by different aspects of their school environment as compared to black students. An important extension of this study would be to investigate if other aspects of the school community influence the health

of Hispanic, Asian, and American Indian students, and if peer group or family influences modify this relationship.

Considerable heterogeneity exists within the Hispanic, Asian, and American Indian student population. Small sample sizes and unmeasured heterogeneity coupled with less dispersion of Hispanics, Asians and American Indians across schools may have also impacted our results. Future studies may need to sample not only larger numbers of Hispanic, Asian, and American Indian adolescents, but may also need to sample a greater number of U.S. schools in order to determine if our results are robust.

In addition to those already mentioned, other caveats should be noted. First, our sample was designed to be representative of U.S. students who were enrolled in junior and senior high school in 1994/5. As such, our ability to generalize to current junior and senior high school students in the U.S. may be limited. However, to our knowledge, Add Health is the only nationally representative school-based survey in the U.S. that allows for analysis of school-level associations with adolescent depressive and somatic symptoms. Second, because we rely on cross-sectional data we were unable to make causal claims about the relationship between school racial/ethnic composition and depressive and somatic symptoms, or investigate if school racial/ethnic composition has long-term effects on depressive and somatic symptoms. Third, depressive and somatic symptoms constitute only two dimensions of health. Other outcomes (e.g., externalizing behaviors, anxiety) should be explored in future research. However; it is important to emphasize that our findings were similar across measures of depressive *and* somatic symptoms, even though the reference period differed across measures, lending additional support for our findings. Finally, although adolescents navigate many social settings on a daily basis, our analyses and results are limited to the school environment. Prior research suggests that other

social environments also play a role in adolescents' mental and physical health (Aneshensel & Sucoff, 1996; Cook, Herman, Phillips, & Settersten, 2002; Leventhal & Brooks-Gunn, 2003). However, we chose to limit our analyses to schools given the finding that schools are one of the strongest socializing forces in an adolescent's life. Additional research is needed to more fully understand how different social environments (e.g., neighborhoods and schools) interact to affect adolescent health.

In closing, our study provides preliminary evidence that school racial/ethnic composition influences the mental and physical health of black students. Attending predominately-minority schools may buffer black students from daily micro-aggressions that they may be more likely to experience at predominately-white schools. This is not to say that school segregation is *good* per se; indeed, the underlying and historical factors resulting in the continued perpetuation of school segregation is inherently unjust. However, given the continued significance of race in U.S. society, school environments that promote feelings of acceptance, belonging, and identity may be particularly important for black students, and may be more readily found for black students at predominately-minority schools.

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Figure Captions:

Figure 1: Percentage of Students of Each Racial/Ethnic Group Attending Schools with Varying Percentages of White Students

Figure 2: Level of Predicted Square Root Depressive Symptoms by Percent White at School and Student Race/Ethnicity

Figure 3: Predicted Probability of High Somatic Symptoms by Percent White at School and Student Race/Ethnicity

Table 1: Indicators used to comprise the 19-item CES-D scale and the 12-item somatic symptom scale

	19-item CES-D	Somatic Symptoms
Question Stem	"How often was each of the following things true during the past week? You…"	"How often have you had each of the following conditions in the past 12 months…"
Items	a) were bothered by things that usually don't bother you.	a) a headache
	b) didn't feel like eating, your appetite was poor	b) feeling hot all over suddenly, for no reason
	c) felt that you could not shake off the blues, even with help from your family and your friends	c) a stomachache or upset stomach
	d) felt that you were just as good as other people	d) cold sweats
	e) had trouble keeping your mind on what you were doing.	e) feeling physically weak, for no reason
	f) felt depressed	f) feeling really sick
	g) felt that you were too tired to do things	g) waking up feeling tired
	h) felt hopeful about the future[a]	h) dizziness
	i) thought your life had been a failure	i) chest pains
	j) felt fearful	j) aches, pains, or soreness in your muscles or joints
	k) were happy[a]	k) trouble falling asleep or staying asleep
	l) talked less than usual	l) trouble relaxing
	m) felt lonely	
	n) felt people were unfriendly to you	
	o) enjoyed life[a]	
	p) felt sad	
	q) felt that people disliked you	
	r) felt it was hard to get started doing things	
	s) felt life was not worth living	
Response Set	0 = never or rarely 1 = sometimes 2 = a lot of the time 3 = most of the time or all of the time	0 = never 1 = just a few times 2 = about once a week 3 = almost every day 4 = every day
Minimum	0	0
Maximum	56	43
Chronbach's Alpha	0.86	0.80

Notes: [a] Positively worded item reverse coded

Figure 1: Percentage of Students of Each Racial/Ethnic Group Attending Schools with Varying Percentages of White Students

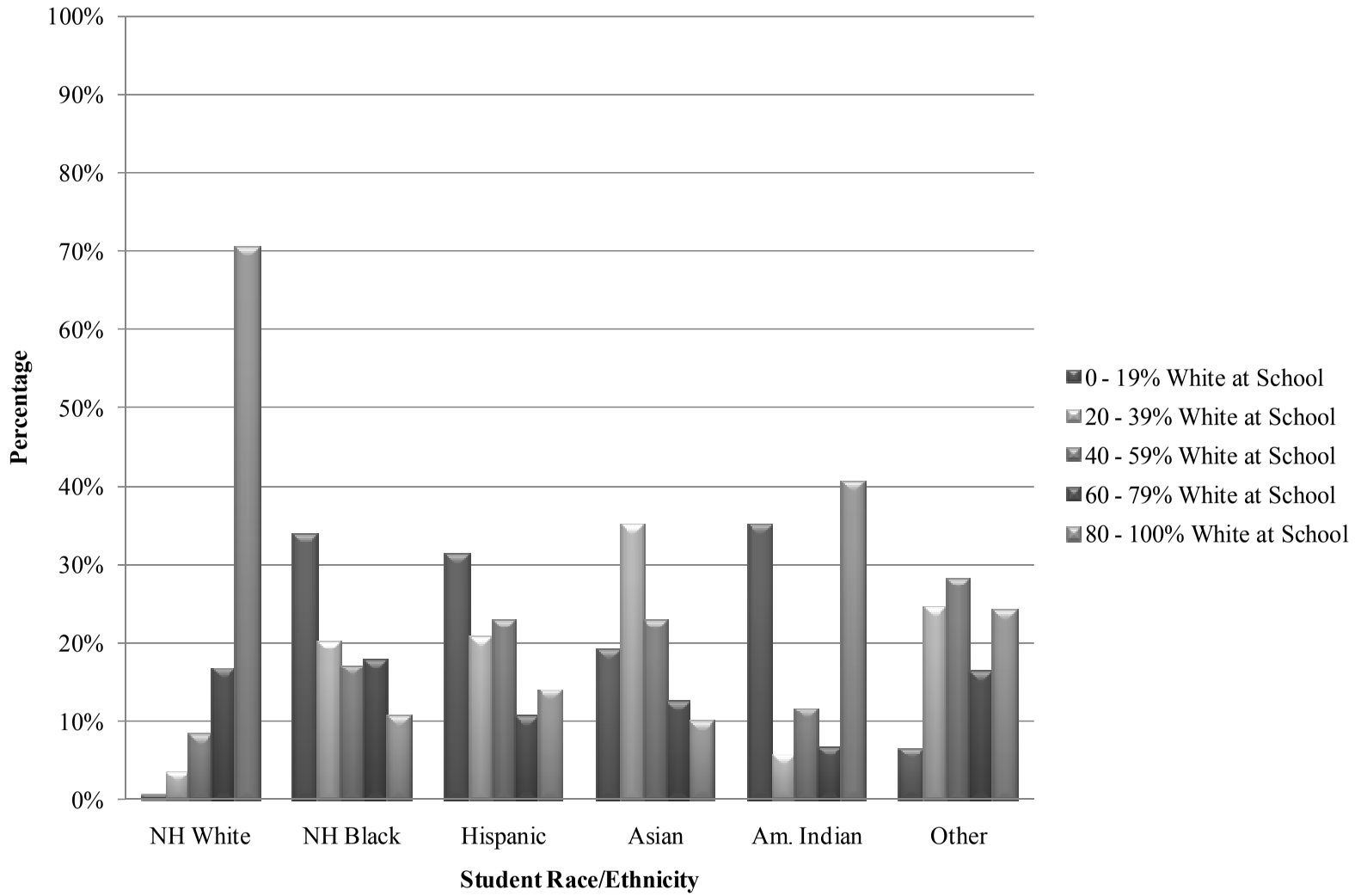


Table 2: Sample Characteristics by Race/Ethnicity, N=18,419, Weighted Data.[a]

	Overall	White	Black	Hispanic	Asian	American Indian	Other
Square-Root Depressive Symptoms[b, c]	3.09	2.99	3.28***	3.31***	3.32***	3.3†	2.96
High Somatic Symptoms[d]	0.23	0.25	0.20***	0.21**	0.18***	0.31	0.16*
Individual-Level Covariates							
Race/Ethnicity[d]							
Non-Hispanic White	0.67						
Non-Hispanic Black	0.16						
Hispanic	0.12						
Asian/Pacific Islander	0.04						
American Indian	0.01						
Other	0.01						
Gender[d]							
Female	0.49	0.49	0.50	0.49	0.48	0.37*	0.47
Age (in years)[b, c]	15.9	15.9	16.1	16.0	16.1	15.5†	15.8
Immigrant[d]	0.05	0.01	0.01	0.24***	0.49***	0.01	0.18**
Family Socio-economic Status[b, c]	-0.07	0.09	-0.35***	-0.55***	-0.10**	-0.31***	-0.16**
Family Structure[d]							
Nuclear	0.47	0.55	0.22***	0.39***	0.57	0.30**	0.39**
Step-Family	0.09	0.11	0.07***	0.08*	0.03***	0.15	0.06†
Female Headed Household	0.15	0.13	0.27***	0.14	0.06***	0.14	0.21†
Extended/Intergenerational	0.22	0.16	0.37***	0.34***	0.29***	0.32***	0.24*
Other	0.06	0.06	0.06	0.05	0.04	0.09	0.08
Unfair Treatment by Teachers[d]	0.20	0.20	0.24**	0.18	0.14**	0.32**	0.22
Close to People at School[d]	0.67	0.67	0.64	0.67	0.73*	0.61	0.63
Part of School[d]	0.73	0.74	0.74	0.67**	0.71	0.63*	0.67
Happy to be at School[d]	0.66	0.65	0.64	0.72***	0.73*	0.53	0.63
School-Level Covariates							
Percent Non-Hispanic White[b, c]	68.1	83.0	36.0***	38.2***	38.8***	54.1*	52.0***
School Socio-economic Status[b, c]	0.12	0.23	-0.05**	-0.24*	0.18	0.01*	0.20
School Type[d]							
Private	0.07	0.07	0.04	0.05	0.15	0.03	0.19
Public	0.93	0.93	0.96	0.95	0.85	0.97	0.81
Community[d]							
Rural	0.16	0.19	0.13	0.04*	0.02**	0.40	0.03**
Urban/Suburban	0.84	0.81	0.87	0.96*	0.98**	0.60	0.97***

Notes:

[a] All variables are dummy coded and can be interpreted as proportions, unless otherwise noted. [b] Continuous variable, mean presented. [c] Two-tailed t-test (Whites are the comparison group). [d] Chi-square test (Whites are the comparison group).

† p<.10, *p<.05, **p<.01, ***p<.001

Table 3: Random Intercept Linear Regression Model of Square-Root Depressive Symptoms (N=18,419), Weighted Analyses.[a, b]

	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)
Intercept	2.89 (0.03)***	2.80 (0.03)***	2.80 (0.04)***	2.83 (0.03)***
Individual-Level Variables				
Age of Respondent[c]	0.07 (0.01)***	0.06 (0.01)***	0.06 (0.01)***	0.04 (0.01)***
Female	0.25 (0.03)***	0.24 (0.02)***	0.24 (0.02)***	0.22 (0.02)***
Immigrant	-0.04 (0.06)	-0.10 (0.05)	-0.10 (0.05)	-0.01 (0.05)
Race/Ethnicity				
Black	0.35 (0.05)***	0.22 (0.05)***	0.22 (0.05)***	0.19 (0.05)***
Hispanic	0.18 (0.06)**	0.07 (0.06)	0.07 (0.06)	0.09 (0.07)
Asian	0.20 (0.09)*	0.20 (0.09)*	0.20 (0.09)*	0.19 (0.08)*
American Indian	0.21 (0.20)	0.10 (0.20)	0.10 (0.19)	-0.00 (0.18)
Other	-0.07 (0.12)	-0.12 (0.12)	-0.11 (0.12)	-0.13 (0.10)
Family Structure				
Step-Family		0.18 (0.04)***	0.18 (0.04)***	0.15 (0.04)***
Female-Headed		0.14 (0.04)***	0.14 (0.04)***	0.09 (0.03)*
Extended		0.27 (0.03)***	0.27 (0.03)***	0.23 (0.04)***
Other		0.33 (0.05)***	0.32 (0.05)***	0.24 (0.03)***
Family SES		-0.18 (0.02)***	-0.19 (0.02)***	-0.16 (0.02)***
Unfair Treatment by Teachers[d]				0.28 (0.03)***
Close to People at School[d]				-0.17 (0.03)***
Part of School[d]				-0.27 (0.03)***
Happy to be at School[d]				-0.34 (0.03)***
School-Level Variables				
% NH White[e]	-0.02 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
School SES			0.005 (0.03)	-0.02 (0.03)
Rural			-0.03 (0.05)	-0.01 (0.04)
Private			-0.03 (0.04)	0.04 (0.04)
Cross-Level Interactions				
Black x % NH White	0.05 (0.02)**	0.04 (0.02)*	0.04 (0.02)*	0.03 (0.02)
Hispanic x % NH White	-0.01 (0.02)	-0.00 (0.02)	-0.00 (0.02)	-0.01 (0.02)
Asian x % NH White	0.00 (0.03)	0.01 (0.03)	0.01 (0.03)	-0.00 (0.03)
American Indian x % NH White	-0.06 (0.05)	-0.07 (0.05)	-0.07 (0.05)	-0.06 (0.04)
Other x % NH White	0.03 (0.03)	0.05 (0.03)	0.05 (0.03)	0.04 (0.03)
Level-1 Variance	1.31	1.28	1.28	1.17
Level-2 Variance	.024	.018	.018	.012
Psuedo-R^2	0.40	0.55	0.55	0.70

Notes:

[a] Reference categories: white, male, US born, nuclear family, urban/suburban school, public school; [b] Unconditional model level 2 variance = 0.04; [c] Age is centered at 16. [d] Student perception of discrimination/attachment variables centered at grand means. [e] Percent white students centered at 68% and divided by 10.*p<.05, **p<.01, ***p<.001

Table 4: Random Intercept Logit Model of High Somatic Symptoms (N=18,419), Weighted Analysis.[a, b, c]

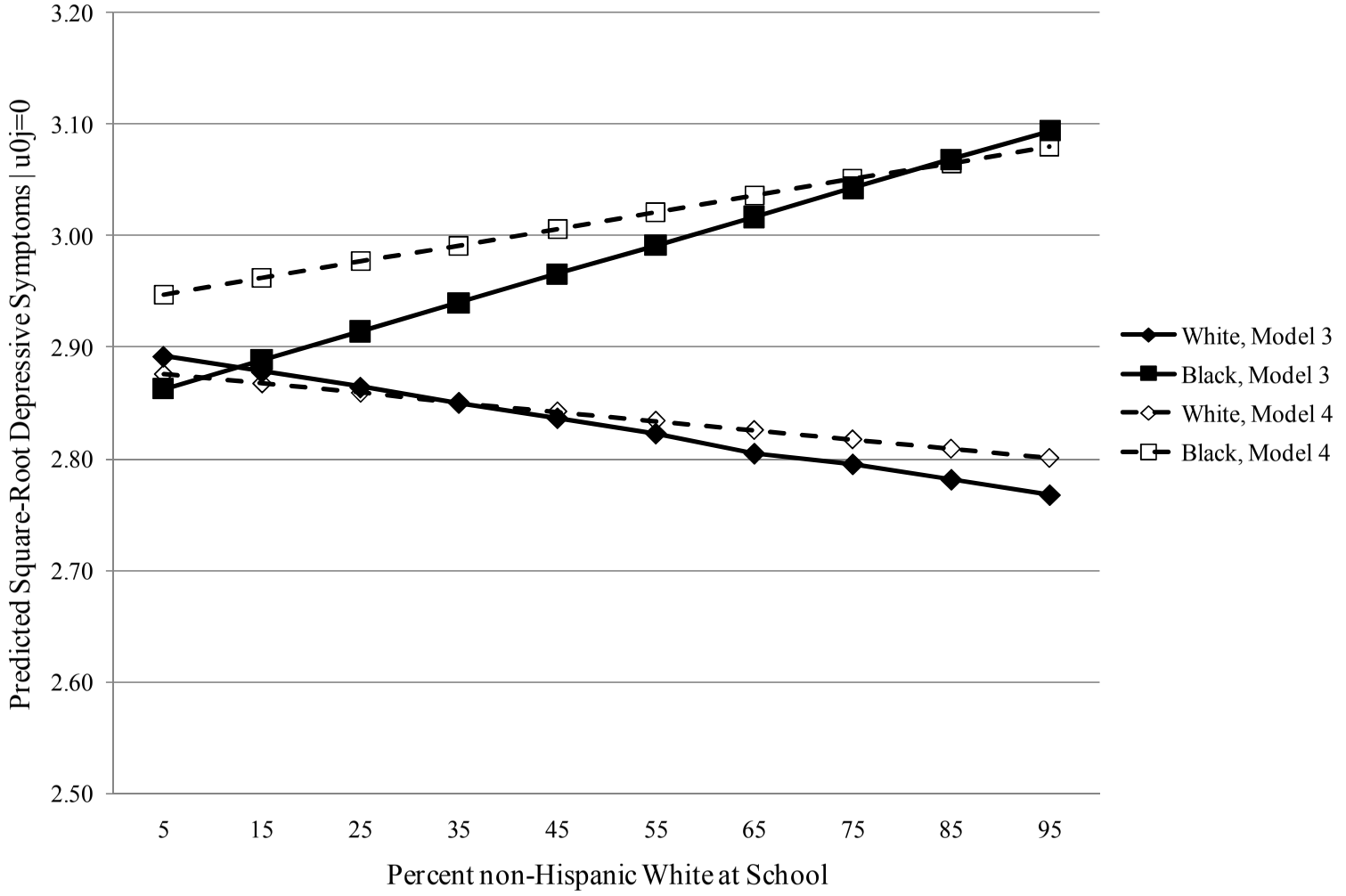
	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 4 b (SE)
Intercept	-1.36 (0.06)***	-1.48 (0.06)***	-1.47 (0.06)***	-1.49 (0.06)***
Individual-Level Variables				
Age of Respondent[d]	0.00 (0.02)	-0.00 (0.02)	-0.00 (0.02)	-0.03 (0.02)*
Female	0.41 (0.05)***	0.40 (0.05)***	0.40 (0.05)***	0.39 (0.05)***
Immigrant	-0.41 (0.12)***	-0.41 (0.12)***	-0.41 (0.12)***	-0.29 (0.12)*
Race/Ethnicity				
Black	-0.09 (0.10)	-0.17 (0.10)	-0.18 (0.10)	-0.21 (0.10)*
Hispanic	-0.16 (0.10)	-0.20 (0.10)	-0.21 (0.10)*	-0.20 (0.11)
Asian	-0.37 (0.19)	-0.34 (0.19)	-0.36 (0.19)	-0.38 (0.18)*
American Indian	0.28 (0.28)	0.23 (0.28)	0.23 (0.27)	0.12 (0.27)
Other	-0.34 (0.32)	-0.34 (0.31)	-0.35 (0.31)	-0.38 (0.33)
Family Structure				
Step-Family		0.23 (0.10)*	0.23 (0.09)*	0.20 (0.10)*
Female-Headed		0.27 (0.07)***	0.27 (0.07)***	0.21 (0.07)**
Extended/Intergenerational		0.27 (0.07)***	0.27 (0.07)***	0.24 (0.07)***
Other		0.23 (0.10)*	0.23 (0.10)*	0.12 (0.10)
Family SES		-0.00 (0.04)	-0.02 (0.04)	0.00 (0.04)
Unfair Treatment by Teachers[e]				0.40 (0.06)***
Close to People at School[e]				-0.10 (0.06)
Part of School[e]				-0.24 (0.06)***
Happy to be at School[e]				-0.47 (0.06)***
School-Level Variables				
% NH White[f]	0.001 (0.02)	0.007 (0.02)	0.002 (0. 02)	0.01 (0.02)
School SES			0.15 (0.07)*	0.13 (0.06)*
Rural			-0.04 (0.10)	-0.02 (0.10)
Private			-0.23 (0.11)*	-0.14 (0.11)
Cross-Level Interactions				
Black x % NH White	0.06 (0.03)*	0.05 (0.02)*	0.05 (0.03)*	0.04 (0.03)
Hispanic x % NH White	0.008 (0.03)	0.007 (0.03)	-0.001 (0.03)	-0.01 (0.03)
Asian x % NH White	-0.05 (0.05)	-0.04 (0.05)	-0.05 (0.05)	-0.06 (0.05)
American Indian x % NH White	0.02 (0.06)	0.01 (0.06)	0.01 (0.06)	0.01 (0.07)
Other x % NH White	0.06 (0.09)	0.07 (0.09)	0.07 (0.09)	0.06 (0.09)
Level-2 Variance	.045	0.044	0.042	0.041
Pseudo-R^2	0.36	0.37	0.40	0.41

Notes:

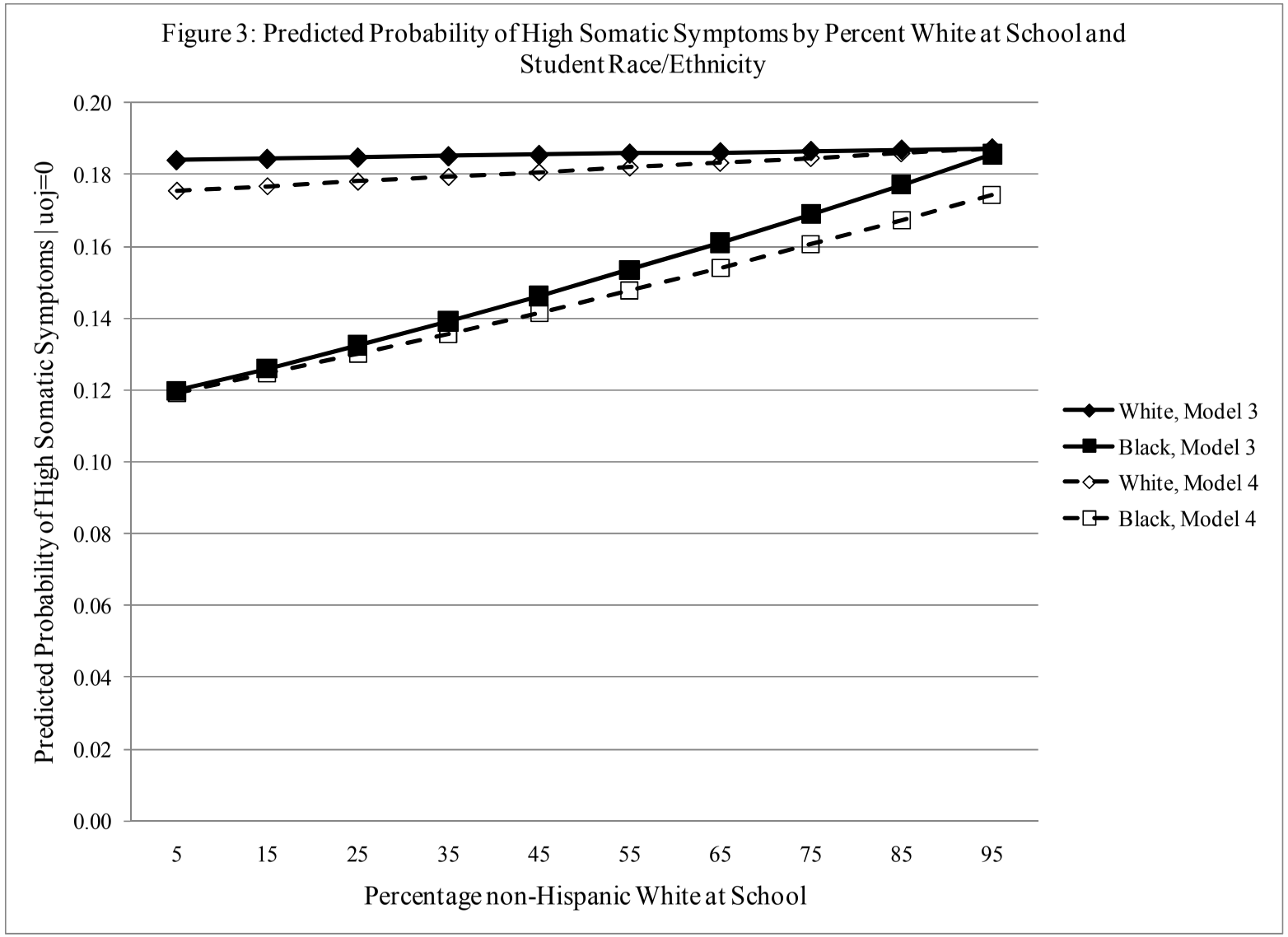
[a] Reference categories: white, male, US born, nuclear family, urban/suburban school, public school. [b] Log-odds and standard errors presented. [c] Unconditional model level 2 variance = 0.07; [d] Age is centered at 16. [e] Student perception of discrimination/attachment variables centered at grand means. [f] Percent white students centered at 68% and divided by 10.

*p<.05, **p<.01, ***p<.001

Figure 2: Level of Predicted Square-Root Depressive Symptoms by Percent White at School and Student Race/Ethnicity



Notes: Adjusted for school SES, rurality, type of school, family SES, family structure, age, gender, and immigrant status (Model 3 & 4). Age is centered at 16. Student perception of discrimination/attachment variables centered at grand means (Model 4). Plotted lines represent black and white male students.



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