

NEW RESEARCH

Neighborhood Deprivation and Adolescent Mental Health: The Protective Role of School Staffing Patterns

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Objective: Schools are key for advancing adolescent well-being, yet the role of school-level factors in supporting student mental health in the context of neighborhood deprivation is unknown.

Method: Students (N = 30,469, age: mean = 15.11 years, SD = 1.75 years) in 62 middle and high schools in Massachusetts completed the Substance Use and Risk Factors (SURF) Survey to assess psychiatric symptoms. Neighborhood deprivation was assessed through the census-extracted Area Deprivation Index (ADI). School-level moderators included school staffing patterns (teacher and mental health staff-to-student ratios, teaching staff increases) and characteristics that may support belonging and inclusion (school written commitment to inclusivity, proportion of teachers of shared race/ethnic minority status). Linear mixed models clustered by school examined links between neighborhood deprivation and psychiatric symptoms and tested school moderators, covarying for student age and sex as well as neighborhood density of substance retailers and crime.

Results: Higher neighborhood deprivation related to higher psychiatric symptom endorsement (β values = 0.04-0.08, p_{FDR} values <.04). Higher mental health staff ratios weakened the associations of neighborhood deprivation with anxiety and depressive symptoms (β [SE] = -0.03 [0.01], p_{FDR} = .04), suicidal thoughts and behaviors (β [SE] = -0.03[0.01], p_{FDR} = .04), and substance use (β [SE] = -0.04 [0.02], p_{FDR} = .04). Interactions were not observed for other school staffing patterns or characteristics supporting belonging and inclusion.

Conclusion: School mental health staffing patterns may represent a modifiable protective factor with the potential to address mental health needs in disadvantaged communities and neighborhood contexts.

Study registration information: School-level protective factors for mental health distress and substance use in youth exposed to systemic neighborhood deprivation; <https://osf.io/qkp25>.

Diversity & Inclusion Statement: We worked to ensure race, ethnic, and/or other types of diversity in the recruitment of human participants. We worked to ensure sex and gender balance in the recruitment of human participants. One or more of the authors of this paper self-identifies as a member of one or more historically underrepresented racial and/or ethnic groups in science. One or more of the authors of this paper self-identifies as living with a disability. One or more of the authors of this paper received support from a program designed to increase minority representation in science. While citing references scientifically relevant for this work, we also actively worked to promote sex and gender balance in our reference list. The author list of this paper includes contributors from the location and/or community where the research was conducted who participated in the data collection, design, analysis, and/or interpretation of the work.

Key words: mental health; neighborhood; school; deprivation; adversity

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A substantial proportion of adolescents in the United States reside within neighborhoods scarce in financial, educational, and material resources needed for healthy development.¹ Furthermore, rates of mental illness in US adolescents have risen steeply over the past decade,² a trend that has been referred to as a mental health crisis.³ Neighborhoods and associated structural disadvantage predict mental health symptom development in adolescents.⁴ Work is needed that considers how youth mental health may relate to neighborhood and school environments, where youth spend a significant amount of

their time.^{5,6} The current study explores potential buffering agents available to schools, including staffing patterns (proportion of teaching staff; increases in teaching staff, that is, teachers employed within the school that academic year divided by number of teachers employed the year prior; and proportion of mental health staff) and school characteristics facilitating belonging and inclusiveness (inclusivity language in mission statements, and for racial/ethnic minority students, density of racial/ethnic minoritized teaching staff).⁷

Youths' neighborhood environment plays a key role in mental health,⁸⁻¹⁰ particularly during adolescence, a

foundational and dynamic sensitive period of development.¹¹⁻¹⁴ Neighborhoods could relate to environmental disadvantage through multiple avenues, including limited stimulation and resource availability (ie, deprivation).^{15,16} Neighborhood deprivation estimates overall resource availability at the structural level, including financial, educational, and health supports; furthermore, an overall scarcity of resources would include a lack of safeguards to bolster mental health. Indeed, neighborhood deprivation has shown powerful links to adolescent mental health, even after accounting for individual influences such as socioeconomic status.^{9,17-19}

Thus, environmental adversity experienced during adolescence—a sensitive period of development—could inform mental health, including transdiagnostic and specific indicators of internalizing, externalizing, and psychosis risk.^{4,7,11,20-22} Adolescence is a period in which vulnerability to mental illness often emerges, and precursor symptoms become apparent.^{23,24} Capturing emerging symptoms in this stage can benefit from a multifaceted approach. For example, emotion reactivity is crucial to emotion regulation capacities, which are transdiagnostic indicators of future difficulties with mental health.^{25,26} Risky behaviors such as substance use in adolescence can also reflect transdiagnostic risk.²⁷⁻²⁹ Internalizing, externalizing, and psychotic-like experiences have been linked to environmental adversity and are predictive of future risk for specific (internalizing, externalizing, and psychotic) disorders.¹⁵

Schools may represent a potent venue for mental health promotion—adolescents spend a substantial amount of time in school,^{6,30} and schools are key access points for meeting youth mental health care needs.³¹ Indeed, modifiable school environments, including teacher support, availability of mental health supports, and school climate, have been associated with better mental health outcomes.^{6,30,32-35} However, in the United States, only 48% of schools report that they can effectively provide mental health services to students in need,³⁶ and empirically supported recommendations on how to prioritize school support resources are scarce.^{31,37-39}

Considering limited resources, understanding which specific facets of modifiable school efforts meaningfully link to mental health could aid in tailoring resource allocation. Previous work suggests that increased teacher availability may be a meaningful support for student academic success, and teachers are considered a critical safeguard for student well-being.^{40,41} Teaching staff increases could represent increased support, and have been linked to increased teacher well-being and a more supportive school climate for students.⁴²⁻⁴⁵ Mental health

supports, including school counselors, have specifically been related to improved symptom and mental health outcomes.^{46,47} Despite promising evidence that school characteristics may help promote adolescent mental health, it is not yet known whether these schools could buffer against the putative effects of neighborhood deprivation.

Beyond the direct availability of school staff supports, school characteristics promoting student belonging, social capital (ie, mutual trust, reciprocity, support), and social inclusivity may also be key to supporting student mental health.^{15,48} Schools often turn to messaging around culture to combat discrepancies in student belonging, and mission statements are used to emphasize inclusivity as core to schools' values and to promote a welcoming environment for underrepresented students.⁴⁹ Early work has shown health benefits of school environments that emphasize inclusivity,⁴⁹ but it is unknown whether mission statement language directly translates to improved student mental health. Furthermore, students of color face unique and multifaceted barriers in achieving belonging, social capital, and inclusion that are identity specific and potentially challenging for mental health.⁵⁰⁻⁵² Racial/ethnic density, or the proportion of individuals within a given context who share one's race/ethnicity, has been found to be protective against mental health difficulties across neighborhood and school settings.^{48,51,53-57} However, it is unclear whether increased representation of racially/ethnically minoritized teaching staff could buffer against neighborhood deprivation-related mental health vulnerability among racially/ethnically minoritized adolescents.

The current study leverages a large sample of middle and high school students to examine associations among neighborhood deprivation, psychiatric symptoms, substance use, and modifiable school-level influences. This study theorized that higher neighborhood deprivation would relate to higher endorsement of psychiatric symptoms. Furthermore, a more supportive school environment (ie, proportion of teaching and mental health staff, increases in teaching staff) and school characteristics supporting belonging and inclusivity (ie, written commitment to inclusivity and a higher proportion of same race/ethnicity teaching staff for racial/ethnic minority youth) would link to lower endorsement of psychiatric symptoms and substance use. Moreover, the study theorized that school staffing and characteristics supporting belonging and inclusivity would weaken associations of neighborhood deprivation, psychiatric symptoms, and substance use.

METHOD

Analysis plans were preregistered on the Open Science Framework (osf.io/qkp25).

Sample

The Substance Use and Risk Factor (SURF) Survey (PI: Schuster) collected data from 30,469 students in 62 Massachusetts middle and high schools in fall 2023⁵⁸ (Supplement 1, Figure S1, available online). Caregiver consent was obtained through an opt-out procedure. Survey participation was voluntary for students not opted out by their caregivers, with assent implied by survey completion. Procedures were approved by the MGB Institutional Review Board. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines were followed.⁵⁹

Predictor

Neighborhood Deprivation. The Area Deprivation Index (ADI), a composite measure of neighborhood socioeconomic adversity aggregating across 17 measures (eg, median family income, percentage of persons with at least a high school diploma, percentage of adult unemployment)⁶⁰ was extracted per census tract corresponding to school location (Supplements 2 and 3, available online). Rankings represent national percentiles ranging from 0 to 100, with higher values indicating higher levels of deprivation.

Moderators

Staffing Ratios. An overall teacher-to-student ratio was computed, including all teachers within a school divided by the number of students, with higher numbers representing more teaching staff. A mental health staff-to-student ratio was calculated; clinical and nonclinical staff working directly to support student mental health were designated as mental health staff (which included school counselors, psychologists, nurses, school adjustment counselors, social workers, family engagement coordinators, diagnostic and evaluation staff, recreation/therapeutic recreation specialists, and rehabilitation counselors), with higher ratios indicating higher mental health staff availability. Data were extracted from publicly available data from the Massachusetts Department of Elementary and Secondary Education (DESE).

Teaching Staff Increases. Rate of increases in teaching staff consisted of the number of teachers employed within the school that academic year divided by the number of teachers employed the year prior as reported by DESE, with higher numbers indicating an increase in teaching staff.

Written Commitment to Inclusivity. A written school commitment to inclusivity in school mission statements has been linked to health benefits for minoritized students.⁴⁹ Mission statements help to establish a shared language around school goals for professional accreditation (eg, <https://www.neasc.org/accreditation>). Statements were coded as emphasizing inclusivity or not emphasizing inclusivity⁴⁹ (Supplement 4, available online). The school mission statements were publicly available and obtained from the school or district websites. Authors TGV and T.B.-D. independently coded each school ($\kappa_w = 0.97$). Discrepancies were resolved through consensus.

Proportion of School Teaching Staff Holding Minoritized Identities. In a subsample including only racial/ethnic minoritized students (ie, excluding White, non-Latine students), ratios were calculated for proportion of teachers in a participant's school that shared the same racial/ethnic identity as the participant (eg, if a student were White, non-Latine, the variable would indicate the percentage of teachers in that student's school who were White, Non-latine); higher numbers indicated higher proportions of individuals of the same race/ethnicity.

Outcomes

Anxiety and Depressive Symptoms. The Patient Health Questionnaire-4 (PHQ-4) assessed the following: feeling nervous, anxious, or on edge, not being able to stop or control worrying, feeling down, depressed, or hopeless, and having little interest or pleasure in doing things. Endorsement was on a scale of 0 to 3⁶¹ querying for the past 2 weeks. A 4-point Likert scale ranged from 0 representing "not at all" to 1 representing "several days," to 2 representing "more than half the days," to 3 representing "nearly every day" for each symptom queried. A sum score was calculated; higher scores indicated more symptoms.

Suicidal Thoughts and Behaviors. Four self-report items (0 = no, 1 = yes) were summed to assess past 12-month suicidal ideation ("Did you...ever have thoughts about killing yourself or ending your life?"), plan ("...think about how you would kill yourself?"), attempts ("...try to kill yourself?"), and nonsuicidal self-injury ("...hurt yourself on purpose without trying to kill yourself?"). Although the original preregistration proposed a binary yes/no score as an outcome variable, a sum score was calculated across the 4 items to parse severity levels for total number of symptoms endorsed. Higher values indicated higher severity of symptoms.

Psychotic-like Experiences. The Adolescent Psychotic-like Symptom Screener (APSS) assessed lifetime psychotic-like symptoms, including the following: thinking others can read your mind, having messages sent to you specifically through the TV, thinking that people are following or spying on you, hearing voices or sounds that no one else can hear, feeling that you were under the control of some special power, seeing things that other people couldn't see, and feeling that you had extra special powers. Endorsement ranged from 0 to 1.⁶² 0 represented "not at all," 0.5 represented "maybe," and 1 represented "yes." A sum score represented quantity of symptoms endorsed. Higher values indicated higher symptom endorsement.

Emotion Reactivity. The Emotional Reactivity Scale (ERS) included 21 items to assess for trait/lifetime domains of emotion sensitivity, intensity, and persistence. Endorsement ranged from 0 to 4⁶³; 0 represented "not at all like me," 1 represented "a little like me," 2 represented "somewhat like me," 3 represented "a lot like me," and 4 represented "completely like me." A sum score was calculated representing total endorsement of emotion reactivity. Higher values indicated higher symptom endorsement.

Substance Use. Substance use was assessed as frequency of past 30-day alcohol, cannabis, and tobacco (vapes, cigarettes, cigars, or smokeless tobacco) use. Use endorsement for each substance use type ranged from 0 to 6; 0 represented 0 times, 1 represented "only once," 2 represented "less than once a week," 3 represented "on at least 1 day a week," 4 represented "2 to 3 days a week," 5 represented "4 to 6 days a week," and 6 represented "every day." A sum score was calculated to estimate total frequency of use across substances. Higher scores indicated higher substance use.

Covariates

Age and Sex. Age was calculated based on self-reported month and year of birth. Assigned sex at birth was self-reported. Although gender likely relates more directly to mental health symptoms, we used sex at birth in analyses because 0.00% to 0.098% of participants within schools identified as gender diverse (ie, nonbinary, gender diverse, or trans), and all others identified as cisgender. Including a separate gender category would have resulted in an insufficient cell size for valid and reliable estimates (eg, estimates are prone to higher sampling error and increased sensitivity to potentially high leverage cases). Our decision aimed to balance inclusivity with the need for reliable and replicable statistical inference. Nonetheless, sexual and gender minority status is a crucial consideration for mental health (Supplement 5, Tables S1-S3, Figure S2, available online).

Neighborhood Personal Crime Index. The personal crime index for each school community was extracted through Applied Geographic Solutions, and assessed relative risk of crime exposure using historical crime data from the Federal Bureau of Investigation's Uniform Crime Report and from city crime databases.^{64,65} This index was chosen in line with recommendations, as prior work showed that the personal crime index performed the best among indices for predicting crime.⁶⁵ Estimates are weighted by population and converted into indexes relative to the national total, with scores of 100 representing crime levels at the national average.⁶⁵

Neighborhood Availability of Substance Retailers. Number of licensed substance retailers in 2023 for alcohol, tobacco, and cannabis were extracted per census tract and summed by school community. State records identified neighborhood establishments licensed to distribute alcohol (Massachusetts Alcohol Beverages Control Commission), tobacco (Massachusetts Department of Revenue Cigarette and Tobacco Unit), and cannabis (Massachusetts Cannabis Control Commission) (Supplemental Table S4, Figure S3, available online).⁶⁶⁻⁶⁸

Data Analyses

Linear mixed models were run accounting for clustering by school using R and the lme4 package,^{69,70} with neighborhood deprivation as predictor controlling for age, sex at birth, neighborhood substance retailers, and crime. Outcome variables included the PHQ-4, suicidal thoughts and behaviors, APSS, ERS, and substance use in separate models. Random intercepts were specified to vary by school. Associations were assessed for neighborhood deprivation and school characteristics in separate models without interaction terms. Separate models tested interactions of neighborhood deprivation, school supports, and school characteristics promoting belonging and inclusivity predicting symptoms. Analyses with school proportions of same racial/ethnicity teaching staff were run in subsamples of racial/ethnicity minoritized students (N = 12,233). All moderators were entered as continuous variables, except school written commitment to inclusivity, which was a binary variable. Significant interactions were probed by computing simple slopes of the association between neighborhood and mental health outcome at low level (1 SD below the mean) and high level (1 SD above the mean) of the school moderator (eg, staffing ratio); follow-up simple slopes analyses were not corrected for multiple testing, and as such uncorrected *p* values are presented in Results.⁷¹ Frequency statistics for samples at low and high are reported; however, simple slopes are estimated using full-sample

statistics. Variables were grand mean standardized. Furthermore, a variance inflation factor (VIF) was computed to inspect multicollinearity among variables, and none was detected (ie, VIFs <5).⁷² A false discovery rate (FDR) for multiple comparisons correction established significance across 5 symptom domains tested ($p_{\text{FDR}} < .05^{73}$); correction was applied within main associations and within interaction tests (5 corrections).

Participants from 1 school ($n = 8$) were excluded because of the school having a low enrollment count, resulting in outlier values exceeding 3 SD from the mean; results did not change direction or magnitude because of this exclusion. As mixed linear models are robust to missing data,⁷⁴ participants were not excluded based on missing observations. The survey included 2 attention checks ("Please select option 4 below"; "Please select option 2 below"). Sensitivity analyses were conducted excluding participants who failed both attention checks, in addition to records with less than 60% overall survey completion. Analyses were also conducted applying square root and natural log transformations for left and right skewed variables, respectively. Finally, analyses were run using multiple imputation for missing data. Results were computed and averaged across 5 imputed datasets using the mice package and predictive mean matching. Pattern of results did not change based on these exclusions, transformations or imputation, as such original analyses using the whole sample are presented (raw data descriptives are presented in Table 1 for interpretability; Supplemental Material for standardized value ranges). The average neighborhood deprivation value was 24.47, representing neighborhood deprivation values lower than approximately 75% of neighborhoods in the United States.

Modifications to Preregistered Analyses. The preregistration originally proposed additional association and interaction analyses with neighborhood substance retailers and substance use. Interaction analyses with nonmodifiable school characteristics (ie, proportion of student race/ethnicity and gender/sexual minority status) were also proposed. Although these analyses are presented in the Supplemental Material to honor the preregistration, they are not presented or interpreted in the main text (Supplement 5; Supplement Tables S3, S5-S9, available online).

RESULTS

Table 1 lists demographic characteristics. Neighborhood deprivation was not highly correlated with school characteristics (Figure 1).

Aim 1: Associations of Neighborhood Deprivation on Psychiatric Symptoms

Neighborhood deprivation related to higher anxiety and depressive symptoms (β [SE] = 0.05 (0.02), $t = 2.56$, $p_{\text{FDR}} = .02$), psychotic-like experiences (β [SE] = 0.08 (0.02), $t = 4.21$, $p_{\text{FDR}} < .001$), emotion reactivity (β [SE] = 0.08 (0.02), $t = 4.76$, $p_{\text{FDR}} < .001$), and substance use (β [SE] = 0.04 (0.02), $t = 2.17$, $p_{\text{FDR}} = .04$). Neighborhood deprivation did not significantly relate to suicidal thoughts and behaviors (Table 2).

Aim 2a: Associations of School Staffing Patterns on Psychiatric Symptoms

Contrary to hypotheses, higher teacher-to-student ratio linked to higher endorsement of anxiety and depression (β [SE] = 0.05 (0.02), $t = 2.62$, $p_{\text{FDR}} = .01$), suicidal thoughts and behaviors (β [SE] = 0.06 (0.02), $t = 3.41$, $p_{\text{FDR}} = .005$), psychotic-like experiences (β [SE] = 0.05 (0.02), $t = 2.56$, $p_{\text{FDR}} = .01$), emotion reactivity (β [SE] = 0.05 (0.02), $t = 2.71$, $p_{\text{FDR}} = .01$), and substance use frequency (β [SE] = 0.06 (0.02), $t = 3.03$, $p_{\text{FDR}} = .01$). Likewise, teaching staff increases related to higher symptom endorsement across anxiety and depression (β [SE] = 0.04 (0.02), $t = 2.47$, $p_{\text{FDR}} = .01$), suicidal thoughts and behaviors (β [SE] = 0.04 (0.02), $t = 2.65$, $p_{\text{FDR}} = .01$), psychotic-like experiences (β [SE] = 0.04 (0.02), $t = 2.22$, $p_{\text{FDR}} = .03$), emotion reactivity (β [SE] = 0.04 (0.02), $t = 2.57$, $p_{\text{FDR}} = .01$), and substance use frequency (β [SE] = 0.04 (0.02), $t = 2.47$, $p_{\text{FDR}} = .01$). Mental health staff-to-student ratios did not significantly relate to symptoms.

Aim 2b: Associations of School Characteristics Promoting Belonging and Inclusivity on Psychiatric Symptoms

Contrary to hypotheses, school written commitment to inclusivity did not significantly relate to symptoms (Table 2). Higher proportion of same race/ethnicity teaching staff related to lower suicidal thoughts and behaviors (β [SE] = -0.03 (0.01), $t = -3.37$, $p_{\text{FDR}} < .00$), psychotic-like experiences (β [SE] = -0.09 (0.01), $t = -10.86$, $p_{\text{FDR}} < .00$), and emotion reactivity (β [SE] = -0.02 (0.01), $t = -2.46$, $p_{\text{FDR}} = .02$), but not anxiety and depressive symptoms or substance use.

Aim 3a: Moderation of Neighborhood Deprivation by School Staffing Patterns

Teacher-to-Student Ratios. Teacher-to-student ratios did not modify the relationship between neighborhood deprivation and any psychiatric symptoms.

TABLE 1 Demographic Characteristics (N = 30,469)

Student level: demographics					
	Range	Mean	SD	N	%
Age, y	8-23	15.11	1.75		
Sex (female/male/data not available)				13,225/12,581/4,663	43.40/41.29/15.30
Gender identity					
Female				12,210	40.08
Male				12,139	39.85
Gender diverse				944	3.10
Other ^a				5,168	16.97
Sexual orientation					
Asexual				209	0.69
Bisexual				1,770	5.81
Gay or lesbian				638	2.09
Straight				19,894	65.31
Other ^a				7,017	23.03
Race and ethnicity					
American Indian or Alaska Native				69	0.23
Asian				1,681	5.52
Black				1,231	4.04
Hawaiian or Pacific Islander				23	0.08
Latine				7,008	23.01
Middle Eastern/North African				296	0.97
Multiracial				1,524	5.00
Other ^a				5,122	16.81
White				13,507	44.3
Student level: outcomes					
	Range	Mean	SD	N	%
Anxiety and depressive symptoms ^b	0-12	2.86	3.28		
Suicidal thoughts and behaviors ^c	0-4	0.43	0.98		
Psychotic-like experiences ^d	0-7	0.87	1.35		
Emotion reactivity ^e	0-84	19.99	21.19		
Substance use (past 30-day frequency) ^f	0-36	0.69	2.90		
School level^g: descriptives					
	Range	Mean	SD	N	%
School enrollment	56-2,566	1,136.12	567.37		
School setting					
Urban				2,390	7.48
Suburban				25,791	84.67
Rural				2,278	7.85
School level: main associations and moderators					
Neighborhood deprivation ^h	0-100	24.47	15.36		
Neighborhood crime ⁱ	2-261	65.59	62.18		
Neighborhood substance retailers ^j	0-136	44.20	27.67		
Staffing patterns					
Teacher-to-student ratio	0.06-0.13	0.09	0.01		
Mental health staff—to-student ratio	0.34-26	0.01	0.003		
Teaching staff increases	0.29-1.63	1.03	0.06		
School written commitment to inclusivity					
Emphasized				12,337	40.50
Not emphasized				18,122	59.50

(continued)

TABLE 1 Continued

School level^g: descriptives

	Range	Mean	SD	N	%
Proportion of teaching staff of the same race/ethnicity ^k	0-0.31	0.07	0.08		

Note: Individual numbers for each variable may not sum to 30,469 because of missing data.

^aEndorsing "other," "don't want to say," "not sure," "something else," or missing.

^bSum of endorsement for 4 items on the Patient Health Questionnaire-4 (PHQ-4).

^cSum of endorsement for 4 items for suicidal ideation, plan, attempts, and nonsuicidal self-injury.

^dAssessed as total sum of the Adolescent Psychotic-like Symptom Screener.

^eSum of items on the Emotional Reactivity Scale.

^fSum of past 30-day use frequency for alcohol, tobacco, and cannabis, with items for each substance on a Likert scale ranging from 0 (zero use) to 6 (use every day for the past 30 days).

^gIncluding 10 middle schools, 1 combination school (7th through 12th grade), and 51 high schools.

^hUsing census-derived Area Deprivation Index.

ⁱUsing Applied Geographics Solutions personal crime index.

^jUsing Massachusetts government data on number of licenses for alcohol and tobacco distribution, as well as state datasets on cannabis retailers.

^kDescriptive statistics derived from subsample of minoritized adolescents excluding non-Latine White students (N = 12,233).

Mental Health Staff-to-Student Ratio. There were interactions between neighborhood deprivation and ratio of mental health staff to students in relation to anxiety and depressive symptoms, suicidal thoughts and behaviors, and substance use frequency. As depicted in Figure 2A, higher neighborhood deprivation was related to greater endorsement of anxiety and depressive symptoms in schools with lower mental health staff-to-student ratios (β [SE] = -0.08

(0.02), $t = 3.43$, $p < .001$; student N = 3,887, school N = 9), but not in schools with higher mental health staff-to-student ratios (β [SE] = 0.01 (0.02), $t = 0.47$, $p = .64$; student N = 3,420, school N = 10). Similarly, as depicted in Figure 2B, higher neighborhood deprivation was associated with higher endorsement of suicidal thoughts and behaviors in schools with lower mental health staff-to-student ratios (β [SE] = 0.07(0.02), $t = 2.92$, $p = .01$), but

FIGURE 1 Bivariate Correlations Among Neighborhood and School Variables for (A) the Whole Sample, (B) Sample of Race/Ethnic Minoritized Adolescents (ie, Excluding Non-Latine White Adolescents; N = 12,233), Including Proportion of Students and Teaching Staff Who Are the Same Race/Ethnicity as Students

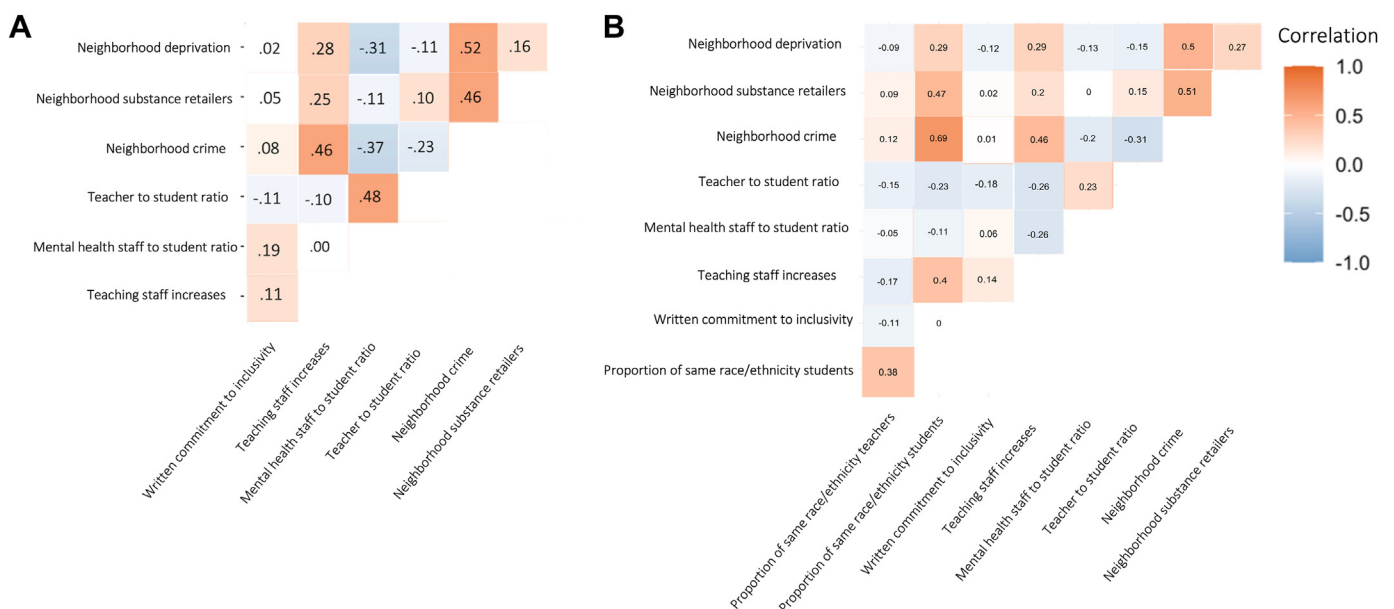


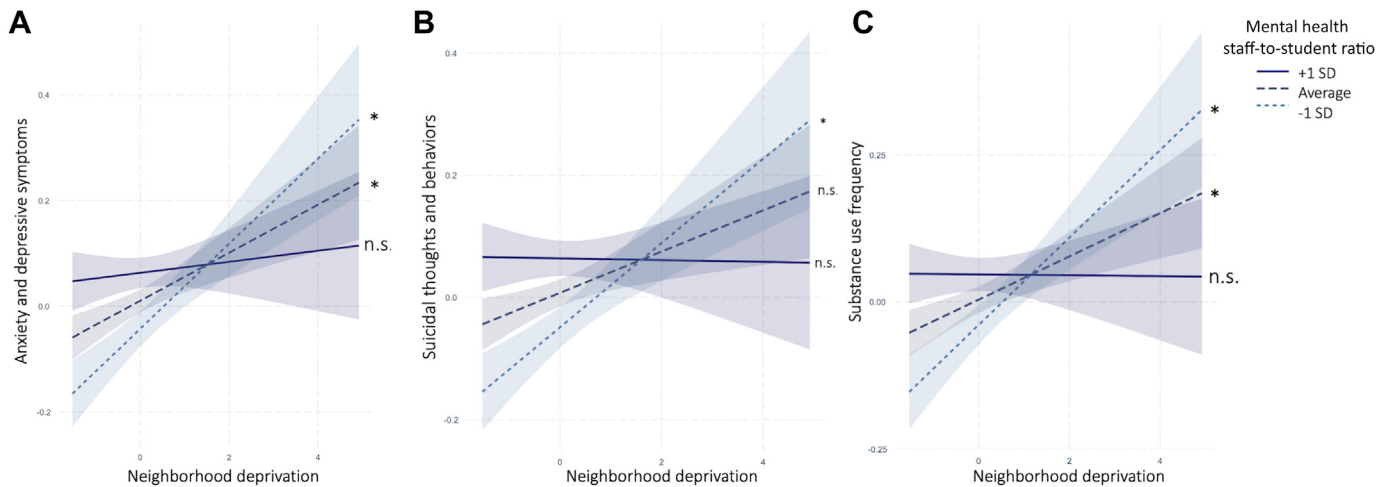
TABLE 2 Association and Interaction Analyses of Neighborhood Deprivation and Theorized Protective Factors, Accounting for Other Neighborhood Characteristics, Sex and Age, False Discovery Rate Corrected per Symptom Domain Explored

	Anxiety and depressive symptoms			Suicidal thoughts and behaviors			Psychotic-like experiences			Emotion reactivity			Substance use		
Main associations	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}
Neighborhood deprivation	0.05 (0.02)	.01	.02	0.04 (0.02)	.06	.67	0.08 (0.02)	<.00	<.00	0.08 (0.02)	<.00	.00	0.04 (0.02)	.03	.04
Teacher-to- student ratio	0.05 (0.02)	.01	.01	0.06 (0.02)	.00	.01	0.05 (0.02)	.01	.01	0.05 (0.02)	.01	.01	0.06 (0.02)	.00	.01
Mental health staff—to- student ratio	0.04 (0.03)	.24	.30	0.06 (0.03)	.09	.18	0.06 (0.03)	.11	.18	0.05 (0.03)	.09	.18	0.01 (0.03)	.70	.70
Teaching staff increases	0.04 (0.02)	.01	.01	0.04 (0.02)	.01	.01	0.04 (0.02)	.03	.03	0.04 (0.02)	.01	.01	0.04 (0.02)	.01	.01
Written commitment to inclusivity	0.03 (0.02)	.15	.19	0.03 (0.02)	.14	.19	0.02 (0.02)	.43	.43	0.02 (0.02)	.15	.19	0.03 (0.02)	.15	.19
Proportion of teaching staff of same race/ethnicity as student ^a	−0.09 (0.01)	<.00	<.00	−0.03 (.01)	<.00	<.00	−0.09 (0.01)	<.00	<.00	−0.02 (0.01)	.01	.02	−0.02 (0.01)	.04	.05
Interaction	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}	β (SE)	p_{uncor}	p_{FDR}
Deprivation * teacher-to- student ratio	−0.0 (0.02)	.81	.99	−0.00 (0.02)	.99	.99	−0.01 (0.02)	.55	.99	−0.01 (0.02)	.70	.99	−0.01 (0.02)	.67	.99
Deprivation * mental health staff—to-student ratio	−0.03 (0.01)	.03	.04	−0.03 (0.01)	.03	.04	−0.003 (0.02)	.85	.85	−0.02 (0.01)	.09	.11	−0.04 (0.02)	.02	.04
Deprivation * teaching staff increases	−0.00 (0.02)	.79	.83	−0.01 (0.02)	.61	.83	−0.04 (0.02)	.02	.10	−0.02 (0.02)	.31	.78	0.00 (0.02)	.83	.83
Deprivation * written commitment to inclusivity	−0.01 (0.02)	.73	.78	−0.01 (0.02)	.78	.78	−0.01 (0.02)	.70	.78	−0.01 (0.02)	.40	.78	−0.03 (0.02)	.10	.5
Deprivation * proportion of teaching staff of same race/ethnicity as student ^a	−0.01 (0.01)	.10	.25	0.02 (0.01)	.03	.15	0.00 (0.01)	.82	.82	0.01 (0.01)	.54	.82	0.00 (0.01)	.76	.82

Note: Sex had significant links to emotion reactivity, psychotic-like experiences, anxiety and depressive symptoms, and suicidal thoughts and behaviors. Age had significant links to psychotic-like experiences, substance use, anxiety and depressive symptoms, and suicidal thoughts and behaviors (Supplementary Material). Associations report analyses not including interaction terms. Significant associations surviving correction are shown in boldface type. p_{uncor} Refers to uncorrected p values, whereas p_{FDR} refers to false discovery rate (FDR) corrected values. Statistics in boldface type represent analyses that survived false discovery rate correction.

^aDerived from subsample of minoritized adolescents excluding non-Latine White students ($N = 12,233$).

FIGURE 2 Interaction of Neighborhood Deprivation and Mental Health Staff-to-Student Ratio for (A) Anxiety and Depressive Symptoms (β [SE] = -0.03 [0.02], $p_{FDR} = .04$), (B) Suicidal Thoughts and Behaviors (β [SE] = -0.03 [0.01], $p_{FDR} = .04$), and (C) Substance Use Frequency (β [SE] = -0.04 [0.02], $p_{FDR} = .04$)



Note: All variables are standardized/z scored.

not in schools with higher mental health staff-to-student ratios (β [SE] = -0.00 (0.02), $t = -0.06$, $p = .95$). Finally, as depicted in Figure 2C, a similar pattern emerged for substance use, such that higher neighborhood deprivation was associated with higher substance use only in students from schools with lower mental health staff-to-student ratios (β [SE] = 0.08 (0.02), $t = 3.10$, $p < .001$), but not for students in schools with higher mental health staff-to-student ratios (β [SE] = 0.00 (0.02), $t = 0.06$, $p = .95$). We did not observe significant interactions between neighborhood deprivation and mental health staff-to-student ratio on psychotic-like experiences or emotion reactivity. Sensitivity analyses including only counselors, psychologists, and social workers are provided in Supplement 6, Figure S4, Table S10, available online.

Teaching Staff Increases. Teaching staff increases did not modify associations of neighborhood deprivation and psychiatric symptoms (Table 2).

Aim 3b: Moderation of Neighborhood Deprivation Associations by School Characteristics Promoting Belonging and Inclusivity

Emphasizing inclusivity as part of the school mission statement did not modify associations of neighborhood deprivation and psychiatric symptoms. For minoritized student representation, the proportion of same race/ethnicity teaching staff did not modify associations of neighborhood deprivation and symptoms.

DISCUSSION

The current study considers the neighborhood school contexts as vital components for adolescents' development of risk and resilience against mental health difficulties.^{13,75-77} Results aligned with previous findings that higher neighborhood deprivation is associated with higher psychiatric symptom endorsement.^{20,78-81} School level modifiers of these links were explored, including school staffing patterns and school characteristics promoting belonging and inclusivity. Greater mental health staff availability weakened the associations of neighborhood deprivation and anxiety and depressive symptoms, suicidal thoughts and behaviors, and substance use. These patterns were not observed for other staffing variables, or for school characteristics promoting belonging and inclusivity (ie, written commitment to inclusivity and proportion of teaching staff sharing racial/ethnic identity). Findings suggest that school mental health staff availability could offer a potential buffer against mental health difficulties for adolescents embedded in disadvantaged spaces.

Research on neighborhood deprivation has grown, and has highlighted associations of higher deprivation and increased psychiatric symptoms in adolescents.^{20,78-81} This work coincides with a robust evidence base linking socioeconomic status and resource availability to mental health^{82,83}; results are also relevant to emerging literature showing that neighborhood level resource availability can relate to altered structure and function in the brain.⁸⁴⁻⁸⁸ The current study observes consistent associations in a

sample with neighborhood deprivation values that are on average lower than 75% of neighborhoods in the United States.⁸⁹ Results underscore that these associations are present even in neighborhoods that are significantly more advantaged relative to the national average.

The current investigation extends neighborhood deprivation research, which has most often focused on the home environment, to the school neighborhood environment. School environments represent a substantial proportion of where children and adolescents spend their time; this work supports that school environments could be a critical consideration for conceptualizing risk and resilience.^{13,75-77} Schools are an essential point of contact for uplifting equitable access to services for youth in need of mental health support.^{31,90-92} Assessing specific aspects of the school environment could be crucial to identifying targets for mental health resilience in adolescents, informing efforts that leverage schools as a primary source of behavioral health support for adolescents.

In this sample, mental health staff availability buffered against the negative associations of neighborhood deprivation and psychiatric symptoms—neighborhood deprivation was not associated with anxiety, depression, suicidal thoughts and behaviors, psychotic-like experiences, emotion reactivity, or substance use among students attending schools with a higher proportion of mental health staff. Mental health staff work to support student mental health directly, and their availability, likely reflect differences in school funding and climate. For instance, schools with more mental health staff likely have a greater capacity to advance mental health initiatives, higher resource allocation to student mental health support, and perhaps a more positive school mental health culture. It is also notable that Massachusetts (where this study takes place) consistently ranks in the top 5 to 10 of states nationwide for counselor and psychologist availability.^{93,94}

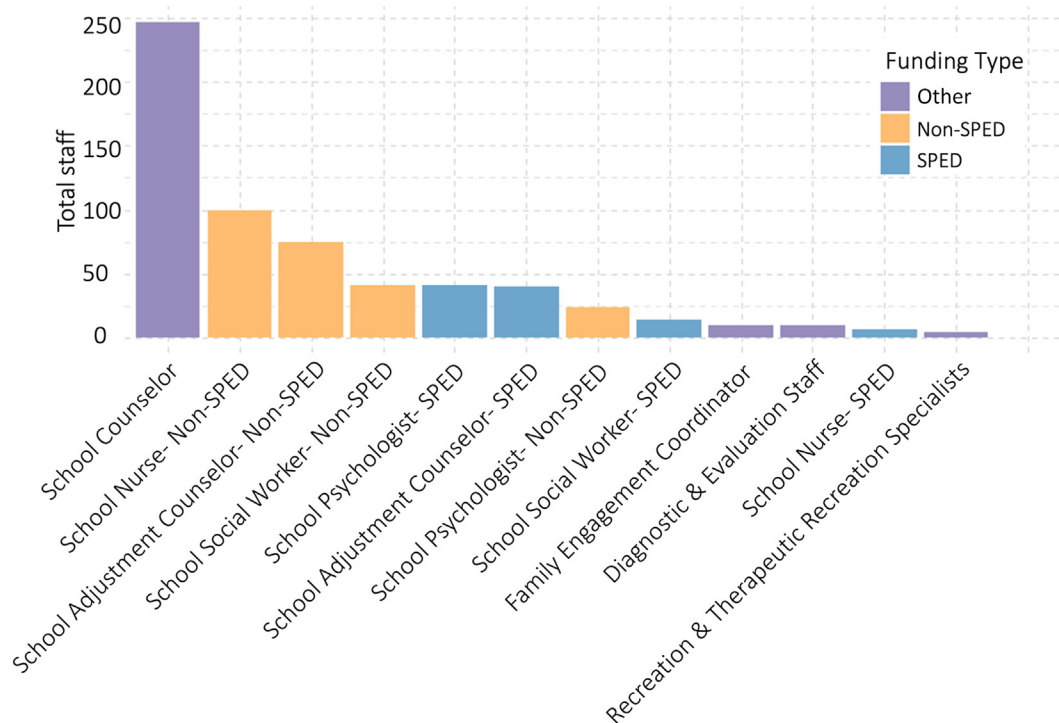
This study sample averaged 1 mental health staff to every 100 students, albeit including a range of roles for mental health staff, both traditional (eg, counselors) and nontraditional (eg, diagnostic and evaluation staff) (Figure 3). Although nationally reported ratios are not easily found for different types of staff addressing mental health needs, this 1-to-100 mental health staff-to-student ratio is likely highly favorable; in the United States, 48 of 50 states do not meet the recommended ratio of 1 mental health counselor per 250 students, and the national average is estimated at 1 counselor per 385 students.⁹⁵ This study's data were collected in a state that has significantly higher educational resources compared to the national average,^{93,94} and that is likely also to have

relatively higher levels of mental health staff availability. Future work might consider the degree to which these associations hold in schools with fewer staff and mental health resources to ensure tailored recommendations to schools with varying levels of access to support. The study's chosen mental health staff designation captures a broader variety of staff that directly support student mental health needs. This choice aligns with growing interest and efficacy of nontraditional and nonclinical mental health providers in supporting youth mental health care.⁹⁶ Results support the utility of an expanded behavioral health workforce in schools. Considering both traditional and nontraditional mental health staff roles and their relative contributions is a crucial future direction.

Moderations are interpreted in the context of a series of associations of staffing patterns and school characteristics supporting belonging and inclusivity. This study identified modest associations of increased teaching staff availability and teaching staff increases and higher symptom endorsement. Research on teacher support and student psychological well-being is mixed, and meta-analytic syntheses suggest that socioemotional support is specifically important for mental health, rather than overall staffing ratios.⁹⁷ Simply hiring a large staff base could be insufficient without meaningful investment in schoolwide training, mental health promotion capacity building, and availability of content and programming to support and connect students to mental health resources. It is possible that schools with higher behavioral needs necessitate hiring more teachers per student. Indeed, sensitivity analyses show that for certain symptoms, these associations are no longer significant when covarying for proportion of students with specialized education needs (Supplement 1, Figure S5, Table S11, available online). Complicating these associations further, perhaps increased attention per student could foster heightened awareness of symptoms and mental health literacy, leading to modest associations with increased symptom endorsement, as was observed in this sample.^{39,98-101} Relative to the United States as a whole, Massachusetts schools rank among the top on favorable metrics for teacher-to-student ratio.^{94,102} Indeed, in our sample, the average ratio represented 9 teachers to 100 students. Additional follow-up is needed to disentangle these potential competing mechanisms, including the presence of teachers, the mental health culture of schools, and student insight into their psychological symptomatology—all of which likely shape adolescents' mental health.

On the other hand, increased representation of teachers sharing the student's race/ethnicity was related to lower psychiatric symptom endorsement among racial/ethnic

FIGURE 3 Number of Mental Health Staff Funded by Special Education Funding, Non-Special Education Funding, or Other Funding Streams by Job Description. This Graph Depicts Totals for All the Schools Included in the Study



Note: SPED = Specialized Education focused.

minoritized adolescents. Results are consistent with a broader body of work suggesting that higher ethnic density can benefit mental health through supporting belonging, inclusion, and social capital in racial/ethnic minority adolescents.^{7,51,53,56,57,103,104} A higher proportion of teaching staff of the race/ethnicity did not modify links of neighborhood deprivation and psychiatric symptoms; this suggests that, beyond demographic representation, schools may benefit from community initiatives to foster school belonging and inclusion in students of color to buffer against disadvantage and related psychiatric difficulties.¹⁰⁵⁻¹⁰⁷

For school characteristics supporting belonging and inclusion, written statements about inclusivity in school mission statements did not associate with psychiatric symptoms or modify links. Emphasizing school inclusivity in writing has received increasing attention in recent years, to communicate school values and theoretically to support student belonging.¹⁰⁸⁻¹¹⁰ These results suggest that the mere presence of a written commitment does not associate with student symptoms; in contrast, concrete actions to directly support mental health (ie, mental health staff availability) do buffer associations of neighborhood deprivation and symptoms. Therefore,

results must be carefully interpreted. Written commitment to inclusivity may not necessarily translate to an inclusive environment, and future work is needed to explicitly disentangle written commitments from concrete actions promoting inclusivity.

Findings should be considered in the context of study limitations. Associations presented in this study reflect a single point in time for students completing the survey, and longitudinal follow-up will be needed to understand how these single-point snapshots reflect trajectories for students. Furthermore, because of data availability, deprivation is measured solely based on the school environment. Although for most students this is the same as the home environment, some schools include students from different communities. Results should be interpreted as reflecting exposure to deprivation in the school community, and future studies are needed to examine the interplay of school and home contexts. The ADI, used to assess deprivation, is a potentially heterogeneous index (Supplemental Material), and future work is needed to compare which characteristics drive associations and why.⁸⁴ In addition, associations among school variables, mental health, and neighborhood deprivation are also almost certainly shaped by other factors not captured here—for example, the role of school climate,

teacher training, and parent communication all shape adolescents' understanding of their own neighborhood climate and psychiatric symptoms. Future work exploring relative contributions among different kinds of mental health aid is needed to tailor recommendations and to further understand mechanisms. Adapting dimensional measures for demographic variables relevant for inclusivity (eg, gender fluidity and identification) could enrich characterizations of student identities. Increased representation of gender diverse individuals is necessary to examine the interplay of minoritized identities and socioeconomic adversity. Finally, although this sample is diverse and drawn from the community, findings may not generalize to other states, schools, and students. Toward the overarching goal of developing recommendations to schools regarding prioritization of resources, detailed follow-up is needed to understand how these findings may extend across time, individual student needs, and school context.

Schools offer a nexus of opportunity for prevention of and intervention in mental health difficulties for disadvantaged adolescents who have regular contact with schools but may not have regular contact with other systems of support.⁹⁰⁻⁹² Schools are a key component in a comprehensive mental health system for adolescents, providing opportunities to identify and to address mental health needs that would otherwise go undetected, through efforts including student needs assessment and establishing relationships to referral systems and community sources of care.^{21,90,111,112} Playing to these strengths by identifying modifiable protective factors at the school level in the context of neighborhood deprivation is thus likely to be a fruitful avenue for supporting mental health for adolescents embedded in disadvantaged spaces. Thus, current study observations of mental health staff as a modifying agent support the notion that when schools have resources and the opportunity to invest those resources toward mental health initiatives and staff support efforts, students may experience both the direct benefits (increased and consistent contact with caring adults) and indirect benefits (bolstered culture of mental health in school) of that investment.^{13,30,34,37,38,113-117}

REFERENCES

1. US Department of Commerce. U.S. geographic inequality is on the rise. US Department of Commerce; 2023.
2. Sacco R, Camilleri N, Eberhardt J, *et al.* A systematic review and meta-analysis on the prevalence of mental disorders among children and adolescents in Europe. *Eur Child Adolesc Psychiatry*. 2024;33(9):2877-2894. <https://doi.org/10.1007/s00787-022-02131-2>
3. Benton TD, Boyd RC, Njoroge WFM. Addressing the global crisis of child and adolescent mental health. *JAMA Pediatr*. 2021;175(11):1108-1110. <https://doi.org/10.1001/jamapediatrics.2021.2479>
4. Vargas TG, Mittal VA. The critical roles of early development, stress, and environment in the course of psychosis. *Annu Rev Dev Psychol*. 2022;4(1):423-445. <https://doi.org/10.1146/annurev-devpsych-121020-032354>
5. Fazel M, Hoagwood K. School mental health: integrating young people's voices to shift the paradigm. *Lancet Child Adolesc Health*. 2021;5(3):156-157. [https://doi.org/10.1016/S2352-4642\(20\)30388-6](https://doi.org/10.1016/S2352-4642(20)30388-6)
6. Ringeisen H, Henderson K, Hoagwood K. Context matters: Schools and the "research to practice gap" in children's mental health. *Sch Psychol Rev*. 2003;32(2):153-168.
7. Ku BS, Yuan Q, Haardorfer R, *et al.* Neighborhood ethnorracial diversity and positive psychotic symptoms among youth at high-risk and healthy comparisons. *Psychiatry Res*. 2024;342:116222. <https://doi.org/10.1016/j.psychres.2024.116222>
8. Elovainio M, Vahtera J, Pentti J, *et al.* The contribution of neighborhood socioeconomic disadvantage to depressive symptoms over the course of adult life: a 32-year prospective cohort study. *Am J Epidemiol*. 2020;189(7):679-689.

CRedit authorship contribution statement

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Data Sharing: To protect the privacy of minors, data collected for the study will not be made available to others.

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9. Hastings PD, Serbin LA, Bukowski W, *et al.* Predicting psychosis-spectrum diagnoses in adulthood from social behaviors and neighborhood contexts in childhood. *Dev Psychopathol.* 2020;32(2):465-479.
10. Stokes JE. Trajectories of perceived neighborhood quality across the life course: sociodemographic determinants and implications for well-being. *Soc Sci Res.* 2019;79:181-193.
11. Leventhal T, Dupéré V. Neighborhood effects on children's development in experimental and nonexperimental research. *Annu Rev Dev Psychol.* 2019;1:149-176.
12. Vaden-Kiernan M, D'Elia MA, O'Brien RW, *et al.* Neighborhoods as a developmental context: a multilevel analysis of neighborhood effects on Head Start families and children. *Am J Community Psychol.* 2010;45(1-2):49-67. <https://doi.org/10.1007/s10464-009-9279-z>
13. Gaias LM, Lindstrom Johnson S, White RM, *et al.* Understanding school-neighborhood mesosystemic effects on adolescent development. *Adolesc Res Rev.* 2018;3:301-319.
14. Midouhas E, Kuang Y, Flouri E. Neighbourhood human capital and the development of children's emotional and behavioural problems: the mediating role of parenting and schools. *Health Place.* 2014;27:155-161.
15. Vargas T, Conley RE, Mittal VA. Chronic stress, structural exposures and neurobiological mechanisms: a stimulation, discrepancy and deprivation model of psychosis. *Int Rev Neurobiol.* 2020;152:41-69. <https://doi.org/10.1016/bs.irn.2019.11.004>
16. Rakesh D, McLaughlin KA, Sheridan M, *et al.* Environmental contributions to cognitive development: the role of cognitive stimulation. *Dev Rev.* 2024;73:101135. <https://doi.org/10.1016/j.dr.2024.101135>
17. Visser K, Bolt G, Finkenauer C, *et al.* Neighbourhood deprivation effects on young people's mental health and well-being: a systematic review of the literature. *Soc Sci Med.* 2021;270:113542. <https://doi.org/10.1016/j.socscimed.2020.113542>
18. Webb EK, Weis CN, Huggins AA, *et al.* Neighborhood disadvantage is associated with stable deficits in neurocognitive functioning in traumatically-injured adults. *Health Place.* 2021;67:102493. <https://doi.org/10.1016/j.healthplace.2020.102493>
19. Carroll SL, Mikhail ME, Burt SA. The development of youth antisocial behavior across time and context: a systematic review and integration of person-centered and variable-centered research. *Clin Psychol Rev.* 2023;102253.
20. Vargas T, Damme KSF, Osborne KJ, *et al.* Differentiating kinds of systemic stressors with relation to psychotic-like experiences in late childhood and early adolescence: the stimulation, discrepancy, and deprivation model of psychosis. *Clin Psychol Sci.* 2022;10(2):291-309. <https://doi.org/10.1177/21677026211016415>
21. Huang Y, Edwards J, Laurel-Wilson M. The shadow of context: neighborhood and school socioeconomic disadvantage, perceived social integration, and the mental and behavioral health of adolescents. *Health Place.* 2020;66:102425. <https://doi.org/10.1016/j.healthplace.2020.102425>
22. Vargas TG, Damme KSF, Mittal VA. Differentiating distinct and converging neural correlates of types of systemic environmental exposures. *Hum Brain Mapp.* 2022;43(7):2232-2248. <https://doi.org/10.1002/hbm.25783>
23. Arias D, Saxena S, Verguet S. Quantifying the global burden of mental disorders and their economic value. *EClinicalMedicine.* 2022;54:101675. <https://doi.org/10.1016/j.eclinm.2022.101675>
24. Bethlehem RA, Seidlitz J, White SR, *et al.* Brain charts for the human lifespan. *Nature.* 2022;604(7906):525-533.
25. Blader JC, Garrett AS, Pliszka SR. Annual research review: what processes are dysregulated among emotionally dysregulated youth? A systematic review. *J Child Psychol Psychiatry.* 2025;66(4):516-546. <https://doi.org/10.1111/jcpp.14126>
26. Beauchaine TP, Cicchetti D. Emotion dysregulation and emerging psychopathology: a transdiagnostic, transdisciplinary perspective. *Dev Psychopathol.* 2019;31(3):799-804. <https://doi.org/10.1017/S0954579419000671>
27. Gray KM, Squeglia LM. Research review: what have we learned about adolescent substance use? *J Child Psychol Psychiatry.* 2018;59(6):618-627. <https://doi.org/10.1111/jcpp.12783>
28. Tervo-Clemmens B, Gilman JM, Evins AE, *et al.* Substance use, suicidal thoughts, and psychiatric comorbidities among high school students. *JAMA Pediatr.* 2024;178(3):310-313. <https://doi.org/10.1001/jamapediatrics.2023.6263>
29. Liu J, Butler R, Turncliff A, *et al.* An urgent need for school-based diversion programs for adolescent substance use: a statewide survey of school personnel. *J Adolesc Health.* 2023;73(3):428-436. <https://doi.org/10.1016/j.jadohealth.2023.04.006>
30. Kalubi J, Rigma T, O'Loughlin EK, *et al.* Health-promoting school culture: how do we measure it and does it vary by school neighborhood deprivation? *J Sch Health.* 2023;93(8):659-668. <https://doi.org/10.1111/josh.13304>
31. Duong MT, Bruns EJ, Lee K, *et al.* Rates of mental health service utilization by children and adolescents in schools and other common service settings: a systematic review and meta-analysis. *Adm Policy Ment Health.* 2021;48(3):420-439. <https://doi.org/10.1007/s10488-020-01080-9>
32. Whipple SS, Evans GW, Barry RL, *et al.* An ecological perspective on cumulative school and neighborhood risk factors related to achievement. *J Appl Dev Psychol.* 2010;31(6):422-427.
33. Crosnoe R, Cooper CE. Economically disadvantaged children's transitions into elementary school: linking family processes, school contexts, and educational policy. *Am Educ Res J.* 2010;47(2):258-291. <https://doi.org/10.3102/0002831209351564>
34. Woodruff MC, Polinsky A, Weiss RA. Equity depends on the definition: examining the impact of segregation definitions on equity in school-based mental health. *Psychol Public Policy Law.* 2024;30(3):314-325.
35. Hopson LM, Schiller KS, Lawson HA. Exploring linkages between school climate, behavioral norms, social supports, and academic success. *Soc Work Res.* 2014;38(4):197-209.
36. National Center for Education Statistics. School Pulse Panel: Responses to the pandemic and efforts toward recovery. U.S. Department of Education, Institute of Education Sciences; 2024. Accessed June 21, 2025. <https://nces.ed.gov/surveys/spp/results.asp>
37. Ozer EJ, Lavi I, Douglas L, *et al.* Protective factors for youth exposed to violence in their communities: a review of family, school, and community moderators. *J Clin Child Adolesc Psychol.* 2017;46(3):353-378. <https://doi.org/10.1080/15374416.2015.1046178>
38. Rones M, Hoagwood K. School-based mental health services: a research review. *Clin Child Fam Psychol Rev.* 2000;3(4):223-241. <https://doi.org/10.1023/a:1026425104386>
39. Ma KKY, Anderson JK, Burn AM. School-based interventions to improve mental health literacy and reduce mental health stigma—a systematic review. *Child Adolesc Ment Health.* 2023;28(2):230-240.
40. Koc N, Celik B. The impact of number of students per teacher on student achievement. *Procedia-Soc Behav Sci.* 2015;177:65-70.
41. Tao Y, Meng Y, Gao Z, *et al.* Perceived teacher support, student engagement, and academic achievement: a meta-analysis. *Educ Psychol.* 2022;42(4):401-420.
42. Casely-Hayford J, Björklund C, Bergström G, *et al.* What makes teachers stay? A cross-sectional exploration of the individual and contextual factors associated with teacher retention in Sweden. *Teach Teacher Educ.* 2022;113:103664.
43. Madigan DJ, Kim LE. Towards an understanding of teacher attrition: a meta-analysis of burnout, job satisfaction, and teachers' intentions to quit. *Teach Teacher Educ.* 2021;105:103425.
44. Luther SS, Kumar NL, Zillmer N. Teachers' responsibilities for students' mental health: challenges in high achieving schools. *Int J Sch Educ Psychol.* 2020;8(2):119-130.
45. Bardach L, Klassen RM, Perry NE. Teachers' psychological characteristics: do they matter for teacher effectiveness, teachers' well-being, retention, and interpersonal relations? An integrative review. *Educ Psychol Rev.* 2022;34(1):259-300.
46. Reback R. Schools' mental health services and young children's emotions, behavior, and learning. *J Policy Anal Manage.* 2010;29(4):698-725. <https://doi.org/10.1002/pam.20528>
47. Hoover S, Bostic J. Schools as a vital component of the child and adolescent mental health system. *Psychiatr Serv.* 2021;72(1):37-48. <https://doi.org/10.1176/appi.ps.201900575>
48. Jansen PW, Mieloo CL, Domisse-van Berkel A, *et al.* Bullying and victimization among young elementary school children: the role of child ethnicity and ethnic school composition. *Race Soc Problems.* 2016;8:271-280.
49. Levine CS, Markus HR, Austin MK, *et al.* Students of color show health advantages when they attend schools that emphasize the value of diversity. *Proc Natl Acad Sci U S A.* 2019;116(13):6013-6018. <https://doi.org/10.1073/pnas.1812068116>
50. Nawyn SJ, Gjokaj L, Agbényiga DL, *et al.* Linguistic isolation, social capital, and immigrant belonging. *J Contemp Ethnogr.* 2012;41(3):255-282.
51. DuPont-Reyes MJ, Villatoro AP, Phelan JC, *et al.* Estimating school race/ethnic enrollment effects on student mental health: density and diversity as a risk or protective factor. *Ethn Dis.* 2021;31(2):205-216. <https://doi.org/10.18865/ed.31.2.205>
52. DuPont-Reyes MJ, Villatoro AP. The role of school race/ethnic composition in mental health outcomes: a systematic literature review. *J Adolesc.* 2019;74:71-82. <https://doi.org/10.1016/j.adolescence.2019.05.006>
53. Urbina-Johanson S, Slopen N, Davis S, *et al.* School ethnic density and mental health problems in Black, Latine, and White pre-adolescent children [published online ahead of print January 20, 2025]. *J Am Acad Child Adolesc Psychiatry.* <https://doi.org/10.1016/j.jaac.2024.10.019>
54. Anglin DM. Advancing the study of local ethnic density and psychosis. *Lancet Psychiatry.* 2020;7(4):293-294. [https://doi.org/10.1016/S2215-0366\(20\)30101-2](https://doi.org/10.1016/S2215-0366(20)30101-2)
55. Echeverria S, Diez-Roux AV, Shea S, *et al.* Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: the Multi-Ethnic Study of Atherosclerosis. *Health Place.* 2008;14(4):853-865. <https://doi.org/10.1016/j.healthplace.2008.01.004>
56. Shankley W, Laurence J. Community ethnic density, ethnic segregation, and ethnic minorities' common mental disorders in the UK. *Health Place.* 2022;73:102723. <https://doi.org/10.1016/j.healthplace.2021.102723>

57. Becares L, Dewey ME, Das-Munshi J. Ethnic density effects for adult mental health: systematic review and meta-analysis of international studies. *Psychol Med*. 2018; 48(12):2054-2072. <https://doi.org/10.1017/S0033291717003580>
58. Costello MA, Pascale M, Potter K, *et al.* Understanding adolescent mental health symptom progression in school-based settings: the Substance Use and Risk Factors (SURF) longitudinal survey [published online ahead of print Feb 10, 2025]. *Sch Psychol*. <https://doi.org/10.1037/spq0000681>
59. Ghaferi AA, Schwartz TA, Pawlik TM. STROBE Reporting Guidelines for Observational Studies. *JAMA Surg*. 2021;156(6):577-578. <https://doi.org/10.1001/jamasurg.2021.0528>
60. Kind AJ, Jencks S, Brock J, *et al.* Neighborhood socioeconomic disadvantage and 30-day rehospitalization: a retrospective cohort study. *Ann Intern Med*. 2014;161(11):765-774. <https://doi.org/10.7326/M13-2946>
61. Kroenke K, Spitzer RL, Williams JB, *et al.* An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009;50(6):613-621. <https://doi.org/10.1176/appi.psy.50.6.613>
62. Nolan E, Murphy S, O'Neill T, *et al.* Prevalence of psychotic-like experiences and associated distress in adolescent community, sexual-trauma and clinical samples. *Psychosis*. 2018;10(4):251-262.
63. Becerra R, Campitelli G. Emotional reactivity: critical analysis and proposal of a new scale. *Int J Appl Psychol*. 2013;3(6):161-168.
64. Federal Bureau of Investigation; Applied Geographic Solutions. Uniform Crime Report: Most current estimates and projections. 2015–2021. Accessed June 21, 2025. <https://www.fbi.gov/how-we-can-help-you/more-fbi-services-and-information/ucr>
65. Nau C, Sidell M, Clift K, *et al.* A commercially available crime index may be a reliable alternative to actual census-tract crime in an urban area. *Prev Med Rep*. 2020;17:100996. <https://doi.org/10.1016/j.pmedr.2019.100996>
66. Cannabis Control Commission. Cannabis Control Commission data catalog. Accessed February 16, 2025. <https://masscannabiscontrol.com/open-data/data-catalog/>
67. Massachusetts Government. Check a Commonwealth licensee. Accessed February 16, 2025. <https://elicensing21.mass.gov/>
68. Massachusetts Department of Revenue. DOR cigarette, tobacco and vaping excise tax. Accessed February 16, 2025. <https://www.mass.gov/info-details/dor-cigarette-tobacco-and-vaping-excise-tax/licensed-tobacco-retailers-and-distributors->
69. Bates D, Maechler M, Bolker B, *et al.* Fitting linear mixed-effects models using lme4. *J Stat Softw*. 2015;67(1):1-48.
70. R Core Team. R: a language and environment for statistical computing. R Foundation for Statistical Computing; 2012:2022.
71. Preacher KJ, Curran PJ, Bauer DJ. Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *J Educ Behav Stat*. 2006;31(4):437-448.
72. Fox J, Weisberg S. *An R Companion to Applied Regression*. Sage Publications; 2018.
73. Benjamini Y, Hochberg Y. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J R Stat Soc Series B*. 1995;57(1):289-300.
74. Molenberghs G, Thijs H, Jansen I, *et al.* Analyzing incomplete longitudinal clinical trial data. *Biostatistics*. 2004;5(3):445-464. <https://doi.org/10.1093/biostatistics/5.3.445>
75. Evans GW, Farah MJ, Hackman DA. Early childhood poverty and adult executive functioning: distinct, mediating pathways for different domains of executive functioning. *Dev Sci*. 2021;24(5):e13084. <https://doi.org/10.1111/desc.13084>
76. Rakesh D, Sadikova E, McLaughlin KA. Beyond the income-achievement gap: the role of individual, family, and environmental factors in cognitive resilience among low-income youth. *JCPP Adv*. 2024:e12297. <https://doi.org/10.1002/jcv2.12297>
77. Eccles JS, Roeser RW. Schools as developmental contexts. *Blackwell Handbook of Adolescence*. Blackwell; 2003:129-148.
78. Maxwell MY, Taylor RL, Barch DM. Relationship between neighborhood poverty and externalizing symptoms in children: mediation and moderation by environmental factors and brain structure. *Child Psychiatry Hum Dev*. 2023;54(6):1710-1722. <https://doi.org/10.1007/s10578-022-01369-w>
79. Sui Y, Ettema D, Helbich M. Longitudinal associations between the neighborhood social, natural, and built environment and mental health: a systematic review with meta-analyses. *Health Place*. 2022;77:102893. <https://doi.org/10.1016/j.healthplace.2022.102893>
80. Chen E, Miller GE, Brody GH, *et al.* Neighborhood poverty, college attendance, and diverging profiles of substance use and allostatic load in rural African American youth. *Clin Psychol Sci*. 2015;3(5):675-685. <https://doi.org/10.1177/2167702614546639>
81. Rudolph KE, Goin DE, Paksarian D, *et al.* Causal mediation analysis with observational data: considerations and illustration examining mechanisms linking neighborhood poverty to adolescent substance use. *Am J Epidemiol*. 2019;188(3):598-608. <https://doi.org/10.1093/aje/kwy248>
82. Peverill M, Dirks MA, Narvaja T, *et al.* Socioeconomic status and child psychopathology in the United States: a meta-analysis of population-based studies. *Clin Psychol Rev*. 2021;83:101933. <https://doi.org/10.1016/j.cpr.2020.101933>
83. Chen E, Miller GE. Socioeconomic status and health: mediating and moderating factors. *Annu Rev Clin Psychol*. 2013;9(1):723-749. <https://doi.org/10.1146/annurev-clinpsy-050212-185634>
84. Ku BS, Aberizk K, Feurer C, *et al.* Aspects of Area Deprivation Index in relation to hippocampal volume among children. *JAMA Netw Open*. 2024;7(6):e2416484. <https://doi.org/10.1001/jamanetworkopen.2024.16484>
85. Vargas T, Damme KSF, Mittal VA. Neighborhood deprivation, prefrontal morphology and neurocognition in late childhood to early adolescence. *Neuroimage*. 2020;220:117086. <https://doi.org/10.1016/j.neuroimage.2020.117086>
86. Rakesh D, Zalesky A, Whittle S. Assessment of parent income and education, neighborhood disadvantage, and child brain structure. *JAMA Netw Open*. 2022;5(8):e2226208. <https://doi.org/10.1001/jamanetworkopen.2022.26208>
87. Rakesh D, Seguin C, Zalesky A, *et al.* Associations between neighborhood disadvantage, resting-state functional connectivity, and behavior in the Adolescent Brain Cognitive Development Study: the moderating role of positive family and school environments. *Biol Psychiatry Cogn Neurosci Neuroimaging*. 2021;6(9):877-886. <https://doi.org/10.1016/j.bpsc.2021.03.008>
88. Vargas TG, Rakesh D, McLaughlin KA. Associations of neighborhood threat and deprivation with psychopathology: uncovering neural mechanisms. *PsyArXiv*. 2025. https://doi.org/10.31234/osf.io/waj8m_v2
89. Hooper A, Hustedt JT, Slicker G, *et al.* Area Deprivation Index as a predictor of economic risk and social and neighborhood perceptions among families enrolled in early Head Start. *Child Youth Serv Rev*. 2022;137:106468.
90. McKay MM, McCadam K, Gonzales JJ. Addressing the barriers to mental health services for inner city children and their caretakers. *Community Ment Health J*. 1996; 32(4):353-361. <https://doi.org/10.1007/BF02249453>
91. Harrison ME, McKay MM, Bannon WM, Jr. Inner-city child mental health service use: the real question is why youth and families do not use services. *Community Ment Health J*. 2004;40(2):119-131. <https://doi.org/10.1023/b:comh.0000022732.80714.8b>
92. McKay MM, Lynn CJ, Bannon WM. Understanding inner city child mental health need and trauma exposure: implications for preparing urban service providers. *Am J Orthopsychiatry*. 2005;75(2):201-210. <https://doi.org/10.1037/0002-9432.75.2.201>
93. Riser-Kositsky M. Data: Does your state have enough school psychologists and counselors? *Education Week*. Accessed June 21, 2025. <https://www.edweek.org/leadership/data-does-your-state-have-enough-school-psychologists-and-counselors/2022/03>
94. These states have the best school systems in the US, according to new data. Accessed June 21, 2025. <https://www.fenews.co.uk/education/these-states-have-the-best-school-systems-in-the-us-according-to-new-data/>
95. Solis M. "There is not enough of me to go around": schools need more counselors. *NEA Today*. 2023. Accessed June 21, 2025. <https://www.nea.org/nea-today/all-news-today/schools-need-more-counselors>
96. Connolly SM, Vanchu-Orosco M, Warner J, *et al.* Mental health interventions by lay counsellors: a systematic review and meta-analysis. *Bull World Health Organ*. 2021; 99(8):572-582. <https://doi.org/10.2471/BLT.20.269050>
97. Wang M-T, Degol JL, Amemiya J, *et al.* Classroom climate and children's academic and psychological wellbeing: a systematic review and meta-analysis. *Dev Rev*. 2020;57:100912.
98. Nobre J, Oliveira AP, Monteiro F, *et al.* Promotion of mental health literacy in adolescents: a scoping review. *Int J Environ Res Public Health*. 2021;18(18):9500. <https://doi.org/10.3390/ijerph18189500>
99. Johnson CL, Gross MA, Jorm AF, *et al.* Mental health literacy for supporting children: a systematic review of teacher and parent/carer knowledge and recognition of mental health problems in childhood. *Clin Child Fam Psychol Rev*. 2023;26(2):569-591. <https://doi.org/10.1007/s10567-023-00426-7>
100. Rafal G, Gatto A, DeBate R. Mental health literacy, stigma, and help-seeking behaviors among male college students. *J Am Coll Health*. 2018;66(4):284-291. <https://doi.org/10.1080/07448481.2018.1434780>
101. Kutcher S, Wei Y, Coniglio C. Mental health literacy: past, present, and future. *Can J Psychiatry*. 2016;61(3):154-158. <https://doi.org/10.1177/0706743715616609>
102. National Center for Educational Statistics at IES. Report on the condition of education. 2024. Accessed August 4, 2024. <https://nces.ed.gov/pubs2024/2024144.pdf>
103. Jun J, Jivraj S, Taylor K. Mental health and ethnic density among adolescents in England: a cross-sectional study. *Soc Sci Med*. 2020;244:112569. <https://doi.org/10.1016/j.socscimed.2019.112569>
104. Zhang N, Beauregard JL, Kramer MR, *et al.* Neighbourhood ethnic density effects on behavioural and cognitive problems among young racial/ethnic minority children in the US and England: a cross-national comparison. *Popul Res Policy Rev*. 2017;36(5):761-804. <https://doi.org/10.1007/s11113-017-9445-1>

105. Chen E, Lam PH, Yu T, *et al*. Racial disparities in school belonging and prospective associations with diabetes and metabolic syndrome. *JAMA Pediatr*. 2023;177(2): 141-148. <https://doi.org/10.1001/jamapediatrics.2022.3856>
106. Ahn MY, Davis HH. Sense of belonging as an indicator of social capital. *Int J Sociol Soc Policy*. 2020;40(7/8):627-642.
107. Oliver V, Cheff R. The social network: homeless young women, social capital, and the health implications of belonging outside the nuclear family. *Youth Soc*. 2014;46(5): 642-662.
108. McCabe EM, Davis C, Mandy L, *et al*. The role of school connectedness in supporting the health and well-being of youth: recommendations for school nurses. *NASN Sch Nurse*. 2022;37(1):42-47. <https://doi.org/10.1177/1942602X211048481>
109. Long E, Zucca C, Sweeting H. School climate, peer relationships, and adolescent mental health: a social ecological perspective. *Youth Soc*. 2021;53(8):1400-1415. <https://doi.org/10.1177/0044118X20970232>
110. Morgan F, Costello E. *Square Pegs: Inclusivity, Compassion and Fitting In—A Guide for Schools*. Crown House Publishing; 2023.
111. Stattin H, Svensson Y, Korol L. Schools can be supporting environments in disadvantaged neighborhoods. *Int J Behav Dev*. 2019;43(5):383-392.
112. Jaycox LH, Langley AK, Stein BD, *et al*. Support for students exposed to trauma: a pilot study. *School Ment Health*. 2009;1(2):49-60. <https://doi.org/10.1007/s12310-009-9007-8>
113. May EM, Azar ST, Matthews SA. How does the neighborhood “come through the door?” Concentrated disadvantage, residential instability, and the home environment for preschoolers. *Am J Community Psychol*. 2018;61(1-2):218-228.
114. Glazzard J, Rose A. The impact of teacher well-being and mental health on pupil progress in primary schools. *J Public Ment Health*. 2020;19(4):349-357.
115. Owens A. Neighborhoods and schools as competing and reinforcing contexts for educational attainment. *Sociol Educ*. 2010;83(4):287-311.
116. Crosnoe R, Leventhal T. School-and neighborhood-based interventions to improve the lives of disadvantaged children. *Soc Contexts Child Dev*. 2013;44(2):156.
117. Dupere V, Leventhal T, Crosnoe R, *et al*. Understanding the positive role of neighborhood socioeconomic advantage in achievement: the contribution of the home, child care, and school environments. *Dev Psychol*. 2010;46(5):1227-12244. <https://doi.org/10.1037/a0020211>