HHS Public Access

Author manuscript

J Sch Health. Author manuscript; available in PMC 2015 August 01.

Published in final edited form as:

J Sch Health. 2014 August ; 84(8): 502–506. doi:10.1111/josh.12177.

Positive School Climate Is Associated With Lower Body Mass Index Percentile Among Urban Preadolescents

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Abstract

BACKGROUND—Schools are an important environmental context in children's lives and are part of the complex web of factors that contribute to childhood obesity. Increasingly, attention has been placed on the importance of school climate (connectedness, academic standards, engagement, and student autonomy) as 1 domain of school environment beyond health policies and education that may have implications for student health outcomes. The purpose of this study is to examine the association of school climate with body mass index (BMI) among urban preadolescents.

METHODS—Health surveys and physical measures were collected among fifth- and sixth-grade students from 12 randomly selected public schools in a small New England city. School climate surveys were completed district-wide by students and teachers. Hierarchical linear modeling was used to test the association between students' BMI and schools' climate scores.

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Human Subjects Approval Statement

Procedures were approved by the Yale University Institutional Review Board and the local school district.

RESULTS—After controlling for potentially confounding individual-level characteristics, a 1-unit increase in school climate score (indicating more positive climate) was associated with a 7-point decrease in students' BMI percentile.

CONCLUSIONS—Positive school climate is associated with lower student BMI percentile. More research is needed to understand the mechanisms behind this relationship and to explore whether interventions promoting positive school climate can effectively prevent and/or reduce obesity.

Keywords

child health; adolescent health; public health; health policy; childhood obesity; school climate

Childhood obesity in the United States (US) continues to be a major public health concern with approximately 1 of 3 children classified as overweight or obese.[1] Although childhood obesity affects children from all backgrounds, it disproportionately affects children of low socioeconomic status (SES) and those who are Black or Latino.[2] Preadolescents are a particularly important group for obesity research and interventions, as obesity rates nearly double during preadolescence.[3] It is also an age when children are developing lifelong dietary and exercise habits.[4]

In public health, obesity is often understood within a social ecological framework, which looks beyond individual-level factors to the complex web of broader social and environmental factors that contribute to obesity.[5] Schools are an important environmental context in children's lives. In its recent report on obesity prevention, the Institute of Medicine identified schools as a "national focal point for obesity prevention," recommending that schools adopt strong physical activity and nutrition standards and provide nutrition education.[1] Increasingly, attention has been placed on the importance of school climate as one domain of school environment beyond health policies and education that may have implications for student health outcomes.[6,7]

Although one clear and concise definition of school climate does not exist in the literature, we use the National School Climate Center's definition: "School climate refers to the quality and character of school life. School climate is based on patterns of students', parents', and school personnel's experience of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures."[8] More positive school climate is associated with fewer risky health behaviors (ie, alcohol use, reckless driving, and violence),[6] increased physical activity among girls,[9] and emotional well-being.[7] The association of school climate with positive health behaviors and emotional well-being suggests that school climate could also have an association with positive physical health outcomes. Indeed, an association of school climate with physical health symptoms has been documented,[7] but there are limited studies that have examined the association between school climate and obesity. Most prior studies have focused on school food or physical activity environments instead of school climate,[10] or on health behaviors rather[6,9] than health outcomes, such as body mass index (BMI).

In this study, we tested the hypothesis that a more positive school climate would be associated with lower BMI in an at-risk sample of preadolescents in a low-income, ethnically diverse urban New England school district.

METHODS

Participants

Data were from a larger study of fifth- and sixth-grade students from 12 randomly selected public K-8 schools of 28 in an urban New England school district. Each of the 12 schools agreed to participate, and all fifth- and sixth-grade students in these schools were invited to participate. The study sample included 1226 participants, representing 88% of all eligible children (2% parental opt-out; 10% absent on data collection days). Of the 1226 participants, 1029 (84%) completed both the health survey and physical measurements. The final analytic sample included 1009 students with complete data. Parental consent and child assent were obtained for all participants in English or Spanish.

Instruments and Procedures

Individual-level variables—Individual-level variables were collected in fall 2009 by direct measurement, the student health survey, or through the school district's administrative database. Height and weight measurements were obtained by trained research assistants according to the World Health Organization's expanded STEPS protocol[11] to calculate BMI (kg/m^2). Height was measured to the nearest 0.5 cm with a standard stadiometer (Charder Electronic Co., Ltd., Taichung City, Taiwan) and height was measured to the nearest 0.1 pound using an electronic flat scale (Seca Co., Hamburg, Germany). A 30 to 40 minutes health survey was administered online (SurveyMonkey, LLC, Palo Alto, CA) to students during computer classes on desktop computers. Questions and responses were read aloud by trained research assistants to facilitate varying reading levels. Students who completed the survey received a small gift, such as a backpack. BMI percentile, the outcome variable, was based upon Centers for Disease Control and Prevention age-adjusted and sex-adjusted growth charts.[12] Individual-level control variables included race/ethnicity, age, sex, free or reduced-price school lunch eligibility, and food insecurity. The latter 2 were proxies for SES. Food security was measured by a single item from the student survey: "Since school started, were you ever hungry, but didn't eat, because there wasn't enough food at home?"[13] All other data were obtained from the school district's administrative database.

School-level variables—The percentage of students eligible for free or reduced-price lunch at each school was publically available on the State Department of Education's Web site. School climate data came from a district-wide survey collected from students and teachers in the 2009–2010 academic year. Aggregated results were publicly available online. District-wide response rates were 88% for students and 82% for teachers. Six items (4 student and 2 teacher items) were used to create a composite based on a previously used measure of school climate[6] to capture the extent of students' connectedness to their school and involvement in the decision-making process at school, and whether students have supportive educators who set high academic standards, as well as levels of parental and student engagement. The 4 student items were: "I have a voice in my classroom and/or

school decisions," "I feel welcome in my school," "My teacher(s) believe I am capable of learning," and "How available to you are teachers and other adults at your school to talk about an academic problem you are having?" The 2 teacher items were: "Parents at my school are given the opportunity to become involved in the classroom and school" and "My school offers a wide variety of activities to keep students at my school engaged." All items were rated on a 1 to 5 scale, with 5 being the most positive. The mean of these 6 items was calculated to create a climate score for each school. This scale demonstrated good internal reliability (Cronbach's alpha = .83).

Data Analysis

Descriptive statistics (mean and standard deviation for continuous variables and counts and percentages for categorical variables) for the sample were calculated. Hierarchical linear modeling, with students nested in schools, was used to test the association between students' BMI and schools' climate scores above and beyond individual-level sociodemographic characteristics and school-level lunch eligibility. To make model interpretation more meaningful, age, the only continuous individual-level variable, was centered about the grand mean and both school-level variables (school climate scale and percentage of students eligible for free lunch) were centered around the school-level mean. All statistical analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC).

RESULTS

Characteristics of the study sample are shown in Table 1. Consistent with the district's sociodemographics, our sample includes predominantly (84.8%) Black and Latino students, with 83.3% qualifying for free or reduced-price lunch and 11.6% reporting food insecurity. Students ranged in age from 9 to 13 years, with an average age of 10.9 years. Almost one-half of the students in our sample were overweight or obese (≥85th percentile for age-adjusted and sex-adjusted BMI). The average school climate score was 3.92 on a scale of 1 to 5, with 5 representing more positive school climate. In the hierarchical linear modeling analysis, (Table 2) even after controlling for potentially confounding individual-level sociodemographic variables and school-level percentage of students eligible for free or reduced-price lunch, more positive school climate (measured at the school level) was associated with lower BMI percentile. More specifically, a 1-unit increase in school climate score was associated with a 7.21-point decrease in BMI percentile ($p = .045$). Additionally, BMI percentile was significantly higher among Latino ($\beta = 12.51$, $p < .001$) and Black ($\beta = 10.45$, $p < .001$) students, compared with White students and students of other races. No significant association with BMI percentile was found for age, sex, lunch eligibility, or food security at the individual level, or the percentage of students eligible for free or reduced-price lunch at the school level.

DISCUSSION

Findings from the current investigation suggest that, among this sample of fifth and sixth graders, the more a school creates a climate that engages and supports students while setting high academic standards and involving parents in the school, the lower students' age-adjusted and sex-adjusted BMI percentiles, even after adjusting for individual-level and

school-level sociodemographics. This study adds to the growing body of evidence suggesting that school climate may be an important protective health factor, and is also, as far as we know, the first to link school social climate with student BMI.

Latino and Black students in our study had higher BMI percentiles compared to White students, consistent with other studies.[2,14] Our findings of no significant associations of BMI percentile with age, sex, or food security at the individual level are also consistent with findings from a national sample[1] and urban, low-income study samples similar to ours.[15–17] Low SES is generally associated with obesity,[2] but we did not find an association of BMI with lunch eligibility. A likely explanation for this lack of association is that the limited variability in SES among the students in this sample and our limited measure of SES prevented us from finding significant differences. Strengths of the study include objectively measured height and weight, and a sample representing an at-risk population with high obesity prevalence. Moreover, our measure of school climate reflects responses from the entire student population as well as teachers, not just the students in our study.

Limitations

Our results are based on cross-sectional data, so we cannot establish a causal relationship between school climate and BMI percentile. Additionally, as mentioned previously, the use of school lunch eligibility as a proxy for SES has noted limitations.[18] However, our sample was drawn from a generally low-income population in a city where median household income is almost $13,000 and $29,000 below the national and state medians, respectively, and where 25% of the residents live below the poverty line.[19] These statistics are reflected in the limited variability in school lunch eligibility among our sample, so we included a measure of food insecurity as another indicator of SES. Additionally, our sample is drawn from a school district that has a public school choice system, aimed to foster racial, ethnic, and economic diversity. This school choice program allows students from all over the school district as well as surrounding districts to attend schools outside of their neighborhoods, so that students from the poorest neighborhoods are able to attend schools in upper income neighborhoods and thus are not necessarily all clustered in the same neighborhood schools. This, along with controlling for the percentage of students eligible for free or reduced-price lunch at each school, suggests that the findings are not simply confounded with socioeconomic differences between schools.

Another limitation is that results of our study could be confounded by unmeasured differences in school-level health policies or implementation of district-level health policies. At the time of our study, all schools in our study were following district-wide nutrition and physical activity policies. For example, school lunches were prepared centrally and menus were the same across all schools. Additionally, all schools followed a district-wide policy that prohibits the sale of food items (outside of school lunch) during the school day. As for the physical activity environment, physical education class time followed state requirements and was the same by grade level across schools, and teachers at each of the 12 schools received training in ABC for fitness, a classroom-based physical activity program. However, we have no measure of how these policies were actually implemented across schools, nor did we have measures of outdoor recess time or after school activities, which are left to the

discretion of the schools. Future research is needed to understand the independent and potentially interactive association of school climate and the nutrition and school physical activity environments of schools with BMI.

Given that our data are cross-sectional, we were not able to determine the direction of the relationship between school climate and BMI. As such, there is always the possibility that climate surveys conducted in schools with more obese students are capturing the feelings of marginalization experienced by these students[20] rather than positive school climate promoting healthy BMI. However, because climate data were collected by both students and teachers at the school level, and BMI was collected just from our fifth- and sixth-grade students, we think the former explanation is less likely to be true. Future longitudinal studies based upon subsequent waves of data collection in these schools are needed to better understand the direction of the relationship between school climate and BMI.

Furthermore, we did not explore any mechanisms that may drive the association of school climate with BMI. The social development model suggests that children who are attached to and invested in their community are more likely to accept and internalize community norms.[21,22] Thus, students who attend schools with positive school climates are possibly more likely to adopt positive health behaviors, which in turn, reduces their risk of obesity. Future research is needed to explore this and other possible mechanisms that could explain the relationship between school climate and BMI.

Conclusions

Our findings suggest that school-based interventions aimed at reducing and preventing obesity might benefit from efforts to improve school climate. More research is needed to understand the mechanisms behind this relationship and to explore whether interventions promoting positive school climate can effectively prevent and/or reduce obesity.

IMPLICATIONS FOR SCHOOL HEALTH

The finding that a more positive school climate is associated with lower student BMI percentile adds to the growing body of evidence that positive school climate is associated with better student health behaviors and outcomes. Although strong health policies and health and physical education are certainly needed in our schools to help prevent and reduce childhood obesity and to improve other aspects of students' health, school administrators should complement these efforts with policies and programs aimed at creating a positive school climate for students, parents, and teachers. The benefits of such an approach could go well beyond enhancing existing student health improvement efforts since research has shown that positive school climate is also associated with higher academic achievement, graduation rates and teacher retention, and less school violence.[8] Our findings suggest that positive school climate should be part of comprehensive plans aimed at producing students who are both successful and healthy.

Acknowledgments

This study was funded by a grant from the Aetna Foundation. Funding for the baseline data collection came from the Patrick and Catherine Weldon Donaghue Medical Research Foundation. This research was conducted in affiliation with Community Interventions for Health, Oxford Health Alliance, Oxford England.

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Table 1

Description of Sample

Explanatory Variable	Mean (SD) or N (%)*
Individual level (N = 1009)	
Age (in years)	10.9 (0.75)
Race/ethnicity	
Latino	449 (44.5)
Black	407 (40.3)
White	138 (13.7)
Other	15 (1.5)
Sex	
Female	543 (53.8)
Male	466 (46.2)
Lunch eligibility	
Free or reduced price	840 (83.3)
Full price	169 (16.8)
Food secure	
No	117 (11.6)
Yes	892 (88.4)
BMI percentile	79. 5 (29.3)
BMI risk category	
<85th percentile (healthy weight)	528 (52.3)
85th to <95th percentile (overweight)	193 (19.1)
≥95th percentile (obese)	288 (28.5)
School level (N = 12) (Scale: 1 to 5)	
School climate score	3.92 (0.30)
Individual school climate items	
I have a voice in my classroom and/or school decisions	3.51 (0.24)
I feel welcome in my school	4.05 (0.26)
My teacher(s) believe I am capable of learning	4.50 (0.13)
How available to you are teachers and other adults at your school to talk about an academic problem you are having	3.89 (0.19)
Parents at my school are given the opportunity to become involved in the classroom and school	3.91 (0.56)
My school offers a wide variety of activities to keep students at my school engaged	3.68 (0.74)
Percentage of students eligible for free/reduced-price lunch	82.70 (9.71)

Percentages may not add to 100 due to rounding.

*Numbers represent mean (standard deviation) for continuous variables and frequency (percentage) for categorical variables.

Table 2

Hierarchical Linear Modeling of the Association of Positive School Climate With BMI Percentile, Adjusted for Individual- and School-level Sociodemographic Variables (N = 1009)

Explanatory Variable	Beta Coefficient	Standard Error	p Value
Individual-level variables (N= 1009)			
Age (years)†	−.755	1.230	.540
Black	10.522	2.950	<.001*
Latino	12.761	3.012	<.001*
Female	−2.485	1.843	.178
Eligible for free or reduced-price lunch	−4.049	2.926	.166
Food secure	2.372	2.849	.405
School-level variables‡(N= 12)			
School climate score (higher= more positive)	−7.207	3.584	.045*
Percentage of students eligible for free or reduced-price lunch	−.029	.115	.799
Intercept	67.001	5.013	<.001*

*Statistically significant ($p < .05$).

BMI, body mass index.

†Grand mean centered.

‡Group mean centered.