DIGITAL ACCESS TO SCHOLARSHIP AT HARVARD
DASH.HARVARD.EDU

HARVARD LIBRARY
Office for Scholarly Communication

School Social Capital and Body Mass Index in the National Longitudinal Study of Adolescent Health

Citation

Richmond, Tracy K., Carly Milliren, Courtney E. Walls, and Ichiro Kawachi. 2014. "School Social Capital and Body Mass Index in the National Longitudinal Study of Adolescent Health." Journal of School Health 84 (12): 759–68. https://doi.org/10.1111/josh.12213.

Permanent link

http://nrs.harvard.edu/urn-3:HUL.InstRepos:41288136

Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Open Access Policy Articles, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#OAP

Share Your Story

The Harvard community has made this article openly available.
Please share how this access benefits you. Submit a story .

Accessibility

NIH Public Access
Author Manuscript
J Sch Health. Author manuscript; available in PMC 2015 December 01.

Published in final edited form as:
J Sch Health. 2014 December ; 84(12): 759–768. doi:10.1111/josh.12213.

School Social Capital and Body Mass Index in the National Longitudinal Study of Adolescent Health

TRACY K. RICHMOND, MD, MPH[a] **[Assistant Professor]**, **CARLY MILLIREN, MPH**[b] **[Statistical Programmer]**, **COURTNEY E. WALLS, MPH**[c], and **ICHIRO KAWACHI, MD, PhD**[d] **[Professor of Social Epidemiology Chair]**

[a]Division of Adolescent and Young Adult Medicine, Boston Children's Hospital, 333 Longwood Ave, 6th Floor, Boston, MA 02115

[b]Clinical Research Center, Boston Children's Hospital, 21 Autumn St. No. 304, Boston, MA 02115

[c]Decision Resources Group, 8 New England Executive Park, Burlington, MA 01803

[d]Department cf Social and Behavioral Sciences, Department of Social and Behavioral Sciences, Harvard School cf Public Health, 677 Huntington Ave, Kresge Bldg, 7th Floor, Boston, MA 02115

Abstract

BACKGROUND—Social capital in neighborhoods and workplaces positively affects health. Less is known about the inAuence of school social capital on student health outcomes, in particular weight status. We sought to examine the association between individual- and school-level social capital and student body mass index (BMI).

METHODS—Analyzing data from The National Longitudinal Study of Adolescent Health, a nationally representative sample of adolescents in grades 7-12 (N = 13,428), we used principal components analysis to define 3 school social capital factors: "connectedness" (feel part of/close to people/safe in school), "treatment" (get along with teachers/students, teachers treat students fairly), and "parental involvement" (school administrator reported percent family/parent self-reported participation in Parent Teacher Organization, average daily school attendance). We examined the associations between individual- and school-level social capital and individual BMI using multilevel modeling techniques.

RESULTS—In girls, both feeling connected to one's school ($b = -0.06$, $p < .05$) and attending schools with overall high connectedness ($b = -0.43$, $p < .01$) were associated with lower BM Is. In boys only attending a school with high "treatment" was inversely associated with BMI ($b = -0.61$, $p < .01$), adjusting for individual and school demographics.

CONCLUSIONS—Although further studies are needed, our findings suggest enhancing school social capital as a novel approach to addressing student obesity.

© 2014, American School Health Association

Address correspondence to: Tracy K. Richmond, Assistant Professor, (tracy.richmond@childrens.harvard.edu), Division of Adolescent and Young Adult Medicine, Boston Children's Hospital, 333 Longwood Ave., 6th Floor, Boston, MA 02115.. carly.milliren@childrens.harvard.edu. Courtney.e.walls@gmail.com. ikawachi@hsph.harvard.edu.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Keywords

social cohesion; body mass index; schools; social capital

Child/adolescent obesity is one of the most significant public health issues in the world today. [1] US rates of obesity among school-aged children have tripled over the last 2 decades.[2] Although the some recent national surveys have shown a leveling off in obesity, the problem is far from being solved.[3] Obese children are more likely to become obese adults and to have comorbid conditions such as hypertension, type 2 diabetes mellitus, and obstructive sleep apnea, both in childhood and as adults.[4-6] In addition, studies have found that the heaviest Americans are continuing to get heavier and that onset of obesity is earlier relative to prior birth cohorts, thus further increasing the risk of untoward consequences.[7, 8]

In searching for both contributors and potential remedies to the obesity epidemic, much public health attention has focused on environmental contexts such as neighborhoods, schools, and workplaces.[9-12] Schools in particular have been a target as children/adolescents spend a large percentage of their waking hours, eat a significant portion of their daily intake, and have the potential for physical activity opportunities while at school.[13, 14] Although much attention has been paid to the types of nutritional and physical activity programs that are offered by schools, less attention has been paid to potentially pro-social influences of the school environment such as engendering feelings of connection to the school or providing feelings of reciprocity or trust—attributes commonly referred to as “social capital” in other contexts.

School connectedness and school climate have long been studied relative to academic achievement and behavioral outcomes;[15-18] more recently, there has been interest in their impact on student health outcomes.[19] Conversely, social capital has long been studied relative to its health promoting aspects but has rarely been studied in school contexts.[20, 21] In this study, we apply knowledge from studies related to social capital in neighborhoods and workplaces to focus on school connectedness and school climate. We hypothesized that school social capital may be protective for teen obesity on several grounds. First, health promotion messages tend to be more effectively transmitted in socially cohesive schools. Second, a climate of safety and mutual respect promotes the mental well-being of students (whereas by contrast, depression is linked to weight gain). Third, greater parental involvement in schools is linked to more effective action to promote the health and well-being of children. Consequently, we hypothesized that students who report higher individual-level school social capital and who attend schools with higher school-level social capital will have a lower body mass index (BMI). In this study, we specifically set out to (1) generate individual- and school-level markers of school social capital, and (2) examine the relationships of these markers with student BMI.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

METHODS

Participants

This study uses data from the In-Home Survey of Wave I (collected in 1994-1995 when participants were aged 12-19 years, N = 20,745) of the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative longitudinal study of adolescents originally sampled from schools, the primary sampling unit.[22] Schools were first sorted by size, school type, census region, level of urbanization, and the percentage of the student body that is non-Hispanic white, and then sampled using implicit stratification and systematic sampling methods to ensure that the sample was representative of all US schools. All students within a sampled school were asked to complete the In-School survey at Wave I and were eligible for the Wave I In-Home survey as well as subsequent In-Home surveys. After stratifying the student body of the 132 chosen schools by sex and grade, the final sample of 20,745 students was randomly selected for the Wave I In-Home survey. Approximately 200 students were sampled per school, with the exception of the 16 schools in which the entire student body was sampled.

In addition to data from the Wave I In-Home Survey, this study uses data from both the School Administrator Survey and the Parent Survey. Of the 20,745 students who participated in the In-Home Survey, 98% had data collected from a school administrator and 85% had a parent respond to the Parent Questionnaire.

We made a number of exclusions from our initial sample of 20,745 due to missing data on key variables. Overall, 1821 participants were excluded because they did not have an individual sampling weight available and 528 because there was no school sampling weight available. In addition, 501 were excluded due to missing information needed for our outcome (either height or weight). A large number were excluded due to missing data for our predictor variables (4197 for “parental involvement,” 252 for “treatment,” and 10 for “connectedness”). Finally, 4 were excluded due to missing data for race/ethnicity and 4 due to missing age. Because of the high degree of missing in one of our markers of school social capital, “parental involvement,” we ran the models with and without excluding those missing information on “parental involvement.” There was no material difference in these models, and thus we present models with those missing information dropped to have a uniform sample across models.

Markers of individual level and school level SES as well as the variable for “parental involvement” relied on parent responses to the Parental Survey. As indicated above, the response rate for the parent questionnaire was 85% for the child-specific data. Of those who participated, a number of parent respondents refused to provide information regarding household income or maternal education, leaving 1764 of Wave I participants with no information on household income and 91 without information on maternal education. We imputed both of these variables using the Gaussian normal regression imputation method. After all exclusions and imputations for missing SES variables, our final analytic sample was 13,428 students nested in 115 schools.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Instruments

Outcome variable—Our primary outcome variable was BMI (kg/m^2) calculated from self-reported height (m) and weight (kg).

Social capital measures (primary predictor variables)—Table 1 summarizes the 11 independent variables used to quantify measures of individual- and school-level school social capital. Variable selection was informed by social capital studies from the fields of sociology and public health,[20, 21] as well as studies from the education literature on school connectedness, [17, 19, 23] school climate,[15, 16, 24, 25] and parental involvement in schools.[26]

Individual-level demographic variables—We adjusted for the age, sex, and race/ethnicity of the individual participant, as well as 2 markers of socioeconomic status: household income and highest education level achieved by a parent. Study participants self-reported both their age and sex. They were asked to indicate if they were of Hispanic ethnicity and, in an additional question, to choose the category best describing their race (White, Black or African-American, American Indian or Native American, Asian or Pacific Islander, and other). Racial/ethnic categories were then defined following classifications used in the US Census (American Indian or Native American, Asian or Pacific Islander, Black or African-American, Hispanic, White, multiracial).[27] Those who chose more than one racial category were considered multiracial. Any person who indicated they were Hispanic was considered Hispanic regardless of the racial data indicated.

The parent completing the Parental Questionnaire (almost exclusively the mother or female guardian) was asked to report the household income (in thousands of dollars on a continuous scale) and, separately, the highest education level achieved by herself and the father of the study participant (responses ranged from less than eighth grade to professional training beyond college). As noted above, the response rate for the parental questionnaire overall was 85%, and the response rate to the questions regarding income and education was even lower. In an attempt to reduce bias from listwise deletion,[28] we imputed values for both educational level and household income using best subset regression.[29] After imputation, we took the higher response for maternal versus paternal educational achievement and then categorized the parental education variable into 4 categories: less than high school education, high school/vocational/high school equivalent, some college but not college graduate, completed college or beyond. With regards to the household income variable, we created a percent of the federal poverty level variable by comparing the reported household income to the poverty level in 1995 for each household size.[30]

School-level demographic variables—We controlled for several demographic variables at the school level. Both school-level parental education and school-level household income were taken from first aggregating the student-level parental education and household income variables then taking the median value. The school administrators reported the percent of the student body that is White using the following categories: 0%, 1-66%, 67-93%, and 94-100%.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Data Analysis

Principal components analysis—The 11 independent variables were analyzed using principal components analysis to create composite variables quantifying school social capital. SAS version 9.2 PROC FACTOR[31] was used with the varimax rotation method. Variables with loadings >0.35 were retained and used to interpret the factors.[32]

Univariate, bivariate, and multiple regression analyses—We first examined univariate distributions and performed bivariate analyses of our variables of interest by sex. Because of the known variability in weight outcomes by sex, we used sex-stratified multilevel linear regression models to examine the association of individual- and school-level markers of social capital and individual student BMI while accounting for the clustering of students in schools. For each marker of school social capital, we built a separate series of models: (1) a null model in which we examined the variance components, ie, individual and school level, while adjusting for no individual- or school-level factors (model 1); (2) a model examining associations of our individual-level markers of school social capital adjusting for individual- and school-level demographics (model 2); (3) a model assessing the association of the school-level markers of school social capital adjusting for individual and school-level demographics (model 3); and (4) a model including both the individual- and school-level markers of school social capital adjusting for demographics at the individual level and school level (model 4). All analyses, with the exception of the principal components analysis, were conducted in STATA SE 11 and were adjusted for the complex survey design using svy commands.[33] We applied sampling weights to account for the unequal likelihood of being sampled in certain populations.

RESULTS

Principal Components Analysis

Initial analysis revealed 3 factors in which all except 2 variables had loadings >0.35 on at least one factor. Parental report of volunteering in school and participant report of their school being prejudiced did not have loadings >0.35 on any of the factors; consequently, they were removed. The variable “talk to parents of participant’s friends” loaded strongly on 2 variables so was excluded. The analysis was rerun with a 3-factor solution specified accounting for 54% of the variation in the constituent variables.

In the final rotated solution, “feel close to people at your school,” “feel safe in your school,” and “feel like you are part of the school” loaded most strongly and positively on factor 1, “connectedness” with factor loadings of 0.85, 0.52, and 0.85, respectively. “Had trouble getting along with other students,” “had trouble getting along with teachers,” and “teachers treat students fairly” loaded most strongly on factor 2, “treatment” with factor loadings of 0.62, 0.84, and 0.62, respectively. Both parent and school administrator report of “PTO involvement,” as well as school administrator report of “average daily student attendance,” loaded on factor 3, “parental involvement” with factor loadings of 0.48, 0.79, and 0.73, respectively. The total variance accounted for by each factor was 27% by “connectedness,” 15.7% by “treatment,” and 11.7% by “involvement.”

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Results of Univariate and Bivariate Analyses

The range of and mean values for the 3 social capital subscales for boys and girls combined were “connectedness” range = 0-12, mean 8.4; “treatment” 0-12, mean 8.7; and “parental involvement” range = 1.1-2.6 with mean 1.7. Table 2 shows demographic and anthropometric characteristics by sex. Our sample was racially/ethnically as well as socioeconomically diverse with few statistically significant differences in demographic and school characteristics between boys and girls.

Results of Multivariate Analyses

Tables 3-5 show results of our sex-stratified multi-level models examining the association separately of each of our social capital factors at both the individual level and school level with individual BMI. Unlike boys, girls who themselves reported feeling connected to their school (b = −0.063, 95% confidence interval [CI]: −0.12, −0.003) and who attended schools with high degree of connectedness (b = −0.43, 95% CI: −0.76, −0.11) had on average lower BMIs than similar girls who attended schools with lower levels of school connectedness in the student body. Of note, the effect size of the school-level marker of connectedness was almost 7 times greater than that of the individual perception. The effect size of individual-level connectedness was attenuated with the addition of school-level connectedness while school-level connectedness was only moderately attenuated with the inclusion of individual-level connectedness.

The models for “treatment” as the primary predictor variable are presented in Table 4. Boys attending a school with higher school-level “treatment” had moderately lower BMIs (b = −0.63, 95% CI: −1.1, −0.15) compared with boys attending schools with lower “treatment” at the school level. The association was only modestly attenuated in models that included individual markers of “treatment.” In girls, there was no significant association between both individual- or school-level “treatment” and BMI.

Table 5 shows results from models with “parental involvement” as the primary school social capital predictor variable. Girls who attended schools with higher reported “parental involvement” (b = −0.90, 95% CI: −1.5, −0.27) had moderately lower BMIs compared with girls attending schools with lower “parental involvement.” However, this association was attenuated and no longer statistically significant in models that included the individual marker of “parental involvement.” Parental involvement was not associated with boys’ BMI.

DISCUSSION

In one of the first multilevel studies of school social capital and a health outcome, we find that both individual perceptions of and school contextual markers of school social capital are associated with lower BMIs; the associations vary by sex and by the specific marker of school social capital. In girls, attending schools with high levels of school connectedness and feeling connected oneself were associated with lower BMIs. In contrast, in boys, neither individual- nor school-level markers of school connectedness or parental involvement was associated with BMI. However, boys attending schools in which overall students felt well

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

treated had lower BMIs on average than boys attending schools where students did not feel well treated.

Our findings are in concert with others demonstrating the positive effects of school connectedness. Studies in the education literature have long connected individual student perceptions of school connectedness to academic outcomes such as school attendance,[34] higher grades,[35] and dropping out.[18] Resnick et al[19] extended the examination of school connectedness to health outcomes in youth finding that school connectedness protected against frequent alcohol use, disordered eating, early sexual initiation, violence, and risk of unintentional injury. Our study advances the study of school connectedness in several key ways. First, in using principal components analysis, we are assured that the variables comprising our connectedness variable (which mirrored those used in Resnick's study) were measuring the same construct. Second, we extended the study of school connectedness to one of the most pressing public health issues today, child and adolescent obesity. Finally, we assessed the influence not only of the individual student's perception of their own school connectedness but also that of connectedness as a school-level attribute. This is an important contribution as it opens the possibility that interventions aimed at improving connectedness overall in the school may have positive "spillover" effects even in those who individually report low school connectedness.

We found that attending schools with high degrees of parental involvement was protective for female BMI, despite individual parental involvement having no effect. Studies in the education literature have demonstrated positive effects of parental involvement on academic outcomes.[26, 36] However, these studies almost universally focus on individual reports of parental involvement rather than considering a school-level marker of parental involvement. We are unaware of any studies of parental involvement and a health outcome. Our study adds significantly to what is known about parental involvement by considering its influence in a multilevel approach and by extending its study to a health problem.

Limitations

There are limitations to this study that must be acknowledged. First, due to the cross-sectional nature of the study, we cannot infer causality. Second, a large number of participants did not have a parent participate in the survey and of those who did a large number did not provide information on key variables. We compared those who were missing information on key variables (and thus dropped from analyses) and not and found no discernible difference by demographics. We also performed sensitivity analyses to assess the impact of dropping all participants missing information from one of our key variables, "parental involvement," and found no material difference in models with and without those missing information for the "parental involvement" variable excluded. A number of potential variables for our principal components analysis were not assessed as they were not asked of the more than 60% of participants interviewed during summertime months and thus had an intolerably high percent missing. Finally, the data were collected more than 15 years ago now. Add Health is one of few samples that allow for a multilevel examination of school and individual variables and their influence on health behaviors and outcomes.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Participants were only nested within schools in waves 1 and 2, making it irrelevant to look at more recently collected waves of data collection.

Conclusions

Given the continued interest in schools as a means to intervene on and hopefully reverse the childhood obesity epidemic as well as schools' general potential pro-social influence,[37] our findings suggest a novel approach in which to harness schools' influence on weight status. At least one study, the Seattle Social Development Program,[23] demonstrated that connectedness to school could be improved through a teacher intervention. Further studies are needed to understand the mechanisms through which various markers of school social capital operate in specific sex subpopulations. Additional studies are needed to identify interventions that can increase school social capital to engender healthy habits with the ultimate goal of achieving healthier weight status in students.

IMPLICATIONS FOR SCHOOL HEALTH

Our findings underscore another positive implication for improving school social cohesion: improved weight status of the student population. Schools should consider interventions to improve overall school connectedness as it had the largest effect size of any of our measures of school social cohesion. Based on prior studies, schools would likely see many benefits to their student body in raising feelings of connectedness with our findings adding a health outcome to academic and mental health outcomes identified in other studies. Improving overall school connectedness is a novel approach to improving the weight status of the student body.

Human Subjects Approval Statement

This study was approved by the Institutional Review Board of Boston Children's Hospital.

REFERENCES

1. World Health Organization. Childhood overweight and obesity. Available at: http://www.who.int/dietphysicalactivity/childhood/en/index.html. Accessed November 1, 2012
2. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. JAMA. 2010; 303(3):242–249. [PubMed: 20071470]
3. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. JAMA. 2002; 288(14):1723–1727. [PubMed: 12365955]
4. Dietz W. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics. 1998; 101(3):518–525. [PubMed: 12224658]
5. Franks PW, Hanson RL, Knowler WC, Sievers ML, Bennett PH, Looker HC. Childhood obesity, other cardiovascular risk factors, and premature death. N Engl J Med. 2010; 362(6):485–493. [PubMed: 20147714]
6. The NS, Suchindran C, North KE, Popkin BM, Gordon-Larsen P. Association of adolescent obesity with risk of severe obesity in adulthood. JAMA. 2010; 304(18):2042–2047. [PubMed: 21063014]
7. Sturm R, Hattori A. Morbid obesity rates continue to rise rapidly in the United States. Int J Obes. 2012; 37(6):1–3.
8. Lee JM, Pilli S, Gebremariam A, et al. Getting heavier, younger: trajectories of obesity over the life course. Int J Obes. 2010; 34(4):614–623.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

9. Gordon-Larsen P, Nelson M, Page P, Popkin B. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006; 117(2):417–424. [PubMed: 16452361]
10. Richmond T, Hayward R, Gahagan S, Field A, Heisler M. Can school income and racial/ethnic composition explain the racial/ethnic disparity in adolescent physical activity participation? Pediatrics. 2006; 117(6):2158–2166. [PubMed: 16740860]
11. Richmond TK, Subramanian SV. School level contextual factors are associated with the weight status of adolescent males and females. Obesity. 2008; 16(6):1324–1330. [PubMed: 18356836]
12. Boone-Heinonen J, Gordon-Larsen P. Obesogenic environments in youth: concepts and methods from a longitudinal national sample. Am J Prev Med. 2012; 42(5):e37–e46. [PubMed: 22516502]
13. Story M, Kaphingst K, French S. The role of schools in obesity prevention. Future Child. 2006; 16(1):109–142. [PubMed: 16532661]
14. Johnson LD, Delva J, O'Malley PM. Sports participation and physical education in American secondary schools: current levels and racial/ethnic and socioeconomic disparities. Am J Prev Med. 2007; 33(6):S195–S208. [PubMed: 17884568]
15. Gottfredson GD, Gottfredson DC. School Climate, Academic Performance, Attendance, and Dropout. Charleston, SC: Charleston County School District SC. 1989
16. National School Climate Council. School climate. Available at: http://www.schoolclimate.org/climate/. Accessed January 13, 2013
17. Centers for Disease Control and Prevention. School Connectedness: Strategies for Increasing Protective Factors Among Youth. US Department of Health and Human Services; Atlanta, GA: 2009.
18. Battin-Pearson S, Newcomb MD, Abbott RD, Hill KG, Catalano RF, Hawkins JD. Predictors of early high school dropout: a test of five theories. Educ Psychol. 2000; 92(3):568–582.
19. Resnick MD, Bearman PS, Blum RW, et al. Protecting adolescents from harm. Findings from the National Longitudinal Study on Adolescent Health. JAMA. 1997; 278(10):823–832.
20. Kawachi, I.; Subramanian, SV.; Kim, D., editors. Social Capital and Health. Springer; New York, NY: 2008.
21. Virtanen, M.; Ervasti, J.; Oksanen, T.; Kivimaki, M.; Vahtera, J. Social capital in schools. In: Kawachi, I.; Subramanian, SV.; Kim, D., editors. Social Capital and Health. 2nd. Springer; New York, NY: 2013.
22. Harris, KM. The National Longitudinal Study of Adolescent Health: Design and Accomplishments. Available at: http://www.cpc.unc.edu/projects/addhealth/data/guides/DesignPaperWIIV.pdf. Accessed March 17, 2014
23. Hawkins JD, Catalano RF, Kosterman R, Abbott R, Hill KG. Preventing adolescent health-risk behaviors by strengthening protection during childhood. Arch Pediatr Adolesc Med. 1999; 153(3): 226–234. [PubMed: 10086398]
24. LaRusso M, Romer D, Selman R. Teachers as builders of respectful school climates: implications for drug use norms and depressive symptoms in high school. J Youth Adolesc. 2008; 37(4):386–398.
25. Kasen SN, Johnson PN, Cohen PN. The impact of social emotional climate on student psychophathology. J Abnorm Child Psychol. 1990; 18(2):165–177. [PubMed: 2348030]
26. Epstein, J. School, Family, and Community Partnerships: Preparing Educators and Improving Schools. Westview Press; Boulder, CO: 1987.
27. US Census Bureau. Race main: what is race?. Washington, DC: 2010. Available at: http://www.census.gov/population/race/. Accessed xxx xx, xxxx
28. King, G.; Honaker, J.; Joseph, A.; Scheve, K. List-wise deletion is evil: what to do about missing data in political science. Presented at the Annual Meeting of the American Political Science Association; Philadelphia, PA: 1998.
29. StataCorp. Stata help for impute. Available at: http://www.stata.com/help.cgi?impute. Accessed March 14, 2014
30. US Census Bureau 1995. Poverty thresholds. Available at: http://www.census.gov/hhes/www/poverty/threshld/thresh95.html. Accessed March 17, 2014

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

31. SAS Institute Inc.. The factor procedure. SAS Institute, Inc; Cary, NC: 2008. SAS/STAT® 92 User's Guide

32. Tabachnick, BG.; Fidell, LS. A Practical Approach to Using Multivariate Analyses. 6th. Pearson; New York, NY: 2012.

33. StataCorp. 2010. Stata Statistical Software: Release 11. StataCorp LP; College Station, TX: 2011.

34. Rosenfeld LB, Richman JM, Bowen GL. Low social support among at-risk adolescents. Soc Work Educ. 1998; 20(4):245–160.

35. Klem ML, Wing RR, McGuire MT, Seagle HM, Hill JO. A descriptive study of individuals successful at long-term maintenance of substantial weight loss. Am J Clin Nutr. 1997; 66(2):239–246. [PubMed: 9250100]

36. McNeal RB. Parental involvement as social capital: differential effectiveness on science, achievement, truancy, and dropping out. Soc Forces. 1999; 78(1):117–144.

37. Hawkins JD, Catalano RF. Broadening the vision of education: schools as health promoting environments. J Sch Health. 1990; 60(4):178–181. [PubMed: 2348701]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Table 1

Variables Used to Create Social Cohesion Factors

Variable Descriptor	Source	Response Categories
During this school year, have you participated in school fund raising or done volunteer work for (NAME)′s school, such as supervising lunch, chaperoning a field trip, etc.?	Parent	Yes/no
Please tell me if you are a member of… parent/teacher organization	Parent	Yes/no
Please think of all of XX′s friends. How many of his friends′ parents have you talked to in the last 4weeks?	Parent	Numeric response 0-6
What is the average daily attendance of your school	School administrator	Greater than 95%, 90-94%, 85-89%, 80-84%, 75-59%
Considering all of the children in your school, approximately what percentage has family members in the parent-teacher organization or other organization of parents?	School administrator	1-100%
Since school started this year, how often have you had trouble getting along with teachers?	Student participant	Just a few times, about once a week, almost every day, every day, refused
Since school started this year, how often have you had trouble getting along with other students?	Student participant	Just a few times, about once a week, almost every day, every day, refused
You feel close to people at your school	Student participant	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
You feel like you are part of your school	Student participant	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
Students at your school are prejudiced	Student participant	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
The teachers at your school treat students fairly	Student participant	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree
You feel safe in your school	Student participant	Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 2

Demographic and Health Characteristics of Study Sample by Sex

	Mean (95% CI) or Percent		
	Boys (N=6734)	**Girls (N=6694)**	**p-Value***
Individual level			
Age (years)	15.9 (15.6, 16.1)	15.7 (15.5, 16.0)	<.01
BMI	22.6 (22.3, 22.8)	22.1 (21.9, 22.3)	<.01
Race/ethnicity			.52
White	65%	64%	
Black	16%	17%	
Hispanic	12%	12%	
Asian	4%	4%	
Native American	2%	2%	
Multi/other	1%	1%	
Household income (thousands)	45.5 (41.8, 49.3)	44.5 (41.2, 47.9)	.40
Highest educational level achieved			.60
Less than high school	12%	12%	
High school graduate	27%	28%	
Some college	31%	30%	
College and beyond	30%	30%	
Connectedness	8.4 (8.3, 8.5)	8.4 (8.2, 8.5)	.85
Treatment	8.6 (8.5, 8.7)	8.8 (8.7, 8.9)	<.01
Parent involvement	1.7 (1.7, 1.8)	1.7 (1.7, 1.8)	.13
School level			
Household income (thousands)	45.1 (41.7, 48.6)	44.8 (41.4, 48.2)	.70
Household education			.98
Less than high school	1%	1%	
High school graduate	44%	44%	
Some college	54%	54%	
College and beyond	1%	1%	
Connectedness	8.3 (8.2, 8.5)	8.3 (8.2, 8.4)	.38
Treatment	8.7 (8.6, 8.8)	8.7 (8.6, 8.8)	.54
Parent involvement	1.7 (1.7, 1.8)	1.7 (1.7, 1.8)	.09

CI, confidence interval; BMI, body mass index.

* Independent 2-sample *t*-tests were conducted for continuous variables, and chi-squared tests were conducted for categorical variables. All analyses were adjusted for the complex survey sampling design.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 3

The Association of Individual- and School-Level "Connectedness" With Individual BMI

	Parameter Estimate (95% CI)							
	Boys (N=6734)				Girls (N=6694)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Individual level								
Connectedness	—	0.064 (−0.01, 0.14)	—	0.07 (−0.003, 0.14)	—	−0.063 (−0.12,−0.003)*	—	−0.05 (−0.11, 0.01)
Age	—	0.541 (0.41, 0.67)**	0.529 (0.39, 0.66)**	0.531 (0.4, 0.67)**	—	0.406 (0.3, 0.52)**	0.385 (0.28, 0.49)**	0.382 (0.27, 0.49)**
Race/ethnicity								
White	—	Ref.	Ref.	Ref.	—	Ref.	Ref.	Ref.
Black	—	−0.074 (−0.67, 0.52)	−0.079 (−0.66, 0.5)	−0.1 (−0.69, 0.49)	—	1.215 (0.68, 1.75)**	1.176 (0.65, 1.7)**	1.164 (0.63, 1.7)**
Native American	—	2.234 (−0.79, 5.26)	2.215 (−0.78, 5.21)	2.232 (−0.77, 5.23)	—	1.638 (−0.49, 3.77)	1.567 (−0.53, 3.67)	1.577 (−0.52, 3.67)
Asian	—	−1.28 (−2.39, −0.17)*	−1.265 (−2.39, −0.14)*	−1.283 (−2.38, −0.18)*	—	−1.19 (−2.21, −0.17)*	−1.232 (−2.25, −0.21)*	−1.227 (−2.24, −0.21)*
Multi/other	—	−0.351 (−1.79, 1.09)	−0.365 (−1.8, 1.07)	−0.328 (−1.74, 1.08)	—	−1.27 (−2.4, −0.14)*	−1.24 (−2.43, −0.05)*	−1.286 (−2.43, −0.14)*
Hispanic	—	0.005 (−0.65, 0.66)	−0.007 (−0.68, 0.67)	0 (−0.65, 0.65)	—	0.717 (0.03, 1.41)*	0.686 (0, 1.37)	0.695 (0.01, 1.38)*
Household income	—	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	—	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)
Parental education	—	0.066 (−0.07, 0.21)	0.065 (−0.08, 0.2)	0.066 (−0.07, 0.21)	—	−0.117 (−0.2, −0.04)***	−0.122 (−0.2, −0.04)***	−0.119 (−0.2, −0.04)**
School level								
Connectedness	—	—	−0.135 (−0.59, 0.32)	−0.197 (−0.65, 0.26)	—	—	−0.434 (−0.76, −0.11)**	−0.382 (−0.72, −0.05)*
Household income	—	−0.009 (−0.02, 0.005)	−0.008 (−0.02, 0.005)	−0.008 (−0.02, 0.005)	—	−0.008 (−0.02, 0.003)	−0.007 (−0.02, 0.004)	−0.007 (−0.02, 0.004)
Household education	—	−0.105 (−0.55, 0.34)	−0.091 (−0.54, 0.36)	−0.088 (−0.54, 0.36)	—	−0.195 (−0.5, 0.11)	−0.164 (−0.45, 0.13)	−0.166 (−0.45, 0.12)
Percent white								
0%	—	−0.674 (−1.46, 0.11)	−0.644 (−1.46, 0.17)	−0.653 (−1.47, 0.16)	—	−0.366 (−1.07, 0.34)	−0.302 (−0.93, 0.32)	−0.301 (−0.93, 0.33)
1-66%	—	−0.057 (−0.92, 0.81)	−0.161 (−1.11, 0.79)	−0.152 (−1.1, 0.79)	—	−0.299 (−1.02, 0.42)	−0.484 (−1.16, 0.19)	−0.483 (−1.16, 0.19)
67-93%	—	−0.281 (−0.83, 0.27)	−0.332 (−0.9, 0.24)	−0.324 (−0.9, 0.25)	—	−0.292 (−0.83, 0.25)	−0.372 (−0.91, 0.17)	−0.371 (−0.91, 0.17)
94-100%	—	Ref.	Ref.	Ref.	—	Ref.	Ref.	Ref.
Variance								
Individual (SE)	22.1 (1.8)	21.4 (1.7)	21.4 (1.7)	21.4 (1.7)	18.0 (0.87)	17.5 (0.86)	17.5 (0.87)	17.5 (0.86)
School (SE)	0.94 (0.33)	0.20 (0.14)	0.19 (0.14)	0.19 (0.14)	1.15 (0.24)	0.22 (0.11)	0.21 (0.10)	0.21 (0.10)

BMI, body mass index; CI, confidence interval; SE, standard error.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Model 1: null model predicting BMI from individual and school levels.

Model 2: examine association between individual closeness and BMI adjusting for age, race/ethnicity, household income, parental education, and school-level education, household income, and proportion white.

Model 3: examine association between school-level closeness and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

Model 4: examine association between individual and school-level closeness and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

*** p<.001,

** p<.01,

* p<.05

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

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 4

The Association of Individual- and School-level "Treatment" With Individual BMI

	Parameter Estimate (95% CI)							
	Boys (N=6734)				Girls (N=6694)			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Individual level								
Treatment	—	−0.039 (−0.14, 0.06)	—	−0.022 (−0.12, 0.07)	—	−0.09 (−0.18, 0)	—	−0.086 (−0.18, 0.01)
Age	—	0.538 (0.42, 0.66)**	0.547 (0.43, 0.66)**	0.547 (0.43, 0.66)**	—	0.415 (0.31, 0.53)**	0.418 (0.31, 0.53)**	0.417 (0.31, 0.53)
Race/ethnicity								
White	—	Ref.	Ref.	Ref.	—	Ref.	Ref.	Ref.
Black	—	−0.067 (−0.65, 0.52)	−0.234 (−0.88, 0.41)	−0.232 (−0.87, 0.41)	—	1.188 (0.66, 1.72)**	1.201 (0.68, 1.72)**	1.169 (0.65, 1.69)**
Native American	—	2.209 (−0.83, 5.24)	2.16 (−0.86, 5.18)	2.155 (−0.87, 5.18)	—	1.564 (−0.57, 3.7)	1.611 (−0.52, 3.74)	1.554 (−0.58, 3.69)
Asian	—	−1.242 (−2.33, −0.15)*	−1.273 (−2.4, −0.14)*	−1.26 (−2.36, −0.16)*	—	−1.152 (−2.16, −0.14)*	−1.191 (−2.21, −0.17)*	−1.154 (−2.16, −0.15)*
Multi/other	—	−0.374 (−1.82, 1.07)	−0.497 (−2, 1.01)	−0.491 (−1.99, 1.01)	—	−1.261 (−2.37, −0.15)*	−1.23 (−2.39, −0.07)*	−1.27(−2.37, −0.17)*
Hispanic	—	0.007 (−0.66, 0.67)	0.117 (−0.53, 0.76)	0.119 (−0.52, 0.76)	—	0.729 (0.04, 1.42)*	0.752 (0.02, 1.49)*	0.752 (0.02, 1.48)*
Household Income	—	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	—	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)
Parental education	—	0.065 (−0.07, 0.2)	0.067 (−0.07, 0.21)	0.067 (−0.07, 0.21)	—	−0.116 (−0.2, −0.04)**	−0.119 (−0.2, −0.04)***	−0.115 (−0.19, −0.04)***
School level								
Treatment	—	—	−0.627 (−1.11, −0.15)*	−0.606 (−1.05, −0.16)**	—	—	−0.209 (−0.69, 0.28)	−0.117 (−0.61, 0.37)
Household income	—	−0.008 (−0.02, 0.005)	−0.0002 (−0.01, 0.01)	−0.0003 (−0.01, 0.01)	—	−0.008 (−0.02, 0.003)	−0.006 (−0.02, 0.004)	−0.006 (−0.02, 0.004)
Household education	—	−0.118 (−0.54, 0.3)	−0.3 (−0.6, 0.0004)*	−0.301 (−0.6, −0.001)*	—	−0.228 (−0.55, 0.1)	−0.257 (−0.56, 0.05)	−0.261 (−0.57, 0.04)*
Percent White								
0%	—	−0.64 (−1.4, 0.12)	−0.408 (−0.98, 0.17)	−0.406 (−0.98, 0.17)	—	−0.337 (−1.09, 0.41)	−0.307 (−1.08, 0.47)	−0.299 (−1.08, 0.48)
1-66%	—	−0.099 (−0.94, 0.74)	−0.169 (−0.96, 0.63)	−0.169 (−0.96, 0.62)	—	−0.282 (−1.01, 0.44)	−0.297 (−1.02, 0.43)	−0.298 (−1.03, 0.43)
67-93%	—	−0.304 (−0.85, 0.24)	−0.275 (−0.81, 0.26)	−0.277 (−0.81, 0.25)	—	−0.266 (−0.81, 0.28)	−0.27 (−0.81, 0.27)	−0.261 (−0.8, 0.28)
94-100%	—	Ref.	Ref.	Ref.	—	Ref.	Ref.	Ref.
Variance								
Individual (SE)	22.1 (1.8)	21.4 (1.7)	21.4 (1.7)	21.4 (1.7)	18.0 (0.9)	17.5 (0.86)	17.5 (0.87)	17.5 (0.9)
School (SE)	0.94 (0.33)	0.17 (0.14)	0.13 (0.13)	0.13 (0.13)	1.15 (0.24)	0.23 (0.11)	0.22 (0.11)	0.23 (0.11)

BMI, body mass index; CI, confidence interval; SE, standard error.

Model 1: null model predicting BMI from individual and school levels.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Model 2: examine association between individual treatment and BMI adjusting for age, race/ethnicity, household income, parental education, and school-level education, household income, and proportion white.

Model 3: examine association between school-level treatment and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

Model 4: examine association between individual and school-level treatment and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

*** p<.001,

** p<.01,

* p<.05

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Table 5

The Association of Individual- and School-Level "Parental Involvement" With Individual BMI

	Parameter Estimate (95% CI)							
	Boys (N=6734)				Girls (N=6694)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Individual level								
Parental involvement	—	−0.048 (−0.94, 0.85)	—	0.559 (−0.74, 1.86)	—	−0.613 (−1.37, 0.14)	—	−0.244 (−1.61, 1.12)
Age	—	0.537 (0.41, 0.66)**	0.535 (0.41, 0.66)**	0.533 (0.41, 0.65)**	—	0.416 (0.31, 0.52)**	0.412 (0.3, 0.52)**	0.414 (0.3, 0.52)**
Race/ethnicity								
White	—	Ref.	Ref.	Ref.		Ref.	Ref.	Ref.
Black	—	−0.066 (−0.66, 0.53)	−0.104 (−0.71, 0.51)	−0.112 (−0.73, 0.5)	—	1.218 (0.7, 1.73)**	1.181 (0.67, 1.69)**	1.188 (0.69, 1.69)**
Native American	—	2.217 (−0.81, 5.24)	2.195 (−0.82, 5.21)	2.196 (−0.81, 5.2)	—	1.648 (−0.49, 3.78)	1.635 (−0.49, 3.76)	1.638 (−0.49, 3.77)
Asian	—	−1.264 (−2.39, −0.14)*	−1.293 (−2.42, −0.17)*	−1.327 (−2.48, −0.17)*	—	−1.17 (−2.2, −0.14)*	−1.193 (−2.23, −0.16)*	−1.185 (−2.22, −0.15)*
Multi/other	—	−0.378 (−1.83, 1.08)	−0.406 (−1.89, 1.07)	−0.433 (−1.93, 1.07)	—	−1.223 (−2.38, −0.06)*	−1.259 (−2.42, −0.09)*	−1.251 (−2.4, −0.1)*
Hispanic	—	−0.005 (−0.67, 0.66)	−0.031 (−0.7, 0.64)	−0.039 (−0.71, 0.63)	—	0.698 (0.02, 1.37)*	0.664 (−0.002, 1.33)	0.672 (0.02, 1.33)*
Household income	—	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	−0.003 (−0.01, 0.001)	—	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)	−0.001 (−0.004, 0.002)
Parental education	—	0.064 (−0.08, 0.21)	0.065 (−0.07, 0.2)	0.077 (−0.07, 0.23)	—	−0.135 (−0.21, −0.06)**	−0.121 (−0.2, −0.04)***	−0.126 (−0.2, −0.05)**
School level								
Parental involvement	—	—	−0.475 (−1.47, 0.52)	−1.032 (−2.38, 0.32)	—	—	−0.901 (−1.54, −0.27)**	−0.655 (−2.07, 0.76)
Household Income	—	−0.008 (−0.02, 0.005)	−0.007 (−0.02, 0.01)	−0.007 (−0.02, 0.01)	—	−0.007 (−0.02, 0.004)	−0.006 (−0.02, 0.004)	−0.006 (−0.02, 0.004)
Household education	—	−0.104 (−0.54, 0.34)	−0.126 (−0.55, 0.3)	−0.143 (−0.56, 0.27)	—	−0.213 (−0.52, 0.1)	−0.239 (−0.54, 0.06)	−0.234 (−0.53, 0.06)
Percent White								
0%	—	−0.651 (−1.44, 0.14)	−0.578 (−1.36, 0.2)	−0.577 (−1.35, 0.2)	—	−0.29 (−1.02, 0.44)	−0.239 (−0.98, 0.5)	−0.242 (−0.97, 0.49)
1-66%	—	−0.092 (−0.94, 0.76)	−0.078 (−0.93, 0.77)	−0.074 (−0.93, 0.78)	—	−0.272 (−0.98, 0.44)	−0.254 (−0.96, 0.45)	−0.259 (−0.96, 0.44)
67-93%	—	−0.3 (−0.84, 0.24)	−0.283 (−0.82, 0.26)	−0.281 (−0.82, 0.26)	—	−0.262 (−0.8, 0.28)	−0.249 (−0.78, 0.28)	−0.25 (−0.78, 0.28)
94-100%	—	Ref.	Ref.	Ref.	—	Ref.	Ref.	Ref.
Variance								
Individual	22.1 (1.81)	21.4 (1.69)	21.4 (1.69)	21.4 (1.68)	18.0 (0.87)	17.5 (0.86)	17.5 (0.87)	17.5 (0.87)
School	0.94 (0.33)	0.19 (0.14)	0.19 (0.14)	0.19 (0.14)	1.15 (0.24)	0.21 (0.11)	0.21 (0.11)	0.21 (0.11)

BMI, body mass index; CI, confidence interval.

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Model 1: null model predicting BMI from individual and school levels.

Model 2: examine association between individual parental involvement and BMI adjusting for age, race/ethnicity, household income, parental education, and school-level education, household income, and proportion white.

Model 3: examine association between school-level parental involvement and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

Model 4: examine association between individual and school-level parental involvement and BMI adjusting for age, race/ethnicity, household income, parental education and school-level education, household income, and proportion white.

*** p<.001,

** p<.01,

* p<.05