Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

HHS Public Access

Author manuscript

J Acad Nutr Diet. Author manuscript; available in PMC 2018 February 01.

Published in final edited form as:

J Acad Nutr Diet. 2017 February ; 117(2): 204–213. doi:10.1016/j.jand.2016.09.030.

School-based obesity prevention policies and practices and weight-control behaviors among adolescents

Nicole Larson, PhD, MPH, RDN,
Senior Research Associate, Division of Epidemiology and Community Health, University of Minnesota, 1300 S. Second Street, Suite 300, Minneapolis, MN 55454, Phone: 612-625-5881

Cynthia S. Davey, MS,
Senior Research Fellow, Biostatistical Design and Analysis Center, Clinical and Translational Science Institute, University of Minnesota, 717 Delaware St SE, Room 1-17, Minneapolis, MN 55414, Phone: 612-626-5202

Caitlin E. Caspi, ScD,
Assistant Professor, Department of Family Medicine & Community Health, Program in Health Disparities Research, University of Minnesota, 717 Delaware Street SE, Minneapolis, MN 55414, Phone: 612-626-7074

Martha Y. Kubik, PhD, MSN, RN, and
Professor and Chair, Department of Nursing, College of Public Health, Temple University, 3307 North Broad Street, Philadelphia, PA 19140, Phone: 215-707-4687

Marilyn S. Nanney, PhD, MPH, RD
Associate Professor, Department of Family Medicine & Community Health, Program in Health Disparities Research, University of Minnesota, 717 Delaware Street SE, Minneapolis, MN 55414, Phone: 612-626-6794

Abstract

Background—The promotion of healthy eating and physical activity within school settings is an important component of population-based strategies to prevent obesity; however, adolescents may be vulnerable to weight-related messages as rapid development during this lifestage often leads to preoccupation with body size and shape.

Objective—This study (1) examines secular trends in secondary school curricula topics relevant to the prevention of unhealthy weight-control behaviors; (2) describes cross-sectional associations between weight-related curricula content and students' use of weight-control behaviors; and (3) assesses whether implementation of school-based obesity prevention policies/practices are longitudinally related to students' weight-control behaviors.

Correspondence to: Nicole Larson.

CONFLICT OF INTEREST DISCLOSURE

The authors have no conflicts of interest to report.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Design/participants—The Minnesota School Health Profiles and Minnesota Student Survey (grades 9 and 12) data were used along with National Center for Education Statistics data to examine secular trends; cross-sectional associations (n=141 schools); and longitudinal associations (n=42 schools).

Main Outcome Measures—Students self-reported their height and weight along with past-year use of healthy (e.g., exercise), unhealthy (e.g., fasting), and extreme (e.g., use laxatives) weight-control behaviors.

Statistical analyses performed—Descriptive statistics, generalized estimating equations, and generalized linear regression models accounting for school-level demographics.

Results—There was no observable pattern over the years 2008 to 2014 in the mean number of curricula topics addressing unhealthy weight-control behaviors despite an increase in the prevalence of curricula addressing acceptance of body size differences. Including three versus fewer weight-control topics and specifically including the topic of eating disorders in the curricula were related to a lower school-level percent of students using any extreme weight-control behaviors. In contrast, an overall measure of implementing school-based obesity prevention policies/practices (e.g., prohibited advertising) was unrelated to use of unhealthy or extreme behaviors.

Conclusions—Results suggest obesity prevention policies/practices do not have unintended consequences for student weight-control behaviors and support the importance of school-based health education as part of efforts to prevent unhealthy behaviors.

Keywords

adolescent; weight control behavior; health education; school environment; obesity prevention

---

The Child Nutrition and WIC Reauthorization Act of 2004 (S.2507) established a requirement for each school district participating in a federally-sponsored child nutrition program to develop and implement a wellness policy by the 2006–2007 school year.[1] Over the past decade, this legislation has directed greater attention by the public and school professionals to weight and related behaviors in the school environment. The attention that has focused on promoting healthy nutrition and physical activity behaviors in schools is an important component of public health strategies to prevent obesity; however, adolescent students may be vulnerable to messages about weight as the rapid growth and development that occurs during this lifestage often leads to preoccupation with body size and shape.[2] Excessive concerns with body size or shape may further lead young people to engage in unhealthy weight-control behaviors such as skipping meals or taking diet pills.[3, 4]

Given the potentially severe medical and psychosocial consequences associated with engaging in unhealthy weight-control behaviors,[5] there is a need for knowledge of what efforts are being taken by schools to prevent these behaviors and whether the efforts may be effective. Research concerning school health education and the weight-related content of the curricula is lacking, particularly in regards to school-level demographic disparities, how the curricula provided by schools may have changed over time in response to obesity prevention efforts, and linkages to students' weight-control behaviors. Likewise, little is known

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

regarding linkages between the implementation of school-based obesity prevention efforts and student weight-control behaviors. A search of the scientific literature identified only one previous study that has examined how state-level obesity prevention policies are related to adolescents' use of unhealthy weight-control behaviors and reported a mixed pattern of findings;[6] no previous studies addressing the potential unintended consequences of school or district-level wellness policies were found. Additional research is needed to ensure school-based obesity prevention efforts do not have unintended consequences and all young people receive educational messages that will help to prevent unhealthy weight-control behaviors.

The current study was designed to help fill these identified research gaps using data on public secondary schools in Minnesota. The first aim was to describe school-level demographic differences and secular patterns (2008–2014) in curricula addressing the prevention of unhealthy weight-related behaviors. The second aim was to describe associations between the weight-related content of school health education curricula and students' weight-control behaviors. In addition, a third aim was to assess whether the implementation of evidence-based school policies and practices designed to prevent obesity over the period 2008 to 2010 were longitudinally related to school-level prevalence of student weight-control behaviors from 2007 to 2010.

METHODS

Data and Sample

The analyses described here were conducted as part of the larger School Obesity-related Policy Evaluation (ScOPE) study, which aims to evaluate food and activity policy and practice environments in Minnesota secondary schools and examine relationships with the behaviors and weight status of students.[7] The ScOPE study was approved by the University of Minnesota's Institutional Review Board. Data for the analysis to be described here were drawn from existing data sets: Minnesota School Health Profiles teacher survey, 2008–2014;[8] Minnesota School Health Profiles principal survey, 2008–2010;[8] Minnesota Student Survey, 2007–2010;[9] and National Center for Educational Statistics (NCES) Common Core Data, 2008–2014.[10] The Minnesota School Health Profiles is a survey of school health policies and practices sponsored by the Centers for Disease Control and Prevention. The Profiles teacher survey includes an assessment of the health topics taught to students in required courses and the principal survey includes an assessment of student access to competitive foods; opportunities for physical activity; exposure to strategies designed to promote healthy food and beverage selection; and exposure to advertising for energy-dense, nutrient-poor foods and beverages. In Minnesota, mailed Profiles questionnaires were collected biennially from a representative sample of public middle, junior/senior high, and high schools; written consent was not collected for teachers or principals as the Profiles surveys were designed to collect information about school environments and not individuals. The Minnesota Student Survey assesses aspects of students' diets along with a broad range of health behaviors, and is sponsored jointly by the Minnesota Departments of Education, Health, Human Services, and Public Safety.[9, 11] All regular schools in the state were invited to participate and, within participating schools, all students enrolled in grades 9 and 12 were invited to complete the classroom-administered survey items addressing weight-control

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

behaviors in 2007 and 2010. Students were given the opportunity to assent if they were present on the day of the survey and their parent did not return a form indicating refusal to have their child participate. An introductory script informed students that participation in the Minnesota Student Survey is voluntary, they could skip any question(s) they did not want to answer, and they could stop at any time; assent by student participants was indicated by completion of the survey. Across the state in 2007, approximately 76% of students in grade 9 and 58% of students in grade 12 participated.[12] Similarly, in 2010, approximately 75% of students in grade 9 and 59% of students in grade 12 participated.[12] The NCES Common Core Data is the Department of Education's primary database on public schools in the U.S. and is updated annually. Additional details of the measures drawn from each survey are described below, including the psychometric properties of scales and scores based on analytic sample specific to the time point and school grade levels most relevant to the study aims.

Minnesota School Health Profiles Teacher Survey Measures

To assess attention to weight-related health in the curricula, health education teachers were asked if students in any of grades six through 12 in their school were taught the following topics as part of a required course: (1) “risks of unhealthy weight control practices”; (2) “accepting body size differences”; and (3) “signs, symptoms, and treatment for eating disorders”. Yes/no responses were summed to form a score that demonstrated high internal consistency among schools included in the final analytic sample (Cronbach’s α=0.85; range: 0–3; mean±standard deviation[SD]=2.72±0.76 for all secondary schools in 2014).

Minnesota School Health Profiles Principal Survey Measures

Availability of competitive foods—Principals were asked several questions relating to the availability of competitive foods. The presence of competitive foods was assessed (yes/no) by asking if students could purchase snack foods or beverages from one or more vending machines at the school or at a school store, canteen, or snack bar. If at least one vending machine or a school store was present, principals were additionally asked if students could purchase the following snack foods or beverages: (1) “chocolate candy”; 2) “other kinds of candy”; 3) “salty snacks not low in fat (e.g., regular potato chips)”; 4) “cookies, crackers, cakes, pastries, or other baked goods that are not low in fat”; 5) “ice cream or frozen yogurt that is not low in fat”; 6) “water ices or frozen slushes not containing juice”; 7) “soda pop or fruit drinks that are not 100% juice”; 8) “sports drinks (e.g., Gatorade)”; (9) “2% or whole milk (plain or flavored)”; (10) “fruits (not fruit juice)”; and (11) “non-fried vegetables (not vegetable juice)”. Yes/no responses representing junior/senior high and high schools were summed in a manner similar to previous research to form scores describing the availability of fruits and vegetables (Cronbach’s α=0.81; range: 0–2; mean±SD=1.03±0.91 in 2008) and absence of other less healthy foods and beverages (Cronbach’s α=0.86; range: 0–9; mean±SD = 5.33±2.85 in 2008).[13]

Strategies to promote healthy foods and beverages—To assess the promotion of healthy food and beverage selection, principals were asked if (1) nutritious foods and beverages were priced “at a lower cost while increasing the price of less nutritious foods and beverages”; (2) suggestions were collected from students, families, and school staff on

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

"nutritious food preferences and strategies to promote healthy eating"; (3) information on the "nutrition and caloric content of foods available" was provided to students or families; (4) taste tests were conducted "to determine food preferences for nutritious items"; and (5) opportunities were provided for students to "visit the cafeteria to learn about food safety, food preparation, or other nutrition-related topics". Yes/no responses representing junior/senior high and high schools were summed as previously described by other research to form a score that demonstrated adequate internal consistency among schools included in the final analytic sample (Cronbach's α=0.65; range: 0–5; mean±SD =1.79±1.48 in 2008).[13]

Banned advertising of unhealthy foods and beverages—To assess whether school policies existed to limit student exposure to promotions for energy-dense, nutrient-poor foods and beverages, principals were asked if their school prohibited advertising for candy, fast-food restaurants, or soft drinks (1) "in the school building"; (2) "on school grounds including on the outsides of the school building, on playing fields, or other areas of the campus"; (3) "on school buses or other vehicles used to transport students", and (4) "in school publications (e.g., newsletters, newspapers, web sites, or other school publications)". Following the example of previous research, yes/no responses representing junior/senior high and high schools were summed to form a score that demonstrated good internal consistency among schools included in the final analytic sample (Cronbach's α=0.86; range: 0–4; mean±SD=2.30±1.64 in 2008).[13]

Physical education and the opportunity to participate in intramural sports—Principals were asked to indicate (yes/no) whether a physical education course was required for students enrolled at their school in any of grades six through 12. Additionally, principals were asked to indicate (yes/no) if their school offered intramural sports (i.e., voluntary programs in which students are given equal opportunity to participate regardless of physical ability) to students. In the final analytic sample for 2008, 96.2% of junior/senior high and high schools required a physical education course and 50.0% offered intramural sports.

School nutrition and physical activity policy and practices score—An overall measure of support for healthy nutrition and physical activity behaviors within each junior/senior high and high school was also calculated as a summary score by adding one point for each evidence-supported policy/practice reported by the school principal.[14–17] The overall scores represented a sum of the individual scores for availability of competitive foods, strategies to promote healthy foods and beverages, and banned advertising of unhealthy foods and beverages along with the two binary measures of physical education requirements and intramural sports offered. Scores demonstrated acceptable internal consistency among schools included in the final analytic sample (Cronbach's α=0.79; range: 0–22; mean ±SD=11.82±4.34 in 2008).

Minnesota Student Survey Measures

Students' weight-control behaviors—School-level prevalences of healthy, unhealthy, and extreme weight-control behaviors were determined by grade and sex using 2007 and 2010 self-reported student survey data. Students were asked the question: "During the last 12 months, have you done any of the following to lose weight or control your weight?".

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Behaviors categorized as healthy included “exercise” and “eat healthier”. Behaviors categorized as unhealthy included “fast or skip meals” and “smoke cigarettes”. Behaviors categorized as extreme included “use diet pills, speed, or other drugs”; “vomit (throw up) on purpose after eating”; and “use laxatives”. Yes/no responses were used to create four dichotomous indicators of having done any of the weight-control behaviors, any of the healthy behaviors, any of the unhealthy behaviors, and any of the extreme behaviors regardless of which one or how many.

Students’ weight status—School-level prevalences of overweight were also determined using 2007 and 2010 self-reported student data on height and weight. Age- and sex-specific body mass index (BMI) percentiles were calculated based on reference data from the Centers for Disease Control and Prevention growth tables and used to classify students as not overweight (BMI<85th percentile) or overweight (BMI≥85th percentile).[18]

NCES Common Core Data and Minnesota Department of Education Data

School-level demographics were obtained from the NCES Common Core Data,[10] and included geographic location, minority enrollment, and free/reduced-price school meal eligibility. School geographic location was categorized as city, suburban, or town/rural based on a combination of NCES and Rural-Urban Commuting Areas classification schemes.[10, 19, 20] Ethnic/racial minority enrollment was defined by the percentage of students within a school representing a background other than non-Hispanic white. Free/reduced-price school meal participation was similarly defined by the percentage of students within a school who were eligible. School grade level (middle school, junior/senior high school, or high school) was also determined based on annual data from the Minnesota Department of Education. Middle schools were defined to include any school that enrolled students in grade 6 or higher and did not enroll students beyond grade 9. Junior/senior high schools were defined to include any school that enrolled students in grade 6 or higher and also enrolled students in grade 10 or higher. High schools were defined to include schools that only enrolled students in grades 9–12.

Statistical Analysis

All analyses were performed using the Statistical Analysis System (SAS, version 9.4, 2012, SAS Institute, Cary, NC, USA). The sample of schools participating in the School Health Profiles was limited for the current analysis to those representing regular secondary schools (excluding alternative schools and schools that enrolled primary grades such as kindergarten through grade 8 configurations) and further limited by the availability of data for analysis to address each of the three aims as described below. Relationships between school policy and practice implementation and weight-control behaviors were examined both in the overall student population and within sex and grade-level strata. Stratified analyses were conducted based on the findings of previous research and the a priori hypothesis that observed associations may differ by sex and developmental stage.[6, 21–23]

Analyses addressing the first aim included middle schools, junior/senior high schools, and high schools (n=266 in 2014) that participated in the Profiles teacher survey of school practices and policies. Associations between school characteristics and the prevalence of

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

curricula addressing the prevention of unhealthy weight-related behaviors were evaluated using chi-square tests; differences in the distribution of the curricula score by school characteristics was assessed with the nonparametric Kruskal-Wallis test and patterns were identified by visually inspecting the mean estimates. Generalized estimating equations with an independent correlation structure, which accounted for correlation of schools included in multiple School Health Profiles samples across years, were used to examine changes over time in curricula score means and the prevalence of each curricula topic. Models of curricula changes for specific topics (e.g., eating disorders) used a binomial distribution and logit link, and the model of change for the overall curricula score used a normal distribution and identity link.

Analysis addressing the second aim included 141 junior-senior high schools and high schools that participated in the 2010 Profiles teacher survey of school practices and policies and represented 33,967 students that participated in the 2010 Minnesota Student Survey. Middle schools were not included in the analysis because only students in grades 9 and 12 were asked to respond to questions about their weight-control behaviors. Separate generalized linear regression models adjusted for minority enrollment, free/reduced-price meal eligibility, and geographic location were used to test for associations between inclusion of each or all three of the weight-related health topics in the curricula and weight-control behavior prevalences. All models were examined with and without adjustment for the school-level percentage of student overweight.

The repeated cross-sectional analysis addressing the third aim was limited to a cohort of junior/senior high schools and high schools with available data from both the Profiles principal survey in years 2008 and 2010, and from the Minnesota Student Survey in years 2007 and 2010. As for the analysis described above, middle schools were not included because only student samples in grades 9 and 12 (10,184 students in 2007 and a separate sample of 9,505 students in 2010) responded to questions about their weight-control behaviors. Linear regression models were used to examine associations between the implementation of evidence-based policies/practices designed to prevent obesity and prevalences of student weight-control behaviors. Models included a fixed effect for school to adjust for measured and unmeasured school characteristics so no additional school-level covariates were included in the models; however, all models were additionally examined with adjustment for the school-level percentage of students who were overweight. Year was included in the models to estimate the change in school-level student weight-control behaviors over time (from 2007 to 2010), which can be interpreted as the secular change in each outcome. School policy/practice scores were included in the models to estimate the prevalence difference in student weight-control behaviors associated with a one unit difference in policy/practice scores. With both year and school policy/practice scores in the models, the resulting estimates represent the association between school policy/ practice environments and school-level prevalences of student weight-control behaviors adjusted for the secular trend. Interaction terms between year and policy/practice scores were included in the models, but removed if they were not found to be statistically significant. To explore whether there were grade or sex differences in the associations, the models were run stratified by grade (9 or 12) and separately run stratified by sex (males or females). The

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

stratified models were examined with and without adjustment for the school-level, strata-specific percentage of students who were overweight.

A 95% confidence level was used to interpret the statistical significance of probability tests, corresponding to $P<0.05$; confidence intervals are reported along with the P-values when appropriate.

RESULTS

Health Education Curricula Addressing the Prevention of Unhealthy Weight-control Behaviors

Table 1 shows the mean number of health education topics schools provided to address the prevention of unhealthy weight control behaviors was 2.7±0.8 in 2014. The overall prevalence of providing each topic examined here was 92.9% for risks of unhealthy weight control practices, 92.1% for accepting body size differences, and 89.0% for eating disorders. The provision of health education topics was associated with school grade level, location, and minority enrollment but was unrelated to the proportion of students eligible for free/reduced-price school meals. Middle schools, schools in city locations, and schools enrolling a higher proportion of minority students reported providing, on average, a smaller mean number of topics relevant to the prevention of unhealthy weight-control behaviors ($P<0.01$) and were less likely to address the topic of eating disorders as part of a required course ($P\leq0.05$). Middle schools were also less likely to report providing curricula that addresses the acceptance of body size differences ($P=0.02$).

There was no observable trend over the years 2008 to 2014 in the mean number of health education topics provided by schools to address the prevention of unhealthy weight-control behaviors (data not shown). The mean number of topics was similar over time ranging from a low of 2.6±0.9 in 2010 to a high of 2.7±0.8 in 2012 and 2014. There was likewise little variation over time in the prevalence of schools providing instruction on the risks of unhealthy weight control practices or eating disorders. However, there was a statistically significant secular trend in the prevalence of providing instruction on accepting body size differences ($P=0.007$). The prevalence of providing instruction on this topic increased from 83.5% of schools in 2010 to 92.1% of schools in 2014.

Associations of the Health Education Curricula with Students' Weight-control Behaviors

Table 2 describes associations between the health education curricula and school-level prevalence of using extreme weight-control behaviors (e.g., vomit on purpose) among students enrolled at junior-senior high schools and high schools in 2010. Models adjusting for school minority enrollment, free/reduced-price school meal eligibility, and school location showed that the inclusion of all three weight-related topics versus 0–2 topics ($P=0.03$) and specifically including the topic of eating disorders ($P<0.01$) in the school health education curricula were inversely associated with school-level prevalence of students using any extreme weight-control behaviors. After further adjustment for school-level prevalence of overweight, the observed association with addressing the topic of eating disorders remained statistically significant ($P=0.02$); however, the association with offering

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

all three weight-related topics was weakened (P=0.07). No associations were found between health education curricula offerings and school-level prevalences of students using healthy (e.g., exercise) and unhealthy (e.g., smoking cigarettes) weight-control behaviors.

School Obesity Prevention Policy Implementation and Students' Weight-control Behaviors

A cohort of 42 schools was included in the repeated cross-sectional analysis addressing associations between the presence of school obesity prevention policies and the prevalence of student weight-control behaviors. In 2008, approximately half of the cohort represented junior-senior high schools (52%) and the remainder represented high schools. The cohort of schools was geographically distributed in city (7%), suburban (17%), and town/rural (76%) locations. Among schools in the cohort, the average proportion of students representing an ethnic/racial minority background was 13% (SD=14%) and the average proportion of students eligible for free/reduced-price school meals was 29%. Schools remained demographically similar from 2008 to 2010 with only small increases observed for minority enrollment and free/reduced-price meal eligibility; additionally, just one school changed from a junior-senior high school to a high school and one school changed from suburban to town/rural.

The mean prevalences of weight-control behaviors and overweight status among the student samples enrolled at these schools in 2007 and 2010 are presented in Table 3. Prevalences of weight-control behaviors are presented by sex as statistically significant secular trends were observed only among females. There were small secular decreases over time in the percentage of females reporting extreme (P=0.02), unhealthy (P=0.001), and healthy (P=0.003) weight-control behaviors.

Models including a fixed effect for school, year, and the percentage of students who were overweight showed school obesity prevention policies were unrelated to the prevalence of student weight-control behaviors in the overall sample population. Among females, the number of locations where a school banned advertising for unhealthy foods was associated with a higher prevalence of extreme weight-control behaviors and healthy weight-control behaviors (Table 4). Conversely, among males, the number of strategies implemented to promote healthy food and beverage selection was related to a lower prevalence of unhealthy weight-control behaviors (Table 5).

DISCUSSION

This study found most schools in Minnesota provide education on the risks of unhealthy weight-control practices, accepting body size differences, and eating disorders. However, school-level differences according to grade level, location, and minority enrollment were observed in the prevalence of including content relating to eating disorders and there was no observable pattern of improvement over time in the number of topics provided. Including all three versus fewer topics and specifically including the topic of eating disorders in the curricula were related to a lower school-level percent of students using extreme weight-control behaviors such as taking diet pills, speed, or other drugs. In contrast, few relationships were found between the implementation of school-based obesity prevention policies/practices and student use of weight-control behaviors. Together, the results help to

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

assuage concerns that obesity prevention policies/ practices may have unintended consequences for student weight-control behaviors and support the importance of school-based health education as part of efforts to prevent disordered eating.

The results provide information to fill an important gap in the literature as no previous studies were found to have addressed the relationship between school health curricula content and student weight-control behaviors. The finding that school-based health education in the context of a required course may help to prevent disordered eating is unique and provides additional support for policy initiatives favored by the U.S. public and health professionals specializing in eating disorders. A recent survey in a national sample of 944 adults and 1,420 members of professional organizations found that implementing policies requiring school-based health curricula to include content to address eating disorders was selected among the top five actions most likely to have the highest impact and among the top five actions that would be most feasible to implement.[24] In complement to policies addressing the content of school-based health curricula, there was also strong support among these groups for other school-based initiatives such as training sports coaches about the prevention and early identification of eating disorders and implementing anti-bullying policies that protect students from being bullied about their weight. Based on existing research, experts in weight stigma have further advised that health curricula addressing the prevention of excess weight gain should give particular attention to eliminating body disparaging comments and avoid simplifying the discussion of energy balance or focusing on weight or measurements in a manner that could be tied to calorie counting.[25]

In this context, it is encouraging that the current study observed a secular increase in the prevalence of secondary schools providing instruction regarding the acceptance of body size differences. The maintenance of this content within required curricula for secondary school students will be important to continue monitoring over time along with trends in the provision of other topics relating to the prevention of unhealthy weight-control behaviors. Results of the current study mostly align with previous analyses conducted to examine trends in health-related curricula among the full sample of Minnesota schools that participated in the Profiles Teacher Survey.[26]

Only one previous study was found that had examined a similar relationship between school-based obesity policies and the weight-related behaviors of students at the state level.[6] Results from the state-level analysis identified a mixed pattern of relationships that differed by student sex and an index of social capital (i.e., civic engagement, trust, and social networks within a community) based on participation in public activities, participation in community organizations, community volunteerism, informal sociability, and social trust. More specifically, school-based obesity policies were related to a higher proportion of males reporting they had exercised and limited energy intake to lose or maintain weight, a smaller proportion of males reporting they had fasted to lose weight, and a higher proportion of males who took diet or laxative pills to control weight in states with high levels of social capital. However, school-based obesity policies did not appear to promote healthy weight-control behaviors among females and, in states with low social capital, the existence of more policies was related to a higher percentage of females reporting they had fasted to control their weight. The current study likewise found a mixed pattern of results that differed by sex

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

but few statistically significant associations and no relationships between policy and student weight-control behaviors in the overall sample.

Research addressing the potential unintended consequences of obesity prevention interventions in the school setting is also of broader relevance to the results reported here. For example, at least one study has evaluated the impact of disseminating an obesity prevention program on students' use of weight-control behaviors.[27] The results of this evaluation of the Planet Health program, in a Massachusetts sample of 45 middle schools, showed that exposure to the intervention led to lower odds of using unhealthy weight-control behaviors. In particular, students in schools reaching a high number of adolescents with lessons on reducing television viewing were less likely to report the unhealthy weight-control behaviors of vomiting after eating, taking laxatives, and taking diet pills without a doctor's permission. The Planet Health program is an example of a program in alignment with the advice of experts in weight stigma to emphasize the importance of healthy behaviors for all students regardless of their size, to avoid school-wide weight loss competitions, and the reporting of height and weight measurements to parents.[25] However, some measures of exposure to the Planet Health program were associated with increased use of unhealthy weight-control behaviors. The evaluation found that a larger number of instructors involved in teaching the Planet Health lessons and a larger number of student lesson-exposures to the physical activity and fitness topics were associated with greater use of unhealthy weight-control behaviors among students at follow-up. In combination with the other research discussed here, the evaluation results suggest the importance of ensuring all school personnel involved in teaching health curricula and implementing obesity prevention policies be trained in recognizing their own possible weight-biased attitudes and eliminating weight stigmatization from the school environment.

Strengths of this study include the combination of repeated cross-sectional and cohort analyses along with the use of statewide data to capture the weight-related curricula, practices, and policies of a diverse school sample. The repeated cross-sectional design component allowed for the study of secular changes during a six-year period during which much attention was directed toward weight-related topics.[28–32] Further, the design allowed for linking school-level data to measures of weight-control behaviors used by students in grades 9 and 12. The temporal ordering of survey measures was most advantageous for examining associations between the implementation of obesity prevention policies and practices and student behaviors in a sample of schools that participated in multiple assessments during the period 2007 to 2010. Along with these important contributions, a number of limitations should be considered in interpreting the results. Although the sample was demographically diverse, caution should be used in making generalizations to schools and students from other areas as the data were collected in one upper Midwest state. Also, the data may not be fully representative of students or schools in Minnesota as only selected subsamples of student and school personnel surveys were included in analysis in order to address research questions requiring the correspondence of these data sources. The data were potentially subject to bias as a result of nonresponse and as school principals or designees reported on school practices and policies, and students self-reported their own height, weight, and weight-control behaviors. Details were lacking on whether or how school personnel discussed with students their school policies and practices aimed at

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

preventing obesity and the content of school health education curricula addressing unhealthy weight-control behaviors. The survey did not assess, for example, when and how often instruction on each topic was provided as part of a required course, the level of depth in which each topic was addressed in a required course, or whether instruction on any of the topics was provided as part of unrequired courses or programs. The frequency of instruction and timing of instruction in relation to developmental milestones may be relevant for student behavior outcomes and with the data available it was only possible to examine associations between policy and weight-control behaviors among students in grades 9 and 12.

Conclusions

In summary, the results of this study demonstrate the potential importance of school health education curricula for preventing unhealthy weight-control behaviors and help to assuage concerns regarding potential unintended consequences of obesity prevention policies and practices. Food and nutrition professionals can use the results of this study in advocating for policies that support the dissemination of educational messages addressing unhealthy weight-control behavior and eating disorders. Several of the findings can also be used to inform follow-up research. Results indicating that males and females may respond differently to obesity prevention efforts aligned with previous studies and suggest the need to separately consider impacts by sex in future studies. As most schools in the study sample provided their students with education addressing unhealthy weight-control behaviors, it will further be important for future research to evaluate whether health education of this form may be enhanced to better prevent unhealthy weight behaviors and play a role in preventing any unintended consequence of obesity prevention policies and practices. Logical next steps for state-level and national-level research studies would be to conduct detailed evaluations of health education curricula content addressing the prevention of unhealthy weight-control behaviors and to gather feedback on the content from stakeholders of diverse body shapes and sizes.

Acknowledgments

FUNDING DISCLOSURE

Funding for the School Obesity-related Policy Evaluation (ScOPE) study is currently provided by the National Institute of Child Health and Human Development (5R01HD070738-02). Additional support for statistical analysis was provided by the National Center for Advancing Translational Sciences of the National Institutes of Health (UL1TR000114).

References

1. Child Nutrition and Women, Infants, and Children Reauthorization Act of 2004. *S. 2507.* Vol Public Law 108-2652004.
2. Stang, J., Larson, N. Nutrition in adolescence. In: Mahan, L., Escott-Stump, S., editors. Krause's Food, Nutrition, and Diet Therapy. 13. Maryland Heights, MO: Elsevier; 2012. p. 410-430.
3. Neumark-Sztainer D, Paxton S, Hannan P, Haines J, Story M. Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. J Adolesc Health. 2006; 39(2):244–251. [PubMed: 16857537]
4. Loth K, MacLehose R, Bucchianeri M, Crow S, Neumark-Sztainer D. Predictors of dieting and disordered eating behaviors from adolescence to young adulthood. J Adolesc Health. 2014; 55(5): 705–712. [PubMed: 24925491]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

5. The Society for Adolescent Health and Medicine. Position paper of the Society for Adolescent Health and Medicine: Medical management of restrictive eating disorders in adolescents and young adults. J Adolesc Health. 2015; 56:121–125. [PubMed: 25530605]
6. Zhu L, Thomas B. School-based obesity policy, social capital, and gender differences in weight control behaviors. Am J Public Health. 2013; 103(6):1067–1073. [PubMed: 23597368]
7. Nanney M, Nelson T, Kubik M, et al. Evaluating school obesity-related policies using state surveillance tools: lessons from the ScOPE study. Health Promot Pract. 2014; 15(5):622–628. [PubMed: 24942750]
8. Adolescent and School Health. Centers for Disease Control and Prevention; School Health Profiles. Available at: http://www.cdc.gov/Healthyyouth/profiles [Accessed August 31, 2016]
9. Minnesota Student Survey. Minnesota Department of Health. Minnesota Center for Health Statistics; Available at: http://www.health.state.mn.us/divs/chs/mss/ [Accessed August 31, 2016]
10. National Center for Education Statistics. [Accessed August 31, 2016] Common Core of Data. Available at: http://nces.ed.gov/ccd
11. Kast N, Eisenberg M, Sieving R. The role of parent communication and connectedness in dating violence victimization among Latino adolescents. J Interpers Violence. 2016; 31(10):1932–1955. [PubMed: 25711614]
12. Minnesota Department of Health. [Accessed August 31, 2016] Minnesota Student Survey Statewide Tables for Educational Settings and Racial/Ethnic Groups. Available at: http://www.health.state.mn.us/divs/chs/mss/statewidetables/
13. Nanney M, Davey C, Kubik M. Rural disparities in the distribution of policies that support healthy eating in U.S. secondary schools. J Acad Nutr Diet. 2013; 113(8):1062–1068. [PubMed: 23885703]
14. Coffield J, Metos J, Utz R, Waitzman N. A multivariate analysis of federally mandated school wellness policies on adolescent obesity. J Adolesc Health. 2011; 49:363–370. [PubMed: 21939866]
15. Fox M, Dodd A, Wilson A, Gleason P. Association between school food environment and practices and body mass index of U.S. public school children. J Am Diet Assoc. 2009; 109(Suppl 2):108–117.
16. Kubik M, Lytle L, Story M. Schoolwide food practices are associated with body mass index in middle school students. Arch Pediatr Adolesc Med. 2005; 159:1111–1114. [PubMed: 16330732]
17. Nanney M, Nelson T, Wall M, et al. State school nutrition and physical activity policy environments and youth obesity. Am J Prev Med. 2010; 38(1):9–16. [PubMed: 20117552]
18. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, et al. CDC Growth Charts: United States. Adv Data. 2000; 314:1–27.
19. Economic Research Service, United States Department of Agriculture. [Accessed August 31, 2016] Rural-Urban Commuting Area Codes. Available at: http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx
20. Kehm R, Davey C, Kubik M, Nanney M. A comparison of the vending environment between three rural subtypes of secondary schools: town/rural fringe, town/rural distant, and remote rural. J Hunger and Environ Nutr. In press.
21. Paxton S, Schutz H, Wertheim E, Muir S. Friendship clique and peer influences on body image concerns, dietary restraint, extreme weight-loss behaviors, and binge eating in adolescent girls. J Abnorm Psychol. 1999; 108(2):255–266. [PubMed: 10369035]
22. Lampard A, MacLehose R, Eisenberg M, Neumark-Sztainer D, Davison K. Weight-related teasing in the school environment: associations with psychosocial health and weight control practices among adolescent boys and girls. J Youth Adolesc. 2014; 43(10):1770–1780. [PubMed: 24395152]
23. Neumark-Sztainer D, Falkner N, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: correlations with weight status and disordered eating behaviors. Int J Obes Relat Metab Disord. Jan; 2002 26(1):123–131. [PubMed: 11791157]
24. Puhl R, Neumark-Sztainer D, Austin B, Luedicke J, King K. Setting policy priorities to address eating disorders and weight stigma: views from the field of eating disorders and the US general public. BMC Public Health. 2014; 14:524. [PubMed: 24884645]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

25. Weight Stigma Stakeholders Group. Preventing inadvertent weight bias and weight stigma in the Let's Move! Campaign. 2014 [Accessed February 24, 2016]
26. Centers for Disease Control and Prevention. [Accessed: August 31, 2016] Minnesota 2014 School Health Profiles Report. Available at: http://www.cdc.gov/healthyyouth/data/profiles/requestingfiles.htm
27. Austin S, Spadano-Gasbarro J, Greaney M, et al. Effect of the Planet Health intervention on eating disorder symptoms in Massachusetts middle schools, 2005–2008. Prev Chronic Dis. 2012; 9:120111.
28. Institute of Medicine, Committee on Progress in Preventing Childhood Obesity, Food and Nutrition Board. Progress in Preventing Childhood Obesity. Washington, DC: National Academies Press; 2007.
29. Barry C, Jarlenski M, Grob R, Schlesinger M, Gollust S. News media framing of childhood obesity in the United States from 2000 to 2009. Pediatrics. 2011; 128(1):132–145. [PubMed: 21690111]
30. Nixon L, Mejia P, Cheyne A, Wilking C, Dorfman L, Daynard R. "We're Part of the Solution": Evolution of the food and beverage industry's framing of obesity concerns between 2000 and 2012. Am J Public Health. 2015; 105(11):2228–2236. [PubMed: 26378841]
31. Donaldson E, Cohen J, Truant P, Rutkow L, Kanarek N, CL1, CB. News media framing of New York City's sugar-sweetened beverage portion-size cap. Am J Public Health. 2015; 105(11):2202–2209. [PubMed: 26378853]
32. Saguy A, Almeling R. Fat in the fire? Science, the news media, and the "obesity epidemic". Sociol Form. 2008; 23(1):53–83.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

J Acad Nutr Diet. Author manuscript; available in PMC 2018 February 01.

Table 1

Percentage of Minnesota schools surveyed in 2014 that address weight-related health education topics relevant to the prevention of unhealthy weight-control behaviors as part of required coursework for students in grades 6 through 12

	Number of schools	Risks of unhealthy weight control (% of schools)[a]	Accepting body size differences (% of schools)[a]	Eating disorders (% of schools)[a]	Curricula to prevent disordered eating score (mean ± SD)[b,c]
Overall		92.9	92.1	89.0	2.7 ± 0.8
By school level					
Middle schools	98	87.6	86.5	81.1	2.5 ± 1.0
Junior-senior high schools	90	95.5	97.7	92.1	2.8 ± 0.6
High schools	78	96.1	92.1	94.7	2.8 ± 0.6
		P value = 0.06	*P* value = 0.02	*P* value = 0.01	*P* value = 0.009
By school location					
City	28	88.0	88.0	69.2	2.4 ± 1.0
Suburban	51	91.7	87.5	89.6	2.7 ± 0.8
Town/rural	187	93.9	93.9	91.7	2.8 ± 0.7
		P value = 0.52	*P* value = 0.25	*P* value = 0.003	*P* value = 0.009
By minority enrollment					
<5%	48	100.0	100.0	97.9	3.0 ± 0.2
5 to <20%	134	92.1	91.3	89.8	2.7 ± 0.8
≥20%	84	90.0	88.8	82.7	2.6 ± 0.9
		P value = 0.09	*P* value = 0.07	*P* value = 0.03	*P* value = 0.009
By free/reduced-price meal eligibility					
<20%	42	94.9	92.3	94.9	2.8 ± 0.7
20 to <40%	146	92.8	90.6	87.8	2.7 ± 0.8
≥40%	78	92.2	94.7	88.3	2.7 ± 0.7
		P value = 0.86	*P* value = 0.56	*P* value = 0.44	*P* value = 0.39

[a] *P* values represent the chi-square test for distribution differences in prevalence of providing the topic by school characteristics.

[b] *P* values represent the Kruskal-Wallis test for distribution differences in the curricula score by school characteristics.

[c] Curricula to prevent disordered eating score range: 0–3; SD=standard deviation

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 2

Associations of weight-related health education curricula with school-level use of extreme weight control behaviors by junior-senior high school and high school students in Minnesota, 2010[a]

Topic addressed as part of required coursework	Model 1[b]		Model 2[c]	
	β (SE)[d]	*P* value	β (SE)[d]	*P* value
Risks of unhealthy weight control practices	0.006 (0.012)	0.648	0.012 (0.012)	0.299
Accepting body size differences	−0.002 (0.007)	0.817	−0.002 (0.007)	0.831
Eating disorders	−0.028 (0.010)	0.008	−0.024 (0.010)	0.015
All 3 topics	−0.015 (0.007)	0.034	−0.012 (0.007)	0.067

[a] Analyses represent a sample of 141 schools and 33,967 students in grades 9 and 12. The models included only secondary schools that participated in both the 2010 Minnesota School Health Profiles teacher survey and the 2010 Minnesota Student Survey.

[b] Models 1 and 2 include adjustment for school minority enrollment (%), free/reduced-price school meal eligibility (%), and school location.

[c] Model 2 additionally includes adjustment for school prevalence of overweight/obesity (%).

[d] SE=standard error

β is the estimated adjusted difference in the mean percent of students using extreme weight control behaviors between schools including the indicated topic (or all 3 topics) and reference schools that do not include the topic (or fewer than 3 topics).

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 3

Prevalence of weight-control behaviors and overweight among 9th and 12th grade students enrolled at a cohort of 42 Minnesota schools, 2007 (n=10,184 students) to 2010 (9,505 students)

	Females:				Males:			
	mean±SD[a]		β (SE)[b]	*P* value[c]	mean±SD[a]		β (SE)[b]	*P* value[c]
	2007	2010			2007	2010		
Weight-control behaviors								
Extreme behaviors[d]	8±4	6±4	−0.014 (0.006)	0.021	4±2	3±2	−0.005 (0.005)	0.32
Unhealthy behaviors[e]	29±8	25±8	−0.042 (0.013)	0.001	14±6	13±5	−0.018 (0.010)	0.08
Healthy behaviors[f]	72±7	68±8	−0.041 (0.014)	0.003	46±7	43±11	−0.025 (0.019)	0.18
Overweight status (≥85th percentile)	18±6	18±7	−0.001 (0.011)	0.91	28±6	27±9	−0.009 (0.013)	0.49

[a] SD=standard deviation

[b] β represents the slope of change over time, SE=standard error

[c] *P* values represent test for secular trend.

[d] Extreme behaviors included use of diet pills, speed, or other drugs; vomiting on purpose after eating; and use of laxatives.

[e] Unhealthy behaviors included fasting or skipping meals and smoking cigarettes.

[f] Healthy behaviors included exercising and eating healthier.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 4

Females: Associations of school obesity prevention policies with school-level prevalence of weight-control behaviors among 9th and 12th grade students enrolled at a cohort of Minnesota schools, 2007 to 2010

	Extreme behaviors		Unhealthy behaviors		Healthy behaviors	
	Mean prevalence difference (95% CI)	***P* value**	**Mean prevalence difference (95% CI)**	***P* value**	**Mean prevalence difference (95% CI)**	***P* value**
School policy score						
Limit availability of competitive foods (score range: 0–9)	0.2 (−0.2, 0.6)	0.35	Not estimable [b]	-	0.4 (−0.5, 1.2)	0.43
Make healthy vending options available (score range: 0–2)	0.2 (−0.9, 1.4)	0.68	0.5 (−2.0, 3.0)	0.68	−0.9 (−3.3, 1.4)	0.44
Promote healthy foods and beverages (score range: 0–5)	−0.7 (−1.4, 0.0)	0.06	−0.1 (−1.7, 1.5)	0.91	−1.2 (−2.6, 0.1)	0.07
Ban advertising for unhealthy foods and beverages (score range: 0–4)	0.5 (0.0, 1.0)	0.04	0.3 (−0.8, 1.5)	0.60	1.3 (0.5, 2.2)	0.003
Provide intramural sports (item range: 0–1)	0.6 (−2.0, 3.3)	0.63	1.8 (−3.9, 7.5)	0.53	2.1 (−3.3, 7.5)	0.44
Overall summary score (score range: 0–22)	0.3 (−0.1, 0.6)	0.12	0.3 (−0.4, 1.0)	0.43	0.3 (−0.4, 0.9)	0.57

[a] All models include a fixed effect for school to adjust for measured (school level, location, percentage minority enrollment, percentage eligible for free/reduced-price meals) and unmeasured school characteristics as well as the percentage of enrolled females who were overweight. Year was included in all models to estimate the change in school-level mean student outcomes over time (from 2007–2010), which can be interpreted as the 'secular change" in each outcome.

[b] The estimated difference in prevalence is not directly interpretable due to a significant year by policy interaction (*P* value=0.05); there was a non-significant positive association between the competitive food score and prevalence of unhealthy weight-control behavior in 2007 (mean prevalence difference [95% CI]=0.4 [−0.4, 1.2], p=0.35) and a non-significant negative association between this policy and behavior prevalence in 2010 (mean prevalence difference [95% CI]=−0.6 [−1.6, 0.4], p=0.25).

J Acad Nutr Diet. Author manuscript; available in PMC 2018 February 01.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Table 5

Males: Associations of school obesity prevention policies with school-level prevalence of weight-control behaviors among 9th and 12th grade students enrolled at a cohort of Minnesota schools, 2007 to 2010

	Extreme behaviors		Unhealthy behaviors		Healthy behaviors	
	Mean prevalence difference (95% CI)	***P* value**	**Mean prevalence difference (95% CI)**	***P* value**	**Mean prevalence difference (95% CI)**	***P* value**
School policy score						
Limit availability of competitive foods (score range: 0–9)	0.2 (−0.2, 0.5)	0.29	0.4 (−0.3, 1.1)	0.23	0.1 (−1.3, 1.4)	0.94
Make healthy vending options available (score range: 0–2)	−0.8 (−1.7, 0.0)	0.06	−0.2 (−2.1, 1.7)	0.82	0.1 (−3.5, 3.6)	0.97
Promote healthy foods and beverages (score range: 0–5)	−0.2 (−0.8, 0.4)	0.60	−1.3 (−2.5, −0.1)	0.03	0.8 (−1.5, 3.1)	0.49
Ban advertising for unhealthy foods and beverages (score range: 0–4)	−0.1 (−0.5, 0.3)	0.71	0.3 (−0.6, 1.2)	0.53	0.9 (−0.8, 2.5)	0.30
Provide intramural sports (item range: 0–1)	−0.9 (−2.9, 1.2)	0.42	−1.1 (−5.4, 3.3)	0.63	−2.4 (−10.5, 5.6)	0.56
Overall summary score (score range: 0–22)	−0.0 (−0.3, 0.2)	0.87	0.1 (−0.5, 0.7)	0.74	0.4 (−0.6, 1.4)	0.45

[a]All models include a fixed effect for school to adjust for measured (school level, location, percentage minority enrollment, percentage eligible for free/reduced-price meals) and unmeasured school characteristics as well as the percentage of enrolled males who were overweight. Year was included in all models to estimate the change in school-level mean student outcomes over time (from 2007–2010), which can be interpreted as the ‘secular change” in each outcome.