Published in final edited form as:

J Sch Health. 2014 December ; 84(12): 777–785. doi:10.1111/josh.12209.

Food and beverage promotions in Minnesota secondary schools: secular changes, correlates, and associations with adolescents' dietary behaviors

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Abstract

BACKGROUND—The purpose of this study was to describe promotions for unhealthy and healthy foods and beverages within Minnesota secondary schools from 2008 to 2012, and to examine associations with school-level coordination of environmental improvements and students' dietary behaviors.

METHODS—The Minnesota School Health Profiles and Minnesota Student Survey data were used along with National Center for Education Statistics data to conduct analyses accounting for school-level demographics.

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Human Subjects Approval Statement

This study protocol was approved by the University of Minnesota's Institutional Review Board Human Subjects Committee.

RESULTS—There was no significant improvement over time in the proportion of schools that banned advertising for unhealthy products in school buildings, on school grounds, on buses, or in publications. Whereas more than two-thirds of schools had implemented strategies focused on the promotion of fruits/vegetables by 2012, only 37% labeled healthful foods with appealing names and just 17% used price incentives to encourage healthy choices. The number of stakeholders representing different roles on school health councils was positively correlated with implementation of healthy food and beverage promotion strategies. Little evidence was found to support an influence of in-school advertising bans or promotions on students' diets.

CONCLUSIONS—Policy changes are needed to protect students from food and beverage advertising and additional opportunities exist to reduce disparities in the selection of healthy options at school.

Keywords

marketing; advertising; food environment; school health councils

Reducing consumption of energy-dense, nutrient-poor foods and beverages is a key target of efforts to reverse the obesity epidemic and prevent related chronic disease.¹ To achieve *Healthy People 2020* goals for reducing adolescent obesity, it is estimated an average reduction of 72 kcal/day would be required.² The ubiquitous availability and marketing of energy-dense foods and beverages in settings where young people spend their time detrimentally influence the dietary patterns of adolescents and have thus become of public health concern.³ Young people are particularly vulnerable to food and beverage marketing before they develop a strong understanding of healthy eating principles, fully develop their ability to recognize persuasive intent, and consistently apply this knowledge as a cognitive defense to the messages which permeate their lives.⁴ School settings are a particular focus of concerns because of the amount of time young people spend at school and the legitimacy lent to advertising and all forms of marketing when allowed by policymakers, administrators, and other stakeholders. A congressionally requested report released in 2005 challenged school stakeholders to develop policies and practices that limit student exposure to promotions for energy-dense, nutrient-poor products and to improve the availability and marketing of healthy options.³

Evidence exists that efforts to reduce the availability of energy-dense, nutrient-poor products in schools have achieved some success. National data recently showed a decrease in the availability of vending machines in middle schools and an increase for both middle and high schools in the implementation of nutritional guidelines for competitive foods and beverages.⁵ However, relatively little is known regarding trends over time or factors influencing the implementation of school policies and practices designed to limit student exposure to advertising for energy-dense, nutrient-poor products sold within and outside of school environments. Complimentary knowledge of school practices designed to promote the selection of healthy, nutrient-dense options such as fruits/vegetables and low-fat milk is even more scant. Research regarding secular changes, influences on implementation, and the effectiveness of pertinent school policies and practices in the absence of federal or state-level policies is needed to guide future public health efforts.

The current study was designed to help fill these identified research gaps using data on public middle schools and junior/senior high schools in Minnesota. The first aim was to examine secular changes from 2008 to 2012 in school policies relating to the advertising of energy-dense, nutrient-poor products as well as the degree to which schools made environmental changes to promote healthy food and beverage choices by 2012. Overall changes were examined as well as school-level demographic differences during this period in which there was growing research and regulatory attention on marketing. The second aim was to assess whether school-level efforts to coordinate health improvements were related to advertising policies or the promotion of healthy foods and beverages. In addition, a third aim was to describe associations between advertising policies, healthy food and beverage promotions, and students' dietary behaviors.

METHODS

Data and Sample

This repeated, cross-sectional study was conducted as part of the 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. Data for the analysis described here were drawn from existing data sets: Minnesota School Health Profiles principal survey, 2008-2012;⁶ Minnesota Student Survey, 2010;⁷ and National Center for Educational Statistics (NCES) Common Core Data, 2008-11.⁸ The Minnesota School Health Profiles is a survey of school health policies and practices sponsored by the Centers for Disease Control and Prevention. In Minnesota, mailed questionnaires were collected biennially from a stratified random sample of public middle schools and junior/senior high schools, which are described in Table 1. The majority of Minnesota school districts had only one secondary school included in the sample in each survey year (84.5% in 2008, 80.6% in 2010, 75.1% in 2012) and few districts were represented by more than 2 schools (3.4% in 2008, 5.3% in 2010, 6.2% in 2012). 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. Students in grades 6, 9, and 12 are invited to complete the classroom-administered survey every 3 years; in 2010, the percentage of students in regular public schools statewide who submitted usable surveys was 79% of 6th graders, 75% of 9th graders, and 59% of 12th graders. The NCES Common Core Data is the Department of Education's primary database on public schools in the US and is updated annually. Additional details of the measures drawn from each survey are described below, including information on the presence of individual measures on surveys collected at each time point.

Measures

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 each year 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. Yes/no responses were summed to form a score (range: 0-4; mean $\pm$ standard deviation=2.32 $\pm$ 1.67; Cronbach's α = .88).

Environmental strategies to promote healthy foods and beverages—To assess the promotion of healthy food and beverage selection, principals were asked on the 2012 survey if: (1) nutritious foods and beverages were priced at a lower cost while increasing the price of less nutritious foods and beverages; (2) fruits and vegetables were placed near the cafeteria cashier, where they are easy to access; (3) fruits and vegetables were displayed attractively in the cafeteria; and (4) healthful foods were labeled with appealing names. Yes/no responses were summed to form a score (range: 0-4; mean=1.95 $\pm$ 1.17; Cronbach's α = .57). Only the item regarding price incentives was included on the 2010 principal survey.

Coordination of school health improvement—Principals were additionally asked several questions in 2012 relating to the coordination of efforts to improve their school environment. The *presence of a school health coordinator* was assessed by asking if someone at their school was designated to oversee or coordinate school health and safety programs and activities. Efforts to conduct a self-assessment of the school nutrition environment were assessed by asking principals if their school had ever used the School Health Index or other self-assessment tool to evaluate relevant policies, activities, and programs. Inclusion of nutrition objectives in the School Improvement Plan was assessed by asking whether their school's written plan included goals and objectives relevant to nutrition services or foods and beverages available at school. The *presence of a school health council* was assessed by asking if one or more than one group at their school offered guidance on the development of policies or coordinated activities on health topics. If a school health council was present, principals were additionally asked about *representation on the school health council* from stakeholders representing each of 17 different roles (such as nutrition or food service staff, parents or families of students) and five types of *activities performed by the school health council* during the past year (such as recommended health and safety policies and activities). Responses for all items were yes/no and were summed to form an overall coordination score (range: 0-26; mean=9.85 $\pm$ 7.09; Cronbach's α = .94). Scores were also defined for school health council presence and representation (range: 0-18; mean=6.04 $\pm$ 5.08; Cronbach's α = .92) as well as school health council activities (range: 0-5; mean=2.29 $\pm$ 2.04; Cronbach's α = .88).

Students' dietary behaviors—School-level mean intakes of fruits/vegetables and sugar-sweetened beverages were determined by grade and sex using 2010 self-reported student survey data. Fruit/vegetable intake was assessed by asking students to indicate how many servings of fruits, fruit juices, or vegetables they ate yesterday (range: 0-8 or more). Similarly, sugar-sweetened beverage intake was assessed by two questions asking students to separately indicate how many glasses of pop or soda and sports drinks they drank yesterday (range: 0-14 or more).

School demographics—School-level demographics were obtained from the NCES Common Core Data⁸ for the available years 2008-11, and included geographic location,

minority enrollment, and free/reduced-price school meal eligibility. For the 2011-12 school year, 2010-11 data were used in place of data not yet available. School geographic location was categorized as city; suburban; or town/rural based on a combination of NCES and Rural-Urban Commuting Areas classification schemes.^{8, 9} Ethnic/racial minority enrollment was defined by the percentage of students within a school representing a background other than non-Hispanic white and categorized as <20% or ≥20%. Free/reduced-price school meal eligibility was similarly defined by the percentage of eligible students within a school and categorized for analysis as <40% or ≥40%. School grade level was based on 2012 data from the Minnesota Department of Education. Middle schools were defined as any school that enrolled students in grade 6 or higher and did not enroll students beyond grade 9. Junior/senior high schools were defined as any school that enrolled students in grade 10 or higher and did not enroll students before grade 6.

Statistical Analysis

All analyses were performed using the Statistical Analysis System (SAS, version 9.3, 2011, SAS Institute, Cary, NC) and accounted for school-level demographics, including school grade level, geographic location, minority enrollment, and free/reduced-price meal eligibility. 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 policies that banned advertising of unhealthy foods and beverages. Models of policy change for specific banned advertising locations (eg, school building) used a binomial distribution and logit link, and the model of change for the overall policy score used a normal distribution and identity link. Adjusted overall prevalence of implementing the 4 assessed strategies for promoting healthy food and beverage selection along with the mean number of strategies were examined for the 2012 school year. School-level demographic differences in advertising policy and healthy food and beverage promotion strategies were assessed using generalized estimating equation models that were adjusted for other school-level demographic characteristics and changes over time.

To address the relationship of school-level efforts to coordinate health improvements with advertising policies and the implementation of healthy food and beverage promotion strategies, linear regression analysis was conducted. Separate regression models were used to examine each school health coordination improvement factor and the overall coordination score in terms of their correlation with the number of: (1) locations within schools where advertising of unhealthy foods and beverages were banned; and (2) strategies to promote student selection of healthy options while adjusting for school demographics.

Associations between the number of locations where schools banned advertising for unhealthy foods and the implementation of strategies to promote healthy choices adjusted for school-level demographics were also examined for 2012 using linear and logistic regression models. Finally, linear regression models were used to examine whether students' dietary behaviors were associated with: (1) number of locations within schools where advertising of unhealthy foods and beverages were banned; and (2) the implementation of price incentives to promote healthy food and beverage selection in 2010. The models

examining associations with school-level mean student dietary behaviors were stratified by student sex and school grade level given prior findings indicating the potential importance of these demographic variables as moderators.¹⁰ A 95% confidence level was used to interpret the statistical significance of probability tests, corresponding to $p < .05$.

RESULTS

Changes in Policies Banning the Advertising of Unhealthy Foods and Beverages

Table 2 shows the mean number of locations where schools banned advertising for candy, fast-food restaurants, or soft drinks was 2.4 ± 0.22 and the proportion of schools reporting policies that banned advertising by location was 49% for school grounds, 58% for publications, 61% for school buildings, and 70% for buses in 2008. Little change in advertising policies occurred from 2008 to 2012, but the proportion of schools specifically banning advertisements on school grounds declined to 46% in 2012 after a small increase to 50% in 2010 (2010 versus 2012 $p = .004$). Similarly, the proportion of schools banning advertisements in publications declined to 57% in 2012 after reaching 61% in 2010 (2010 versus 2012 $p = .004$). No school demographic disparities for observed changes in the mean number of locations where schools banned advertising over time were found.

Environmental Strategies Promoting the Selection of Healthy Foods and Beverages

Table 3 shows the mean number of strategies implemented to promote healthy food and beverage choices was 2.0 ± 0.14 in 2012 and the overall prevalence of specific strategies was 17% for price incentives, 37% for appealing labels, 68% for attractive displays, and 75% for fruits/vegetables made accessible near cashier. Few demographic differences were observed at the school level; however, schools in town/rural locations reported implementing fewer strategies overall and both free/reduced-price school meal eligibility and school grade level were additionally related to the implementation of specific strategies.

Associations of Advertising Policies and Healthy Food and Beverage Promotions with Efforts to Coordinate School Health Improvement

Table 4 describes associations between school-level health coordination efforts and measures of nutrition policies/practices observed while adjusting for school demographic factors. No associations were found between coordination factors and policies banning the advertising of unhealthy foods. Only the overall coordination score and the health council representation score were associated with environmental strategies to promote healthy choices ($p = .02$); there was a positive correlation between the number of different stakeholder roles represented on a school's health council and number of environmental strategies implemented.

Associations of Advertising Policies, Healthy Food and Beverage Promotions, and Student Dietary Behaviors

Table 5 describes associations between the number of locations where schools banned advertising for unhealthy foods and environmental strategies to promote healthy choices observed while adjusting for school demographic factors. School advertising policies were unrelated to making fruits/vegetables accessible near the cafeteria cashier or the use of

appealing labels; however, the number of locations where a school banned advertising for unhealthy foods was positively associated with the prevalence of using price incentives (p for trend = .003) and marginally associated with the prevalence of attractive cafeteria displays to promote fruit/vegetable consumption (p for trend = .05). Additionally, the number of locations where schools banned advertising was directly related to the overall number of strategies implemented to promote healthy food and beverage choices (p for trend = .005).

Finally, associations of students' dietary behaviors in 2010 with school advertising policies and environmental strategies to promote healthy choices were examined while adjusting for school demographic factors as shown in Table 6. School-level means for students' dietary behaviors were unrelated to the total number of locations where a school banned advertising for unhealthy foods or to bans on advertising in any of the four specific locations assessed (data not shown by location). Students' mean dietary behaviors were likewise unrelated to the implementation of price incentives to promote healthy choices in the overall population. Although mean intake of fruits and vegetables was positively related to use of price incentives among 12th-grade students (p = .03), no statistically significant associations were found among other population subgroups.

DISCUSSION

This study describes food and beverage promotions within Minnesota secondary schools during the period 2008 to 2012, and examines associations with school-level efforts to coordinate health improvements as well as students' dietary behaviors. Findings indicate there was no significant improvement over time in the proportion of schools that ban advertising for energy-dense, nutrient-poor products in school buildings, on school grounds, on buses, or in publications. Whereas more than two-thirds of schools had implemented strategies focused on the promotion of fruits/vegetables by 2012, disparities were evident and fewer than half of schools reported labeling healthful foods with appealing names or the use of price incentives to encourage healthy choices. Including stakeholders on school health councils that represent different roles (such as students, parents, teachers, other school staff, community members) was associated with greater implementation of environmental strategies to promote healthy food and beverages. Students' dietary behaviors were linked only to the use of price incentives, and specifically to fruit/vegetable consumption among 12th grade students. Together, the results emphasize the need for providing schools with greater support for refining and evaluating school-level advertising policies, diversifying representation on school health councils, and implementing strategies that promote healthy eating.

The findings presented here regarding changes over time in school policies banning the advertising of unhealthy products build on a small number of previous studies focusing on secular changes in adolescent exposure to food and beverage marketing.^{5, 11, 12} In follow-up to a 2006 report of food and beverage industry expenditures on marketing to youth, the Federal Trade Commission recently reported a decline in dollars spent on in-school marketing.¹¹ However, major food and beverage marketers still reported spending \$149 million on marketing in this context in 2009 and the majority of expenditures were

adolescent-directed. Results from a national survey of school administrators likewise demonstrated only a modest shift for the period 2007-10.⁵ The national data showed no changes over time for middle school students and significant decreases (specifically for posters and sponsorships) for high school students in exposure to advertising and promotions for soft drinks or items from fast-food restaurants. Results of the current study, which also indicate little change occurred over time, extend previous research regarding secular changes to the year 2012 and uniquely capture school-level efforts to restrict exposure to advertising in specific locations on the school campus as well as on school buses in a state without strong relevant legislation. Although Minnesota law permits advertising only on the exterior of school buses, it does not place any restrictions on the types of foods and beverages that may be advertised.¹³

This study further builds on the limited body of previous research on health-related characteristics of schools associated with the presence of food and beverage advertising and promotions. Just one other study was found that reported on factors associated with advertising and no other studies that had reported on correlates of healthy food and beverage promotions. A 2006 study by Probart et al¹⁴ used survey data from 228 high school principals in Pennsylvania and found the presence of soft drink advertising was related to the existence of pouring rights contracts, subscription to Channel One, and the receipt of incentives from soft drink bottlers, but negatively related to daily participation in school lunch. The finding that school health improvement coordination factors examined in the current study were not linked to advertising policies suggests that other school health issues were prioritized by school personnel and health council members. However, as noted above, the number of stakeholders on school health councils representing different roles was positively correlated with implementation of healthy food and beverage promotion strategies.

In regards to students' dietary behaviors, the surprising lack of associations with school advertising policies around candy, fast food, and soft drinks and school implementation of price incentives likely reflects measurement challenges and the need for future research to investigate other potentially influential factors both within and beyond the school environment. The results encouragingly indicate that use of price incentives may promote fruit/vegetable intake among older adolescents, but no other significant associations were found. Although prior research is limited, at least 2 studies have investigated linkages between the presence of in-school advertising and students' diets. Both of these studies reported a direct relationship between the presence of advertising for unhealthy foods and student consumption of advertised foods.^{15, 16} Additionally, school-based intervention research has demonstrated previously the effectiveness of price incentives for promoting fruit/vegetable consumption.¹⁷ As the current study uniquely assessed school advertising policies versus the actual presence of advertising and did not quantify reported price incentives, it is possible there was little variation in the actual environments of students. The collection of other more comprehensive data might have provided further insights. For example, data were not available on students' intake of fast food, candy, or low-fat snacks. Additionally, schools did not report on forms of in-school marketing other than direct advertising or marketing near schools within the broader neighborhood. Food and beverage marketing in schools may occur in multiple direct and indirect forms, including the

distribution of products and promotional materials, the display of logos and messaging on school grounds, event sponsorship, and incentive programs.⁴ Recent research in Minnesota regarding marketing beyond school grounds found that 97% of convenience stores in urban school neighborhoods displayed advertising for food and beverages and 94% of advertisements were for less healthful products.¹⁸

Strengths of this study include the unique design and use of statewide data to capture practices and policies among a diverse sample of schools. The repeated cross-sectional design allowed for the study of secular changes during a 4-year period in which much attention was given to the consequences of marketing energy-dense, nutrient-poor foods and beverages. Further, the design allowed for linking school-level data on the promotion of healthy as well as unhealthy products to measures of students' diets. 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 Midwest state. The data were also subject to bias as school practices and policies were reported by school principals or designees and dietary behaviors were self-reported by students.

Conclusions

In summary, the results of this study demonstrate the need for increased efforts to develop, implement, and evaluate school policies and practices that promote healthy eating behaviors. The results further indicate, in line with previous research, that this need is particularly great for schools in town/rural locations.¹⁹ Future research should identify additional factors that support the development of such school-level policies and practices and build the capacity of schools to ensure their implementation. State and federal policies regarding the marketing of unhealthy food and beverages in school settings and on buses as well as local regulations regarding marketing in the neighborhoods near schools may also be needed to reduce student exposure. Prior research further demonstrates the importance of evaluating policies at all levels as knowledge barriers or possibly other school and community factors may inhibit compliance.²⁰ Such evaluation studies should explore in greater detail what foods and beverages are addressed by policies to inform recommendations for strengthening their content as needed. Additional studies should similarly continue to monitor the implementation of school practices designed to promote healthy eating behaviors and evaluate their effectiveness and profitability using strong methods.

IMPLICATIONS FOR SCHOOL HEALTH

Our results have practical implications for health professionals, food and nutrition professionals, administrators, and educators who work in middle and high school settings. Collaboration between these professional groups and with students, parents, local government workers, and other community members as part of a school health council was found to support the implementation of strategies for promoting healthy food and beverage choices. Whereas school professionals and educators have many competing demands on their time, this study and others support the effectiveness of investing time to collaborate on the evaluation and implementation of school health policies and practices, and the

importance of recruiting individuals representing different roles and perspectives from within the school and broader community to serve on a school health council.^{21, 22} The current study did not find an association between participation on school health councils and policies banning the advertising of unhealthy products suggesting that health councils were perhaps less likely to recommend restrictions on advertising for unhealthy products than the promotion of healthy products or alternatively more likely to encounter barriers to administrative implementation. Efforts to educate other members of a school health council as well as the broader school community regarding the detrimental impact of marketing for unhealthy food and beverages may be an important step to further enhance the positive influence of these councils on students' diets.

Acknowledgments

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). Funding previously provided by the Minnesota Population Center and the Robert Wood Johnson Foundation Healthy Eating Research and New Connections Round 2 (Grant #65056) made this research possible. Additional support for statistical analysis was provided by the National Center for Advancing Translational Sciences of the National Institutes of Health (UL1TR000114).

REFERENCES

1. Physical activity and good nutrition: essential elements to prevent chronic diseases and obesity. Centers for Disease Control and Prevention. Department of Health and Human Services, Coordinating Center for Health Promotion; Atlanta, GA: 2008. Available at: <http://www.cdc.gov/nccdphp/publications/aag/pdf/dnpa.pdf>. [June 25, 2013]
2. Wang Y, Orleans C, Gortmaker S. Reaching the Healthy People goals for reducing childhood obesity: closing the energy gap. *Am J Prev Med*. 2012; 42(5):437–444. [PubMed: 22516482]
3. McGinnis, J.; Gootman, J.; Kraak, V., editors. Food Marketing to Children and Youth: Threat or Opportunity?. The National Academies Press; Washington, DC: 2005.
4. Story M, French S. Food advertising and marketing directed at children and adolescents in the U.S. *Int J Behav Nutr Phys Act*. 2004; 1(1):3. [PubMed: 15171786]
5. Johnston, L.; O'Malley, P.; Terry-McElrath, Y.; Colabianchi, N. School policies and practices to improve health and prevent obesity: national secondary school survey results: school years 2006-07 through 2009-10. Vol. 2. Bridging the Gap Program, Survey Research Center, Institute for Social Research; Ann Arbor, MI: 2012. Available at: http://www.bridgingthegapresearch.org/_asset/dqzf6p/SS_2012_report.pdf. [June 25, 2013]
6. School Health Profiles. Centers for Disease Control and Prevention. [June 25, 2013] Adolescent and School Health. Available at: <http://www.cdc.gov/Healthyyouth/profiles>.
7. Minnesota Student Survey. Minnesota Department of Health. [June 25, 2013] Minnesota Center for Health Statistics. Available at: <http://www.health.state.mn.us/divs/chs/mss/>.
8. National Center for Education Statistics. [June 25, 2013] Common Core of Data. Available at: <http://nces.ed.gov/ccd>.
9. USDA Economic Research Service. [June 25, 2013] United States Department of Agriculture. Rural-urban commuting area codes. Available at: <http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>.
10. Briefel R, Crepinsek M, Cabili C, Wilson A, Gleason P. School food environments and practices affect dietary behaviors of U.S. public school children. *J Am Diet Assoc*. 2009; 109:S91–S107. [PubMed: 19166677]
11. Leibowitz, J.; Thomas Rosch, J.; Ramirez, E.; Brill, J.; Ohlhausen, M. [June 25, 2013] A review of food marketing to children and adolescents: follow-up report.. Federal Trade Commission. 2012. Available at: <http://www.ftc.gov/os/2012/12/121221foodmarketingreport.pdf>.

12. Phillips M, Raczynski J, West D, et al. Changes in school environments with implementation of Arkansas Act 1220 of 2003. *Obesity*. 2010; 18(1):S54–S61. [PubMed: 20107462]
13. Pomeranz J. The wheels on the bus go “buy buy buy”: school bus advertising laws. *Am J Public Health*. 2012; 102(9):1638–1643. [PubMed: 22742065]
14. Probart C, McDonnell E, Bailey-Davis L, Weirich J. Existence and predictors of soft drink advertisements in Pennsylvania high schools. *J Am Diet Assoc*. 2006; 106(12):2052–2056. [PubMed: 17126637]
15. Minaker L, Storey K, Raine K, et al. Associations between the perceived presence of vending machines and food and beverage logos in schools and adolescents' diet and weight status. *Public Health Nutr*. 2011; 14(8):1350–1356. [PubMed: 21450139]
16. Mazur A, Telega G, Kotowicz A, et al. Impact of food advertising on food purchases by students in primary and secondary schools in south-eastern Poland. *Public Health Nutr*. 2008; 11(9):978–981. [PubMed: 18353194]
17. French S, Story M, Jeffery R. Pricing strategy to promote fruit and vegetable purchase in high school cafeterias. *J Am Diet Assoc*. 1997; 97(9):1008–1010. [PubMed: 9284880]
18. Gebauer H, Laska M. Convenience stores surrounding urban schools: an assessment of healthy food availability, advertising, and product placement. *J Urban Health*. 2011; 88(4):616–622. [PubMed: 21491151]
19. 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]
20. Polacsek M, O'Rourke K, O'Brien L, Blum J, Donahue S. Examining compliance with a statewide law banning junk food and beverage marketing in Maine schools. *Public Health Rep*. 2012; 127:216–223. [PubMed: 22379223]
21. Kubik M, Farbachsh K, Lytle L. Two years later: wellness councils and healthier vending in a cohort of middle and high schools. *J Adolesc Health*. 2011; 49(5):550–552. [PubMed: 22018573]
22. Kubik M, Lytle L, Farbachsh K. School and district wellness councils and availability of low-nutrient, energy-dense vending fare in Minnesota middle and high schools. *J Am Diet Assoc*. 2011; 111(1):150–155. [PubMed: 21185978]

Table 1

Demographic Characteristics of Schools Participating in the Minnesota School Health Profiles Survey in 2008, 2010, and 2012

	2008 % (N)	2010 % (N)	2012 % (N)
School level			
Middle schools	29.7 (57)	28.0 (73)	28.7 (75)
High schools	70.3 (135)	72.0 (188)	71.3 (186)
School location			
City	14.1 (27)	14.4 (37)	9.7 (25)
Suburban	19.8 (38)	18.3 (47)	17.5 (45)
Town/rural	66.1 (127)	67.3 (173)	72.8 (187)
Minority enrollment			
<20%	73.4 (141)	70.1 (183)	69.7 (182)
20%	26.6 (51)	29.9 (78)	30.3 (79)
Free/reduced-price meal eligibility			
<40%	78.6 (151)	74.7 (195)	72.0 (188)
40%	21.4 (41)	25.3 (66)	28.0 (73)

Table 2Policies Banning the Advertising of Unhealthy Foods and Beverages in Minnesota Schools, 2008-2012[†]

	2008 N = 192	2010 N = 261	2012 N = 261	* p
Prevalence by school location (%)				
Building	61.0	63.2	61.2	.27
Grounds	48.7	50.5	46.1	.01
Buses	70.0	70.8	69.1	.46
Publications	57.9	60.9	56.6	.02
Banned advertising score (mean)[‡]				
Overall	2.4	2.5	2.3	.07
By school level				
Middle schools	2.8	2.9	2.7	.18
High schools	2.2	2.3	2.2	.28
By school location				
City	2.8	2.9	2.7	.23
Suburban	2.7	2.8	2.7	.13
Town/rural	2.2	2.3	2.2	.22
By minority enrollment				
<20%	2.3	2.4	2.2	.18
20%	2.6	2.7	2.6	.32
By free/reduced-price meal eligibility				
<40%	2.4	2.5	2.4	.16
40%	2.2	2.3	2.1	.52

[†] All models include adjustment for school level, school geographic location, school minority enrollment (%), and free/reduced-price school meal eligibility (%).

[‡] Banned advertising score range: 0-4.

* Represents testing for any change over time.

Table 3

Percentage of Schools Implementing Environmental Strategies to Promote Healthy Food and Beverage Choices in Minnesota by School Demographic Characteristics, 2012[†]

	Price incentives for healthy foods (% of schools)	Produce accessible near cashier (% of schools)	Produce attractively displayed (% of schools)	Appealing labels for healthy foods (% of schools)	Healthy food and beverage promotion score (mean) [‡]
Overall	17.2	74.9	67.6	37.1	2.0
By school level					
Middle schools	11.1 ^a	76.7	65.8	41.1	1.9
High schools	19.7 ^b	74.2	68.3	35.5	2.2
By school location					
City	24.0	88.0	72.0 ^{a,b}	44.0	2.2 ^a
Suburban	20.3	88.9	84.4 ^b	42.2	2.3 ^a
Town/rural	15.6	69.8	62.9 ^a	35.0	1.7 ^b
By minority enrollment					
<20%	18.3	70.6	65.0	37.8	2.1
20%	14.6	85.4	73.7	35.5	2.1
By free/reduced-price meal eligibility					
<40%	18.0	78.7 ^a	71.2	38.6	2.2
40%	15.3	65.3 ^b	58.3	33.3	1.9

Different superscript letters (a,b) within columns indicate statistically significant differences, $p < .05$.

[†] All models include adjustment for school level, school geographic location, school minority enrollment (%), and free/reduced-price school meal eligibility (%).

[‡] Healthy food and beverage promotion score range: 0-4.

Table 4

Associations of Advertising Policies and Healthy Food and Beverage Promotions with Efforts to Coordinate School Health Improvement in Minnesota Schools, 2012[†]

<u>Coordination of school health improvement factor</u>	<u>Banned advertising score</u>		<u>Healthy food and beverage promotion score</u>	
	β (SE)	p	β (SE)	p
Presence of school health coordinator	-0.31 (0.32)	.33	-0.07 (0.22)	.75
Completed self-assessment of the school nutrition environment	-0.07 (0.21)	.73	0.27 (0.15)	.07
Included nutrition objectives in the School Improvement Plan	0.26 (0.25)	.29	0.28 (0.17)	.10
Presence of school health council	0.19 (0.22)	.38	0.20 (0.15)	.19
Representation on the school health council	0.02 (0.02)	.37	0.03 (0.01)	.02
Activities performed by the school health council	0.07 (0.05)	.20	0.05 (0.04)	.15
Overall coordination score	0.02 (0.02)	.32	0.02 (0.01)	.02

[†] All models include adjustment for school level, school geographic location, school minority enrollment (%), and free/reduced-price school meal eligibility (%).

Table 5Associations of Advertising Policies and Healthy Food and Beverage Promotions in Minnesota Schools, 2012[†]

	Banned advertising score					p for trend
	0	1	2	3	4	
Price incentives for healthy foods [‡]	7.6	10.0	16.9	21.1	23.9	.003
Produce accessible near cashier [‡]	67.6	78.6	75.5	77.7	78.3	.26
Produce attractively displayed [‡]	57.6	66.6	68.7	71.8	72.8	.05
Appealing labels for healthy foods [‡]	33.0	33.2	36.7	38.8	40.1	.38
Healthy food and beverage promotion score [*]	1.4	1.6	1.5	1.7	2.0	< .01

[†] All models include adjustment for school level, school geographic location, school minority enrollment (%), and free/reduced-price school meal eligibility (%).

[‡] Percentage of schools reporting implementation of the environmental strategy to promote healthy food and beverages.

^{*} Mean score among schools with a given banned advertising score.

Table 6

Associations of Advertising Policies and Price Incentives for Healthy Foods with Student Eating Behaviors in Minnesota Schools, 2010[†]

	<u>Banned advertising score</u>		<u>Price incentives for healthy foods</u>	
	$\beta^{\ddagger}$ (95% CI)	P	Estimated Difference ^{//} (95% CI)	P
All students (school N = 206)				
Sugar-sweetened beverages	0.03 (−0.01, 0.07)	.20	−0.08 (−0.25, 0.08)	.34
Fruits and/or vegetables	−0.01 (−0.03, 0.02)	.60	0.05 (−0.04, 0.13)	.29
Boys (school N = 206)				
Sugar-sweetened beverages	0.01 (−0.04, 0.06)	.69	−0.13 (−0.34, 0.08)	.21
Fruits and/or vegetables	−0.01 (−0.03, 0.02)	.66	0.09 (−0.02, 0.20)	.11
Girls (school N = 206)				
Sugar-sweetened beverages	0.04 (−0.02, 0.10)	.18	−0.07 (−0.30, 0.16)	.56
Fruits and/or vegetables	0.00 (−0.03, 0.03)	.98	0.01 (−0.10, 0.11)	.88
6th grade students (school N = 57)				
Sugar-sweetened beverages	0.06 (−0.04, 0.17)	.24	−0.14 (−0.53, 0.24)	.47
Fruits and/or vegetables	0.02 (−0.03, 0.07)	.39	0.03 (−0.13, 0.20)	.69
9th grade students (school N = 146)				
Sugar-sweetened beverages	0.02 (−0.02, 0.07)	.34	−0.02 (−0.21, 0.16)	.80
Fruits and/or vegetables	−0.01 (−0.04, 0.02)	.55	0.01 (−0.13, 0.15)	.86
12th grade students (school N = 145)				
Sugar-sweetened beverages	0.03 (−0.04, 0.09)	.42	−0.15 (−0.43, 0.12)	.27
Fruits and/or vegetables	−0.01 (−0.05, 0.02)	.37	0.14 (0.01, 0.27)	.03

[†] β is the change in school-level mean servings (95% confidence interval) for each additional banned marketing location.

^{//} Estimated difference (95% confidence interval) represents the difference in school-level mean servings between schools that implemented price incentives and those schools not implementing the strategy.