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State School Nutrition and Physical Activity Policy Environments and Youth Obesity

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Abstract

Background—With the epidemic of childhood obesity, there is national interest in state-level school policies related to nutrition and physical activity, policies adopted by states, and relationships to youth obesity.

Purpose—This study develops a comprehensive state-level approach to characterize the overall obesity prevention policy environment for schools and links the policy environments to youth obesity for each state.

Methods—Using 2006 School Health Policies and Programs Study (SHPPS) state data, qualitative and quantitative methods were used (2008–2009) to construct domains of state-level school obesity prevention policies and practices, establish the validity and reliability of the domain scales, and examine their associations with state-level obesity prevalence among youth aged 10–17 years from the 2003 National Survey of Children's Health.

Results—Nearly 250 state-level obesity prevention–policy questions were identified from the SHPPS. Three broad policy topic areas containing 100 food service and nutrition (FSN) questionnaire items; 146 physical activity and education (PAE) items; and two weight assessment (WA) items were selected. Principal components analysis and content validity assessment were used to further categorize the items into six FSN, ten PAE, and one WA domain. Using a proportional scaled score to summarize the number of policies adopted by states, it was found that on average states adopted about half of the FSN (49%), 38% of the PAE, and 17% of the WA policies examined. After adjusting for state-level measures of ethnicity and income, the average proportion of FSN policies adopted by states was correlated with the prevalence of youth obesity at $r=0.35$ ($p=0.01$). However, no correlation was found between either PAE or WA policies and youth obesity (PAE policies at $r=0.02$ [$p=0.53$] and WA policies at $r=0.16$ [$p=0.40$]).

Conclusions—States appear to be doing a better job adopting FSN policies than PA or WA policies, and adoption of policies is correlated with youth obesity. Continued monitoring of these policies seems to be warranted.

Background

Government policy is a potentially effective and justifiable tool for addressing childhood obesity with policies that encourage both healthy eating and physical activity.^{1–3} Although the childhood obesity epidemic is widely viewed as a national health threat, there has been little coordinated or comprehensive response at the national level and states have been left to respond on their own.^{4,5} States vary in the prevalence of obesity among youth⁶ and all states have experienced significant increases in overweight and obesity in youth since state-level estimates were first tracked in 1991.⁷ Although several states have taken action establishing various policy and programmatic initiatives in school settings, studies evaluating them have been mostly limited to examining food and nutrition-related areas (i.e., vending machines) and characterized as weak.^{8–10} The implementation of policies into practice, especially in school settings, is widely unknown. There is some preliminary evidence of association between state- and local-level implementation^{11,12} that varies greatly from school to school.¹³ Furthermore, most studies of policy efforts to combat childhood obesity focus on evaluating single policies or a single set of policies, rather than a comprehensive policy agenda.^{9,14} Scholars agree that a comprehensive policy approach is needed to make a meaningful impact on future obesity prevalence.¹⁵ In fact, enacting multiple policies with an expanded scope and combinations or groupings of policies may be more effective than a single policy alone or may work in synergy.¹⁶

Given the scientific and analytic complexities in evaluating comprehensive sets of policies, additional research is needed to develop methods for data reduction that would make these evaluations more accessible. The primary aim of this paper was to develop a comprehensive evaluation approach to describe the policy environment related to school-based obesity prevention efforts in each of the 50 U.S. states. A secondary aim was to examine the cross-sectional associations between current state policy environments and youth obesity prevalence.

Methods

This study used qualitative and quantitative methods to construct policy domains of state-level school obesity prevention policies and practices, establish validity and reliability of the domain scales, and examine how domains are associated with state-level youth obesity prevalence.

Data Source for State-Level Policies

The School Health Policies and Programs Study (SHPPS) is the largest, most comprehensive assessment of school health programs and policies in the U.S.,^{17,18} and it is conducted every 6 years. The present study used state-level data from SHPPS 2006, which are publicly available from the CDC.¹⁹ The SHPPS is conducted using computer-assisted telephone interviews and mailed questionnaires and completed by state-level personnel most familiar with school health policies and practices.

Process to Create Obesity Prevention–Policy Domains

To manage the extensive SHPPS policy data set, investigators used principal component analysis (PCA) to create an initial set of policy clusters. Investigators used results from the PCA as a starting point to logically group questions that were uniquely related. The grouping process required several rounds of discussion and was informed by analysis of internal consistency and between-domain correlation. Figure 1 provides a visual map of the process and is described below.

Initial item selection—The SHPPS was examined to identify state-level policies related to obesity prevention. Individual policies and practices were then sorted into three areas: food service and nutrition (FSN), physical activity and education (PAE), and weight assessment (WA). Weight assessment consisted of two questions that did not fit uniquely within FSN or PAE.

Some questions were worded to gather a “yes” (*yes*=1) or “no” (*no*=2) response. For these questions, each policy or practice was recoded to reflect 1=*present* and 0=*not present*. In a small number of cases, respondents did not answer the question. In total, these reflected less than 1% of all data, and no single question had more than one state with missing data. These responses were coded as 0. Some questions were worded to gather the strength of the policy or practice. For example, “Does your state require or recommend that elementary schools test students’ fitness levels?” Response options included 1=*Require*, 2=*Recommend*, and 3=*Neither*. All required policies were coded as 1, while recommended and neither required nor recommended policies were coded as 0.

Principal components analysis—PCA is a statistical technique for simplifying the description of a set of interrelated variables into a smaller set of new variables that are not correlated. Two separate PCAs were conducted for the initial pool of items for the FSN (100 items) and the PAE (146 items) policies. The large number of policies included in the current analysis resulted in more than 20 policy and practice domains for the FSN and PAE areas using eigenvalues and a scree plot as guidelines.

Content validity assessment—Collectively, the investigators had expertise in nutrition, physical activity, school-based obesity prevention initiatives, policy analysis, and biostatistics. Data were reduced further when investigators grouped state policies and practices into domains by reviewing the PCA output and identifying logical policy groupings. In general, the initial domains with higher eigenvalues tended to include the more logically rated groupings. The investigators assessed consistency within domains and differences between domains. Cronbach’s alpha statistic was used to evaluate interitem correlation among policies within each domain. Domains with coefficient alphas ≥ 0.70 were considered to have high internal reliability. Pearson’s correlation coefficient was used to assess the degree to which the newly created policy domains were distinct from each other. Small (<0.20) to moderate (<0.50) correlations were considered to demonstrate discriminant validity.

When the set of domains was finalized, scaled scores were developed for all state-level obesity-related policies and practices, for areas of FSN, PAE, and WA, and for each constructed domain within these areas. The scaled score reflects the proportion of the possible policies in each domain that were enacted in each state, and this measure permits comparisons across domains and across states by their school-based obesity prevention policies and practices. Thus, a scaled score of 0.5 indicates that half of the policies in that domain existed (e.g., two of four, or ten of 20).

Associations Between State-Level School Policies and Youth Obesity

To assess content validity, the scaled policy environment scores were examined in relation to state-level obesity prevalence. Data on age-adjusted obesity prevalence in each state among youth aged 10–17 years were obtained from the 2003 National Survey of Children’s Health (NSCH).²⁰ Data collection for NSCH was administered by the CDC from 2003 to 2006 through telephone interviews with parents reporting the height and weight of their participating child. Convergent construct validity of this data source was established by comparing youth obesity prevalence with self-reported data on youth in Grades 9–12 from

the Youth Risk Behavior Survey (YRBS).⁷ The correlation between the NSCH and the YRBS prevalence for the available states was $r = 0.81$. Correlations for self-reported and measured heights and weights among older children and adolescents are relatively high.^{21–23}

The unadjusted relationship between state policy and practice domains and obesity prevalence among youth aged 10–17 years was assessed using a Pearson correlation coefficient. In addition, state-level demographic data were obtained from the 2000 U.S. Census on ethnicity and income (percentage white and percentage median house-hold income <\$20,000). Linear regression analysis was conducted, adjusting for these state-level covariates using PROC GLM in SAS to assess whether state-level school health policy and practice were related to youth obesity levels.

Results

In total, 248 discrete items were identified from the state-level SHPPS food services and nutrition, physical education and activity, and health services and health education surveys. The three broad policy topic areas containing 100 questionnaire items from FSN, 146 from PAE, and two from WA were identified and further categorized into six FSN, ten PAE, and one WA domain. Figure 1 describes these final policy domains. FSN includes policies related to infrastructure, collaboration, food service standards, competitive foods, nutrition education, and nutrition counseling and assistance programs. Some of the ten policy domains within PAE were the same: infrastructure, collaboration, physical education and activity standards, and physical activity assessment. Other PAE policies were unique to physical activity, and domains were created including adapted physical education, exclusions from physical activity, educator training, restrictions on using activity as punishment, safety, and walking and biking to school. Policies regarding measurement and reporting of BMI in schools were not unique to either FSN or PAE domains and were kept as a separate domain (WA). Each SHPP policy question examined here and the domains created can be found in Appendix A, available online at www.ajpm-online.net.

Internal Consistency Reliability

The internal consistency assessment examined the extent to which items within each domain were correlated. The alpha coefficients within the FSN policy groupings with one exception were greater than 0.70, indicate generally high levels of internal consistency: competitive foods, $\alpha = 0.90$; infrastructure, $\alpha = 0.81$; food service standards, $\alpha = 0.80$; counseling and assistance programs, $\alpha = 0.78$; collaboration, $\alpha = 0.74$; and education, $\alpha = 0.61$. The low alpha coefficient for education could reflect the small number of policies ($n = 4$) representing that domain. Similarly, alpha coefficients for the PAE policy groupings were all greater than 0.70: physical education standards, $\alpha = 0.96$; collaboration, $\alpha = 0.88$; adapted physical education, $\alpha = 0.87$; training and exclusions from physical education, $\alpha = 0.83$; infrastructure, $\alpha = 0.81$; punishment, $\alpha = 0.79$; assessment, $\alpha = 0.78$; and safety, $\alpha = 0.73$. Alpha coefficients were high for the two items in WA ($\alpha = 0.89$).

Discriminant Construct Validity

The discriminant validity assessment examined the extent to which policy and practice domains captured distinct constructs. All correlations among all of the 17 domains were below 0.55, indicating no serious overlap in constructs, and 80% of the correlations were less than 0.20. As expected, the six FSN domains were more correlated with each other than they were with the ten domains of PAE, and vice versa. The correlations among the six FSN policy domains above 0.40 were as follows: collaboration with infrastructure ($r = 0.55$) and with education ($r = 0.55$); and food service standards with competitive foods ($r = 0.46$). Among the ten PAE domains, the correlations greater than 0.40 were as follows: adapted PE

with assessment ($r = 0.46$), with infrastructure ($r = 0.48$), and with training ($r = 0.42$); standards with assessment ($r = 0.40$) and with infrastructure ($r = 0.41$); and safety with training ($r = 0.50$). Despite these moderate positive correlations across policy domains, the investigators judged these to be conceptually unique groupings.

State-Level School-Based Obesity Prevention–Policy Environments

Table 1 provides descriptive statistics for each policy and practice domain, the average number and range of policies adopted, and the proportion of policies adopted. On average, about half (49%) of FSN policies, 38% of PAE policies, and 17% of WA policies examined were adopted by states. The most commonly adopted FSN policies were those related to nutrition education, collaborating with others to improve nutrition, and nutrition infrastructure. In contrast, states reported adopting fewer FSN policies that provide nutrition counseling and food assistance programs, with an average state reporting adopting only 65% of these policies. On average, states adopted most of the PAE policies related to adaptation of physical education for youth with disabilities (75%); establishing standards for physical education (63%); and collaboration with others (61%). The PAE policy areas least likely to be adopted by states were related to walking and biking to school (12%) and restricting the use of activity for discipline (9%). Weight assessment measurement and reporting policies were also among the least adopted by states (17%).

State-specific domain scores and a total across all three domains is available in Appendix B, available online at www.ajpm-online.net. The average proportion of all adopted policies in the U.S. is 34%, ranging from a lowest score of 8.4% (OH) to the highest of 67.4% (NV). Figure 2 describes states by their average proportion of policies across FSN and PAE domains. Blue states indicate the most comprehensive policy environment score where more policy domains are adopted. This map highlights a pattern of more FSN policies adopted among the southern and southeastern U.S. states. No similar pattern emerged for PAE policies. Only three states had comprehensive policy environments for both FSN and PAE: LA, KS, and NC.

State-Level Policy Environments and Youth Obesity

Table 1 shows that a significant, positive correlation was observed among states with the most comprehensive policy environments, as indicated by the average proportion of policies adopted, for FSN and state-level youth obesity prevalence ($r = 0.48$, $p = 0.0005$; $N = 50$). FSN policy groupings with the strongest correlations to youth obesity are those policies that pertain to competitive foods ($r = 0.53$) and food service standards ($r = 0.40$), whereas policies related to collaboration ($r = 0.35$) and infrastructure ($r = 0.34$) had moderate, although significant, positive correlations with obesity. Associations remain significant after adjusting for state-level covariates for FSN policies describing collaboration ($r = 0.34$, $p = 0.02$); competitive foods ($r = 0.29$, $p = 0.04$); and the total FSN policy environment ($r = 0.30$, $p = 0.04$).

The correlation between total PAE policies and youth obesity prevalence was not significant ($r = 0.12$, $p = 0.42$; $N = 50$). Only the PAE policy groupings related to standards had a significant positive correlation with youth obesity ($r = 0.30$), but associations did not remain significant after adjusting for state-level covariates. The correlation between WA policies and youth obesity prevalence was not significant.

Figure 3 presents the plotted association between policy environment in FSN and PAE domains and youth obesity prevalence. The lower left half of the FSN figure shows that AK and MT have low levels of comprehensive FSN environments and lower levels of youth obesity. In contrast, the top right-hand corner of the FSN figure identifies that WV, KY, TN,

NC, TX, SC, and MS have highly comprehensive FSN policy environments and high rates of youth obesity. Similar patterns were not apparent for PAE. Outliers such as UT and WY have lower youth obesity rates, with only Utah having a relatively comprehensive PAE environment. MN, ID, Washington State, MT, and VT appear to have lower youth obesity prevalence, with moderately comprehensive FSN and PAE environments.

Conclusion

This is the first study to develop an evaluation approach to characterize the total obesity prevention-policy environments for schools and link policy environments to youth obesity. The results describe evidence of content validity, internal consistency reliability, and discriminant validity of a set of state health policy domains related to obesity prevention. The initial cross-sectional analysis indicates that states with the highest youth obesity prevalence have adopted more comprehensive school-based obesity prevention policies, especially related to food service and nutrition. These analyses cannot discern temporal relationship, and it is unclear whether states with the highest youth obesity prevalence are reacting by implementing policies and whether the policies are not being implemented or are ineffective. Possible explanations for the preference for FSN policies are that the nutritional quality of school foods and beverages has gotten more public attention in the past few years; FSN policies may seem less of an interference with academic time than PAE policies; and FSN policies are associated with school revenues. The overall lack of state efforts is disturbing, especially for physical activity. The range of policies adopted by states indicates that for nine of the ten PAE domains, at least one state has no relevant policies. Results by state are presented in Appendix B, available online at www.ajpm-online.net.

There is some evidence that a moderately comprehensive environment addressing both FSN and PAE is associated with lower youth obesity rates in some states. One explanation for these findings is that the relationship between obesity prevalence and comprehensive policy environments is not linear. States with the highest or extreme levels of obesity may experience more political pressure to enact policy. Without a longitudinal study, it remains unclear whether obesity prevalence preceded prevention policies.

Study Limitations

This work utilizes existing data and organizes these data for the purpose of building a framework for evaluating school-based obesity prevention policies. Such a task has limitations. First, although using existing national data sources is efficient, they often have item-specific and methodologic limitations. For example, respondents represent the “person most knowledgeable to respond”; therefore, agency and position titles of respondents vary across states. States may have required an obesity-related school policy that was not included and therefore not represented in the proposed framework. The SHPSS survey contains two questions that assess state policy regarding weight assessment and feedback to parents. These policies are controversial and few studies have assessed their effectiveness in obesity prevention. The investigators felt that these policies were conceptually distinct from other obesity prevention policies considered and that they should not be grouped with other policies. Second, these findings may be time dependent. State policies can change over time. Also, the SHPPS survey has expanded to include additional questions since 1994. Third, other important aspects of validity were not assessed, such as predictive validity or concurrent validity. Finally, the extent to which these state-level policies are being implemented in the more proximal classroom or school setting was not known.

Next Steps

To address the study limitations, the authors identified the following questions for future research: examining temporal relationships (i.e., Did policies cause obesity or are states responding to obesity prevalence?); contributing factors (i.e., What state- and district-level factors are associated with policy adoption and implementation?); implementation (i.e., Are state policies being implemented at the district, school, and classroom levels?); and impact (i.e., Are state- and district-level policies associated with individual-level health outcomes?). A study following school-based policies and practices and youth obesity prevalence over time with a longitudinal, repeated measures design, identifying policy and practice adoption confounders, characterizing implementation and evaluating behavioral and health impacts on young people would contribute significantly to the science of obesity prevention policy. Armed with this information, policymakers at all levels across multiple organizations could make funding decisions that may bring us closer to reducing obesity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [10.1016/j.amepre.2009.08.031](https://doi.org/10.1016/j.amepre.2009.08.031).

Figure 1. Schematic diagram of the hybrid expert and empirical process used to create state obesity prevention-policy domains Source: School Health Policies and Programs Study survey 2006, www.cdc.gov/HealthyYouth/shpps/2006/data/index.htm

Figure 2. State-by-state overall scaled scores for food service and nutrition (top) and physical activity and education (bottom) policies

Figure 3. Scatterplots of state-level percentage of obese youth aged 10–17 years versus overall scaled scores for food service and nutrition (left) and physical activity and education (right) policies. (States are identified by 2-letter abbreviations.)

Table 1
State-level policy descriptors and correlations with state-level youth obesity prevalence

State policy domains	Number of policies in each domain, <i>n</i>	Average number of policies adopted by states, <i>M</i> (SD)	Range of policies adopted by states, <i>n</i>	Average proportion of policies adopted by states, % (SD)	Association between youth obesity and policies (unadjusted), <i>r</i>	Association between youth obesity and policies (adjusted), <i>r</i>
FSN						
Education	4	3.4 (1)	0–4	0.84 (0.25)	0.10	0.17
Collaboration	14	11.3 (2)	5–14	0.81 (0.18)	0.35*	0.34*
Infrastructure	34	22.3 (5)	6–32	0.66 (0.15)	0.34*	0.15
Food service standards	21	6.9 (3)	2–16	0.33 (0.16)	0.40*	0.19
Competitive foods	23	5.5 (5)	1–16	0.24 (0.20)	0.53*	0.29*
Counseling/assistance programs	4	0.2 (0.7)	0–4	0.05 (0.17)	–0.05	–0.14
Total FSN environment	100			0.49 (0.11) ^a	0.48*	0.30*
PAE						
Adapted physical education	7	5.2 (2)	0–7	0.75 (0.32)	0.20	0.16
Physical education standards	35	22.1 (10)	0–33	0.63 (0.28)	0.30*	0.25
Collaboration	18	10.9 (4)	0–17	0.61 (0.23)	–0.03	–0.09
Training	38	19.6 (6)	6–36	0.52 (0.17)	0.07	0.14
Infrastructure	17	5.7 (4)	0–14	0.33 (0.23)	0.15	0.07
Exclusions from physical education	3	0.8 (1)	0–3	0.27 (0.38)	0.02	0.08
Safety	3	0.7 (1)	0–3	0.23 (0.32)	–0.02	–0.01
Assessment	20	4.1 (3)	0–13	0.21 (0.15)	0.23	0.14
Walking and biking to school	1	0.12 (0.33)	0–1	0.12 (0.33)	–0.24	–0.21
Punishment	4	0.4 (0.9)	0–4	0.09 (0.22)	–0.06	–0.06
Total PAE environment	146			0.38 (0.14) ^b	0.12	0.08
Weight assessment						
BMI assessing/parent reporting	2	0.3 (0.7)	0–2	0.17 (0.36)	0.15	0.15

^a Because the six FSN domains range widely in the number of policies representing them (four to 34 policies), a scaled score was created to treat each policy domain equally by averaging over proportions of policies within each.

^b Because the ten PAE domains range widely in the number of policies representing them (one to 38 policies), a scaled score was created to treat each policy domain equally by averaging over proportions of policies within each.

* Significant correlation ($p < 0.05$) between state-level policy domain-scaled score and obesity prevalence among state-level youth aged 10–17 years. FSN, food service and nutrition; PAE, physical activity and education