
School district wellness policy quality and weight-related outcomes among high school students in Minnesota

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Abstract

Weight-related outcomes were examined among high school students in Minnesota public school districts according to the quality of district wellness policies. Wellness policy strength and comprehensiveness were scored using the Wellness School Assessment Tool (WellSAT) for 325 Minnesota public school districts in 2013. The associations between WellSAT scores and district-level means of high school student responses to a statewide survey of health behaviors were examined in this ecologic study. WellSAT Total Strength and Total Comprehensiveness scores were positively associated with both student mean Body Mass Index (BMI) percentile (Strength: $P = 0.018$, Comprehensiveness: $P = 0.031$) and mean percent overweight or obese (Strength: $P = 0.008$, Comprehensiveness: $P = 0.026$), but only in districts with >50% of students eligible for Free or Reduced-Price Lunches (FRPLs), or ‘high FRPL districts’. WellSAT Physical Education and Physical Activity subscale scores were also positively associated with the mean days per week students engaged in physical activity for ≥ 60 min in high FRPL districts (Strength: $P = 0.008$, Comprehensiveness: $P = 0.003$) and in low FRPL districts (<35% eligible) for Strength score: ($P = 0.027$). In medium FRPL districts (35–50% eligible), Nutrition Education and Wellness Promotion Strength and

Comprehensiveness subscale scores were positively associated with, respectively, daily servings of vegetables ($P = 0.037$) and fruit ($P = 0.027$); and WellSAT Total scores were positively associated with daily vegetable servings (Strength: $P = 0.037$, Comprehensiveness: $P = 0.012$). Administrators of economically disadvantaged school districts with a higher percentage of overweight students may be recognizing the need for stronger wellness policies and the specific importance of implementing policies pertaining to physical activity as a means to improve student health.

Introduction

Due to the rapid rise in obesity among youth [1], the large amount of time the majority of youth spend in school [2], and the relative permanence of policies versus temporary school-based interventions [3], school wellness policies have become a key tool to promote healthy learning environments and reduce childhood obesity. Recognizing schools’ role in preventing obesity, Congress passed The Child Nutrition and WIC Reauthorization Act of 2004 (CNRA). The legislation required each school district participating in federally sponsored child nutrition programs to enact a school wellness policy by the 2006–2007 school year. The legislation encouraged schools to build nutrition and physical activity policies in five areas: (i) written goals for nutrition education and physical activity; (ii) nutrition

guidelines for all foods available on each school campus; (iii) an assurance that reimbursable school meals follow USDA regulations; (iv) a plan for measuring implementation of the policy; and (v) the involvement of parents, school food authority, school board, school administrators and the public in the development of the policy [4]. Building on the CNRA, the Healthy, Hunger-Free Kids Act of 2010 (HHFKA) set expectations for school district wellness teams to continuously implement and evaluate their wellness policies, sharing indicators of compliance with the general public. Local school districts have the freedom to develop their own tailored policies as long as they meet all required elements [5–8].

Research to date indicates that the adoption of school wellness policies has resulted in some positive changes upon student health [7, 9], especially in the area of nutrition. The relationships between wellness policies and student weight outcomes and physical activity have thus far been ambiguous.

Studies examining school health environments post-policy enactment have shown decreases in the availability and consumption of unhealthy competitive foods and beverages by students [10–13], increased purchasing of healthier food offerings [14], reduced use of food rewards for academic performance [15], increased student participation in national school lunch programs [16], and no compensatory increase in student consumption of unhealthy foods or beverages once students are at home [11].

Studies evaluating the impact of school wellness policies on students' Body Mass Index (BMI) have shown mixed results; with some studies indicating decreases in student BMI and/or adolescent overweight/obesity prevalence [17–20], some showing no significant change in BMI or student obesity prevalence [21, 22], and some showing a higher obesity prevalence among students in states with stronger and more comprehensive obesity prevention policies [23, 24].

The relationship between physical activity and wellness policies also lacks clarity, with some studies indicating a decrease in student physical activity post wellness policy enactment [25, 26] and some studies showing modest increases in student

physical activity after the adoption of state Physical Education (PE) mandates [27, 28]. The adoption of state PE mandates has not shown significant effects upon students' weight status or BMI [20].

This ecologic study examined the wellness policy environments in Minnesota public school districts, providing an analysis of the quality of existing policies and their association with district-level measures of high school student weight-related outcomes. The hypotheses were that school districts with stronger and more comprehensive wellness policies would exhibit lower mean BMI percentiles and lower rates of obesity and overweight status among their students and more positive health behaviors, such as higher mean daily servings of fruits and vegetables, lower mean daily servings of soda and other sugar-sweetened beverages (SSBs) and higher mean days per week of physical activity. A secondary objective was to further examine whether associations of district wellness policy quality with student weight-related outcomes differed across district-level demographic characteristics.

Methods

Data and sample

This cross-sectional study using an ecologic study design involved the evaluation of written wellness policies in a sample of Minnesota public school districts participating in the National School Lunch Program (NSLP). Corresponding district-level student data on weight-related outcomes was drawn from the Minnesota Student Survey (MSS) [29], and district-level school demographic data was obtained from the US Department of Education's National Center for Education Statistics (NCES) Common Core Data (2013). School wellness policies and accompanying relevant documents applicable to the 2013–14 school years were obtained primarily from school district public websites, with some districts providing policies after being contacted by research staff. In 2013, 331 Minnesota public school districts participated in the NSLP. This research focused only on public schools to allow for greater consistency in

comparing data between school districts. Sampling occurred at the school district level, as required by the CNRA. The initial sample for content analysis included 325 school districts with both a wellness policy and corresponding NCES Common Core Data. Of these, 270 school districts had corresponding MSS data for high school students and were included in analyses examining student weight-related outcomes. There were no significant differences in mean wellness policy scores or in mean school demographic characteristics between the 270 school districts in the analysis sample and the remaining districts not in the analysis sample.

Measures

Wellness School Assessment Tool (WellsAT)

Schwartz *et al.* [30] developed a comprehensive, quantitative coding system to score school wellness policies on both the strength and comprehensiveness of the overall policy, as well as in specific areas of student wellness covered in the CNRA. The WellsAT is an abbreviated version of the original policy coding system that allows for online scoring [31]. It has been used by other health professionals and researchers and has been shown to be a reliable assessment tool [9, 15, 32–34]. This study utilized the WellsAT to quantitatively evaluate the quality of Minnesota public school districts' wellness policies.

The WellsAT examines five areas: (i) Nutrition Education and Wellness Promotion, (ii) Standards for USDA Child Nutrition Programs and School Meals, (iii) Nutrition Standards for Competitive and Other Foods and Beverages, (iv) Physical Education and Physical Activity and (v) Evaluation. Policy provisions in each of these five areas were rated as strong (mandatory, specific) or weak (vague, suggested/recommended) depending upon the specific policy language. The WellsAT evaluates wellness policy quality through the provision of two types of scores: strength scores, which describe how strongly the content is stated; and comprehensiveness scores, which reflect the extent to which recommended content areas are covered in the policy. The instrument provides a Total Strength

score and strength scores for each of the five subscales, along with a Total Comprehensiveness score and comprehensiveness scores for each of the five subscales. Scores range from 0 to 100; lower scores indicating weaker language and less content, and higher scores indicating use of specific and directive language and more content.

The scoring of school wellness policies for this evaluation was completed by the first author between November 2013 and January 2014, with inter-rater reliability checks by a second rater. Throughout the study phase, inter-rater reliability was calculated by having the two raters independently score five of every 50 policies. The overall inter-rater reliability during the study phase using the weighted Kappa statistic was $Kappa = 0.93$ ($P = 0.008$), 95% CI [0.916, 0.946].

During the scoring process, policies provided by school districts were classified as one of three types: (i) Original Non-Template, (ii) Template Language Only or (iii) Template with Modified Language policies. Original Non-Template policies contained both unique policy statements and a unique format. Template Language Only policies followed a standard policy template made available by subscription to school districts by the state School Board Association. Template with Modified Language policies followed the format of the same standard policy template, but made one or more changes to the template to tailor it to their school district.

Minnesota Student Survey (MSS)

Student data were drawn from the 2013 MSS, an anonymous self-report survey administered to students every 3 years to examine a variety of health risk and protective factors. All public schools throughout Minnesota and their students enrolled in fifth, eighth, ninth and eleventh grades were invited to participate in the MSS; and 84% of eligible schools participated in the first half of 2013 ($n = 280$). Data from students in grades 9 and 11 were used in this analysis (participation rates by grade were 69 and 62%, respectively). Weight-related outcome measures used for these analyses included student self-reported daily servings of

soda, sports drinks, fruit juice and SSBs; daily servings of fruits and vegetables; days per week of physical activity for at least 60 min; and height and weight. Age- and gender-adjusted BMI percentile was calculated from student self-reports of height and weight using CDC growth charts. Fifth and eighth grade MSS data were not examined in this study, to retain the focus on high school students.

National Center for Education Statistics (NCES)

General school district-level demographic characteristics were obtained from the NCES Common Core Data for the 2012–13 school year [35], including geographic location (defined by category: City, Suburban, Town or Rural), ethnic/racial minority enrollment status (defined as the mean percentage of students within a district representing a background other than non-Hispanic white; also categorized as low minority enrollment: < 7%, medium minority enrollment: 7 to ≤ 20%, and high minority enrollment: > 20%), and Free or Reduced-Price Lunch (FRPL) eligibility status (defined as the mean percentage of FRPL-eligible students within a district; also categorized as low FRPL: < 35%, medium FRPL: 35 to ≤ 50%, and high FRPL: > 50%).

Data analysis

All analyses were performed using the Statistical Analysis System (SAS, version 9.4, 2013, SAS Institute, Cary, NC). Consistent with the ecologic study design, all analyses were performed at the school district level, with individual student responses averaged within the district. Descriptive statistics (means and SDs) of district-level wellness policy scores (WellSAT), district-level demographic variables (NCES), and district-level student weight-related outcomes (MSS) were examined to characterize these variables. Analysis of variance was used to examine whether mean district-level MSS weight-related outcomes differed between categories of district-level FRPL eligibility, adjusting for multiple comparisons using the Tukey method.

Generalized linear regression models tested for associations between district-level student weight-related outcomes and WellSAT scores, adjusted for district percent minority enrollment (as a continuous variable), rural location (as a binary variable for Rural/Not Rural) and FRPL eligibility (as a three-level categorical variable). Models were run both with and without an interaction term between WellSAT score and FRPL variable which was included to test the hypothesis that regression slopes for the association between WellSAT score and district-level student weight-related outcomes were the same in all three FRPL levels. When this interaction term was significant, slope estimates for the association between district-level student weight-related outcomes and WellSAT score were estimated separately for each FRPL category and tested for significance with Tukey adjustment for multiple comparisons. If the WellSAT score by FRPL interaction term was not significant, the overall adjusted association between WellSAT score and student level outcome was estimated.

Results

Descriptive statistics for the sample can be found in Table I. Among the 270 school districts represented in the analysis, there were 41 835 ninth grade students (53%), and 37 019 11th grade students (47%).

The WellSAT total and subscale mean scores for strength and comprehensiveness are presented in Table II. The average Total Strength score ($M = 29.2$) was less than half of the average Total Comprehensiveness score ($M = 63.8$). The Nutrition Standards for Competitive Foods (NSCF) subscale stood out as having the lowest average scores for both strength and comprehensiveness. The Evaluation (EVAL) subscale indicated the highest average strength scores. Although the Standards for USDA Child Nutrition Programs and School Meals (USDA) subscale score was, on average, the most highly comprehensive subscale, it also displayed one of the lowest average strength scores compared with other subscale scores.

Table I. Demographic characteristics of Minnesota public school districts and district-level mean student weight-related outcomes, 2013

School district characteristics as categories (<i>n</i> = 270)	% (<i>n</i>)
Geographic location of school district	
City	3.0 (8)
Suburb	10.4 (28)
Town	24.4 (66)
Rural	62.2 (168)
Minority enrollment	
Low: < 7%	37.4 (101)
Medium: 7 ≤ 20%	39.6 (107)
High: >20%	23.0 (62)
Student FRPL eligibility	
Low: < 35%	37.8 (102)
Medium: 35 ≤ 50%	41.9 (113)
High: >50%	20.4 (55)
Mean school district characteristics	<i>M</i> (<i>SD</i>)
Minority enrollment (district percent)	15.2 (16.1)
Student FRPL eligibility (district percent)	38.9 (14.0)
District-level mean student weight-related outcome data^a	<i>M</i> (<i>SD</i>)
Student BMI percentile	61st (4.4)
Percent students overweight or obese (BMI percentile ≥ 85th)	25.2 (6.8)
Percent students obese (BMI percentile ≥ 95th)	11.0 (4.6)
Student servings of soda per day	1.13 (0.29)
Student servings of sports drinks per day	0.87 (0.24)
Student servings of energy drinks per day	0.26 (0.14)
Student servings of other sweet drinks per day	1.19 (0.25)
Student servings of SSBs ^b per day	3.40 (0.67)
Student servings of fruit juice per day	0.69 (0.14)
Student servings of fruit per day	0.99 (0.19)
Student servings of vegetables per day	0.93 (0.15)
Student days with 60 min or more physical activity	4.10 (0.45)

FRPL, Free or Reduced-Price Lunch; BMI, Body Mass Index; SSB, Sugar-Sweetened Beverages.

^aMSS data: District-level data for 78 854 students in Grades 9 (*n* = 41 835), and 11 (*n* = 37 019).

^bSSBs include soda, sports drinks, energy drinks and other beverages containing added caloric sweeteners.

Many school wellness policies contained similar content. In fact, 29% of school districts had adopted the same standard policy template word for word; and therefore all received the same WellSAT scores (Total Strength: 20/100; Total Comprehensiveness: 57/100). The districts using the exact template did not vary significantly in demographic characteristics from the overall sample nor from districts using a modified version of the template. Table II also shows the WellSAT scores separated by the type of policy provided by district: (i) Original Non-Template, (ii) Template Language Only or (iii) Template with Modified Language policies (at

least one change from the template). When compared with districts that had an original policy or had made changes to the standard template policy, districts using the exact template policy had lower mean scores in both Total Strength and Total Comprehensiveness, as well as in all WellSAT subscales. Districts that adopted original, non-template policies had the highest strength and comprehensiveness scores.

Analysis of variance indicated significant differences between all FRPL categories in both district-level mean student BMI percentile ($P < 0.0001$) and percent overweight or obese ($P < 0.0001$), as well as

Table II. *Minnesota school district wellness policy strength and comprehensiveness scores, 2013-2014*

	Overall Policy Sample (n = 325)		Original Non-Template Policy (n = 58) ^a		Template Language Only Policy (n = 94) ^b		Template with Modified Language Policy (n = 173) ^c	
	M	SD	M	SD	M	SD	M	SD
WellSAT Scoring Scale = 0–100 points								
Section 1: NEWP								
Strength score	25.7	21.9	48.8	29.1	11.2	2.3	25.9	18.1
Comprehensiveness score	64.3	15.6	75.2	22.8	56.1	1.1	65.0	14.4
Section 2: USDA								
Strength score	23.5	21.1	43.8	32.7	14.0	0.0	21.9	17.2
Comprehensiveness score	73.4	14.7	72.9	28.9	71.0	0.0	74.9	11.0
Section 3: NSCF								
Strength score	14.1	19.7	28.0	28.7	6.1	1.3	13.5	18.9
Comprehensiveness score	56.5	19.7	61.9	31.3	49.9	1.1	58.3	19.1
Section 4: PEPA								
Strength score	29.5	15.0	42.4	19.8	21.2	1.5	29.7	14.1
Comprehensiveness score	65.5	12.4	77.5	13.8	57.2	2.4	65.9	11.7
Section 5: EVAL								
Strength score	53.8	21.1	61.6	36.3	50.0	0.0	53.2	19.4
Comprehensiveness score	59.1	21.6	75.4	31.9	50.0	0.0	58.5	20.1
Total								
Strength score	29.2	16.2	44.9	23.4	20.1	1.0	28.8	13.5
Comprehensiveness score	63.8	13.0	72.6	20.7	57.0	0.9	64.6	11.2

NEWP, Nutrition Education and Wellness Promotion; USDA, Standards for USDA School Meals; NSCF, Nutrition Standards for Competitive Foods and Beverages; PEPA, Physical Education and Physical Activity; EVAL, Evaluation.

^aOriginal Non-Template Policy: policies contained both unique policy statements and a unique format.

^bTemplate Language Only Policy: policies followed a standard policy template made available to school districts statewide.

^cTemplate with Modified Language Policy: policies followed the format of the standard policy template, but had one or more changes to the template to tailor it to their school district.

Table III. District-level mean student weight-related outcomes by free and reduced-price lunch categories

Student weight-related outcomes	Mean (SD) by district FRPL category			P values for ANOVA F-test
	Low <i>n</i> = 103	Medium <i>n</i> = 113	High <i>n</i> = 55	
BMI percentile	59th (3.5) ^a	62nd (3.7) ^b	64th (5.2) ^c	<0.0001
Percent overweight or obese	22.4% (4.8) ^a	25.4% (6.1) ^b	29.9% (8.3) ^c	<0.0001
Daily servings of soda	1.03 (0.27) ^a	1.18 (0.26) ^b	1.24 (0.30) ^b	<0.0001
Daily servings of sports drinks	0.79 (0.22) ^a	0.92 (0.25) ^b	0.88 (0.24) ^{ab}	0.0002
Daily servings of SSBs	3.10 (0.52) ^a	3.49 (0.63) ^b	3.74 (0.76) ^c	<0.0001
Daily servings of fruit	1.06 (0.18) ^a	0.96 (0.18) ^b	0.93 (0.19) ^b	<0.0001
Daily servings of vegetables	0.99 (0.15) ^a	0.91 (0.14) ^b	0.88 (0.13) ^b	<0.0001
Daily servings of fruit juice	0.68 (0.11)	0.68 (0.14)	0.70 (0.19)	0.502
Days per week with 60 min or more of physical activity	4.14 (0.35) ^a	4.14 (0.46) ^a	3.95 (0.57) ^b	0.018

FRPL, Free or Reduced-Price Lunch Eligibility; low FRPL, <35%; medium FRPL, 35 ≤ 50%; high FRPL, >50%.

Superscript letters: Means with different superscript letters indicate significant differences after adjusting for multiple comparisons (Tukey method); means with no superscripts or the same superscript letter were not significantly different.

for district-level mean daily servings of SSB ($P < 0.0001$). Mean BMI percentile, percent overweight or obese, and daily SSB servings all increased with increasing FRPL eligibility. Low FRPL districts had significantly lower mean daily servings of soda and higher mean daily servings of fruits and vegetables than both medium and high FRPL districts ($P < 0.0001$ for all). Mean daily servings of sports drinks were significantly lower in low FRPL districts than in medium FRPL districts ($P < 0.001$). District-level mean days of physical activity for 60 min or more were significantly lower in high FRPL districts than in both low and medium FRPL districts ($P < 0.05$). These results are reported in Table III.

Generalized linear regression models adjusted for district minority enrollment, location and FRPL eligibility did not identify any significant associations between district-level mean student weight-related outcomes and WellSAT Total and subscale strength and comprehensiveness scores. However, significant interactions were identified between FRPL category and the following: WellSAT Total Strength and Comprehensiveness scores in models for district-level mean BMI percentile, mean percent overweight or obese, and mean daily servings of vegetables; the Standards for USDA School Meals (USDA) subscale comprehensiveness score in the model for district mean daily servings of fruit

juice; the Nutrition Education and Wellness Promotion (NEWP) subscale comprehensiveness score in the model for district mean daily servings of fruit; the NEWP subscale strength score in the model for district mean daily servings of vegetables; and the PEPA subscale strength and comprehensiveness scores in models for district-level mean days per week of physical activity. Significant positive associations between WellSAT scores and weight-related outcomes were found among high FRPL districts for mean BMI percentile, mean percent overweight or obese, mean daily servings of fruit juice (marginally) and mean days per week of physical activity. Significant positive associations between WellSAT scores and student outcomes were also found among medium FRPL districts for mean daily servings of fruit and vegetables, and among low FRPL districts for mean days per week of physical activity. There were no significant associations between WellSAT scores and daily servings of soda or sports drinks. These results are reported in Table IV.

Discussion

The average WellSAT Total Strength score for this sample of Minnesota school districts was 29/100. The weak, non-specific and non-mandatory language used in Minnesota school wellness policies

Table IV. Associations between WellSAT scores and district-level MSS weight-related BMI and physical activity outcomes for high school students by FRPL category

WellSAT score	District-Level Mean BMI Percentile		
	Slope for 10 U Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
Total Strength	0.34 (0.23)	-0.07 (0.23)	0.76 (0.32) ^a
Total Comprehensiveness	0.46 (0.30)	-0.19 (0.29)	0.83 (0.38) ^a
	District-Level Mean Percent Overweight or Obese		
	Slope for 10 Unit Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
Total Strength	0.12 (0.36)	-0.16 (0.36)	1.35 (0.50) ^b
Total Comprehensiveness	0.19 (0.47)	-0.53 (0.45)	1.35 (0.60) ^a
	District-Level Mean Daily Servings Fruit		
	Slope for 10 U Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
NEWP Comprehensiveness	-0.009 (0.012)	0.023 (0.010) ^a	-0.017 (0.017)
	District-Level Mean Daily Servings Vegetables		
	Slope for 10 Unit Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
Total Strength	-0.012 (0.009)	0.018 (0.008) ^a	0.016 (0.012)
Total Comprehensiveness	-0.014 (0.011)	0.027 (0.011) ^a	0.013 (0.014)
NEWP Strength	-0.006 (0.006)	0.013 (0.006) ^a	0.017 (0.011)
	District-Level Mean Daily Servings Fruit Juice		
	Slope for 10 U Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
USDA Comprehensiveness	-0.003 (0.010)	0.012 (0.008)	-0.027 (0.014) ^c
	District-Level Mean Days per Week of Physical Activity		
	Slope for 10 Unit Increase in WellSAT Score		
	Low FRPL	Medium FRPL	High FRPL
PEPA Strength	0.053 (0.024) ^a	-0.022 (0.026)	0.116 (0.043) ^b
PEPA Comprehensiveness	0.047 (0.032)	-0.010 (0.031)	0.132 (0.044) ^b
	District-Level Mean Daily Servings Soda		
	Slope for 10 U Increase in WellSAT Score		
NEWP Comprehensiveness	0.02 ^a , but no significant interactions with FRPL categories		

Model adjusted for district FRPL category, minority enrollment percentage and geographic location category.

FRPL, Free or Reduced-Price Lunch Eligibility; Low FRPL, <35%, Medium FRPL, 35 ≤ 50%; High FRPL, >50%; USDA, Standards for USDA School Meals; NEWP, Nutrition Education and Wellness Promotion; PEPA, Physical Education and Physical Activity.

^aSignificant at $P < 0.05$.

^bSignificant at $P < 0.01$.

^cMarginally significant ($0.05 < P < 0.07$) adjusted for multiple comparisons (Tukey).

mimics findings from similar studies in other states and in national samples [7, 25, 36–38], and is likely a result of the considerable latitude given by the CNRA and HHFKA to local school districts to achieve wellness policy goals [39]. Minnesota school districts scored moderately on wellness policy Total Comprehensiveness ($M = 64/100$), but still left much room for improvement in addressing the topics covered by the WellSAT subscales. The weakest area for Minnesota school wellness

policies was the Nutrition Standards for Competitive and Other Foods and Beverages subscale.

Many school districts (29%) used the same standard template policy for their district policy. Results indicated that WellSAT scores were more than twice as strong for districts that used an original non-template policy compared with scores for districts with an exact template policy. One might postulate that template-based wellness policies may have been

adopted to meet legal mandates and may not be as highly utilized as tailored school district wellness policies that match the needs and capabilities of individual school districts. Supporting this theory, Murphy found that the greatest reduction in the availability of low-nutrient density competitive foods in K-12 vending machines pre- versus post-wellness policy was seen in schools that developed their own original wellness policy versus using a standard template [13].

There were no meaningful associations between wellness policy scores and district-level high school student weight-related outcomes in the overall sample. Though school wellness policies have been developed in nearly all Minnesota public schools (98%), this may not mean that the policies are being implemented as written. As evidence of this, previous research utilizing the same WellSAT data indicated low concordance between district policy scores and school-level practices and policies in Minnesota public middle and high schools [40].

The lack of significant overall relationships among WellSAT scores and student weight-related outcomes in this study adds to the body of research indicating mixed results of the influence of school wellness policies on student health, especially within student BMI and physical activity. In agreement with our results, research studies from school districts in other states have found that the enactment of a school wellness policy was not significantly associated with a change in BMI [21] or prevalence of student obesity [22]. This study found no significant relationship between the overall scores of wellness policies and mean days of student physical activity. It is possible that the adoption of stronger state PE mandates for schools would translate into more physical activity time for students, as other studies have shown modest but significant increases in student physical activity (rates of PE attendance and days of vigorous physical activity for at least 20 min) after states adopted PE mandates [27, 28].

It is of particular interest that the present study found no overall relationships between wellness policy strength or comprehensiveness scores and student nutrition behaviors in the sample, given

that many other research studies have shown these relationships [10–14]. Perhaps a broader measure of student nutrition behaviors other than daily serving outcomes would lead to more expected results.

Though our overall sample showed no meaningful associations between wellness policy quality and district-level student weight-related outcomes, associations of wellness policy quality with student weight-related outcomes were found to differ across district-level demographic characteristics. Specifically, findings indicate that the majority of the significant associations between school wellness policy quality and district-level student weight-related outcomes were in school districts with higher rates of FRPL-eligible students, a proxy for economically disadvantaged districts.

In high FRPL school districts, stronger and more comprehensive policies were associated with higher mean BMI percentile and higher mean percent of overweight or obese students. It is possible that school districts with higher obesity rates have responded by strengthening their policies [23], as the high FRPL districts in this sample also had the highest mean student BMI percentiles and percent overweight or obese. Similarly, other studies have found higher obesity prevalence among students in states with stronger policy scores on nutrition and PE [23] and more comprehensive obesity prevention policies [24]; though to our knowledge, aside from this study, this association has not been found specific to high FRPL school districts only.

High FRPL districts showed significantly higher mean days per week of student physical activity as scores increased on the PEPA subscale for both strength and comprehensiveness. Interestingly, there was also a significant positive association between PEPA strength scores and student mean days per week of physical activity in the low FRPL districts. Stronger policy statements regarding physical activity may be leading to increases in physical activity opportunities for students in both high and low FRPL districts. Medium FRPL districts showed significantly higher mean student daily servings of fruits and vegetables as scores increased on the NEWP subscale for comprehensiveness (fruits) and strength (vegetables). For Medium FRPL

districts, mean daily servings of vegetables also increased with higher WellSAT Total Strength and Comprehensives scores. Results from this study also indicated that, compared with low FRPL districts, high and medium FRPL district students are consuming more servings of soda, sports drinks and SSB and fewer servings of fruits and vegetables; and high FRPL district students are also engaging in less physical activity than low and medium FRPL district students. Research has indicated higher rates of overweight in children of lower socioeconomic status (SES) [41], with studies also finding lower consumption of nutrient-rich foods, lower levels of physical activity and more television viewing compared with their higher SES bracket counterparts [41, 42]. This suggests that improving the school wellness environment could have a more significant impact in the higher FRPL districts. The significant findings in the high and medium FRPL districts that associate stronger and more comprehensive policies with healthier student outcomes (increased physical activity and increased consumption of fruits and vegetables, respectively) suggest that high-quality wellness policies may promote health-related initiatives in these more economically disadvantaged districts.

School districts address most CNRA and HHFKA requirements, but district wellness policies are weak and often do not require action [39]. Previous studies have shown that when states strengthen school wellness policies through legislative or executive means, significant improvements are made upon student health and schools' compliance with their wellness policies [36, 43–45]. Having community members united in the fight against childhood obesity seems to be a key element in getting childhood obesity prevention legislative policies the momentum they need to gain acceptance and action at a state level, specifically in the development and advocacy of the policy and in acquiring media coverage of the policy [46].

Given the disparities between policy development and school practices [40] and the lack of overall associations shown between policy scores and student weight-related outcomes in the current study, further research must be conducted on how

best to evaluate wellness policy implementation. This, in turn, may identify what factors most influence successful wellness policy implementation that lead to measurable improvements in student health.

The findings for medium and high FRPL districts expose the need to investigate how all school districts are utilizing available resources to promote healthy student behaviors. For instance, it would be helpful to determine whether school districts with more financial resources (low FRPL districts) are providing healthier environments for their students in the absence of strong policies or whether a possible lack of policy monitoring in these districts has led to poorer implementation of strong policies, with questions arising from other research [40].

Strengths and limitations

This study's strengths include the large WellSAT sample size ($n=325$ for policies scored and $n=270$ for WellSAT/MSS matched school districts), a statewide sample, and the inclusion of both nutrition and physical activity behaviors of relevance to positive student weight-related outcomes. A key limitation of this research is the cross-sectional design without access to longitudinal data for wellness policy quality. In addition, with student data aggregated to the school district level; this analysis did not allow the determination of the degree to which student weight-related outcomes varied between districts and thus which differences in WellSAT scores would be relevant to examine. Also, it was not possible to coordinate the exact timing of wellness policy collection to the completion of MSS surveys and the availability of school district demographic data; though each source did overlap in 2013. The self-report student data from the MSS is another potential limitation, as this can result in biased reporting and lead to faulty conclusions. Also, Minneapolis public schools did not participate in the 2013 MSS, so data from a large urban district is missing from the analysis of districts with both MSS and WellSAT scores. Finally, it would have been ideal to include all school types (e.g. charter and private schools) to create a snapshot of the entire state's school wellness policies. However, to

keep the sample relatively uniform and comparable, only public school districts were included in the study.

Conclusion

This study provides a systematic review of the quality of school wellness policies for a large sample of Minnesota public school districts. Study results indicated that overall, Minnesota public school district wellness policies are moderately comprehensive but weak in terms of requiring specific action. Findings also revealed that the quality of school wellness policies is most strongly associated with student weight-related outcomes in school districts with higher percentages of students eligible for FRPL. More specifically, in high FRPL districts, higher quality policies are associated with higher student mean BMI percentiles and the mean percent of students overweight or obese, but are also associated with students engaging in more physical activity. In medium FRPL districts, stronger and more comprehensive policies are associated with students eating more vegetables. Results suggest that high FRPL districts with higher student BMI percentiles may recognize the need for better wellness policies and increased opportunities for physical activity to improve student health.

Recommendations include that high FRPL districts receive focused interventions on obesity prevention and treatment and that state governments increase involvement in school wellness policy development and implementation. A prospective study of the variables examined is also recommended, along with studies examining how best to evaluate wellness policy implementation, what factors most influence successful policy implementation, and why differences were found between policy quality and student weight outcomes, physical activity outcomes and dietary outcomes in school districts with differing financial resources. Finally, it is recommended that wellness policy standard templates should be carefully examined by wellness teams in each individual school district to ensure that the policy elements are uniquely applicable to school

attributes and that the statements are strong, comprehensive and able to be implemented.

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Conflict of interest statement

None declared.

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