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A Multivariate Analysis of Federally Mandated School Wellness Policies on Adolescent Obesity

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A B S T R A C T

Purpose: To evaluate the effects of school wellness policies mandated by the 2004 Child Nutrition and WIC Reauthorization Act on the prevalence of overweight and obesity among adolescents.
Methods: Multivariate logistic regressions, adjusted for clustering within school districts, were used to estimate the effects of district-level wellness policies on the odds of overweight and obesity among adolescents. The analyses were performed on a population-based sample obtained from the Utah Population Database, a compilation of vital characteristic, administrative, and genealogical records on all residents in Utah. Models controlled for individual, maternal, and familial characteristics, as well as characteristics of school district of residence. Self-reported body mass index was taken from drivers license data.
Results: Each additional component included in a district's wellness policy was associated with as much as: 3.2% lower odds in the prevalence of adolescent overweight (OR = .968; 95% CI = .941–.997), 2.5% lower odds of obesity (OR = .975; CI = .952–.997), and 3.4% lower odds of severe obesity (OR = .966; CI = .938–.995). Wellness policy components related to diet were significantly associated with lower body mass indexes across all three thresholds, whereas those related to physical activity had significant associations for lower odds of severe obesity only.
Conclusion: Results suggest that school wellness policies can significantly reduce the risk of adolescent obesity. Further research should address specific policy components that are most effective in various populations, as well as the level of commitment that is required at both the school- and district-levels for sustained effect.

Nearly one-third of children and adolescents in the United States are overweight [1], and the rate of adolescent obesity has nearly doubled over the past 2 decades [2]. The increase in childhood obesity rates is the result of a complex interplay of social, environmental, and policy factors that influence children's nutritional intake and activity levels [3]. School environments present a special opportunity to counteract the increase in adolescent obesity rates. Children spend most of their time away from home [4,5], consume an estimated 33% of their daily caloric intake, and typically expend 50% of their daily caloric outtake while in school [3]. Recognizing such extensive exposure, researchers [5,6] and policy makers [7,8] have maintained that schools might facilitate reduction in childhood obesity rates through school-based promotion of healthful dietary behaviors and physical activity, as reflected in the passage of 2004 federal legislation requiring school districts to establish wellness policies [9].

Population-based research investigating the effect of schools' prevention practices within the school environment, such as modifications to competitive foods or increased physical educa-

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tion requirements, on children's body mass index (BMI) has been limited [4,6,10]. Among those studies which examined the effect of schools' prevention practices on obesity rates [11–17], a few found evidence of policy impacts [11–15,17]. However, the associations were generally inconclusive because of the little variation in practices across schools [11,12] or because of the absence of critical covariates, such as parental BMI [11–16] and school-level socioeconomic status (SES) [15].

Few studies have been conducted on the effectiveness of district-level wellness policies, particularly those enacted under the Child Nutrition and WIC Reauthorization Act (CNRA) of 2004 [9], which mandated that all school districts receiving federal funding under the National School Lunch Program and Child Nutrition Act of 1966 establish nutritional guidelines for foods available on school campuses and a general wellness policy, with implementation plans, no later than the beginning of the 2006–2007 school year [9]. The CNRA gave considerable latitude to local school districts in adopting specific components to achieve, with community involvement, wellness "goals" in the three general areas of nutrition education, physical activity, and other school-based wellness activities [9]. As a result, there was considerable variation in the detailed composition of wellness policies implemented across local school districts.

The primary objective of this analysis was to use a population-based sample of adolescents to investigate the extent to which CNRA mandated wellness policies, at the school district-level, have been effective in curbing the risk of childhood overweight and obesity. This analysis was performed on a population-based sample of children in Utah and incorporated extensive measures of individual, household, and school district-level characteristics as covariates.

Methods

Data

The analysis used three data sources: first, data on individual children and families were extracted from the Utah Population Database (UPDB) [18]; second, school district data were taken from the Common Core of Data (CCD) [19]; and third, information about each Utah school district's written wellness policy was based on evaluations reported in past research [20].

The UPDB is a genealogically linked clearinghouse of de-identified administrative records, including merged vital statistics and drivers license information, for all Utah residents. Demographic characteristics of the mother and child were obtained from the child's birth certificate. Self-reported height and weight during adolescence (age 15–19 years) were taken from each child's first state-issued drivers license. Residential addresses taken from the drivers license were converted to geographic coordinates which placed each child within one of the 40 Utah school district boundaries. Thus, the assignation of school district was made according to residence within a district and not according to individual-level enrollment data. Sociodemographic characteristics of the school district of residence were thereby linked to individuals.

The CCD is a yearly survey of school and school district officials conducted by the federal Department of Education. The variables from the 2006–2007 survey used for the current analysis included each district's sociodemographic composition, specifically the percentage of students eligible for free and reduced price meals, a rural/nonrural designation, as well as the average median income of school district residents appended from the 2000 U.S. Census.

Between July and August of 2006 examinations were undertaken, and assessments made, of wellness policies that had been written and/or adopted by Utah school districts by July 1, 2006 in response to the CNRA legislation [20]. Each component of a policy was characterized as "mandated," "suggested," and "non-mandated" on the basis of policy language [20], as has now become customary [21]. Components were designated as adopted in this analysis only if they were "mandated."

As of the assessment, 75% of Utah school districts had wellness policies (30 of 40 districts) [20], encompassing approximately 94% of Utah school children [19]. Thus, the percentage of Utah children exposed to CNRA wellness policies in 2006–2007 exceeded the national average of 81% [21]. Subsequent reexaminations of these 30 districts' wellness policies revealed that only minimal and inconsequential modifications were made to these original policies through 2009.

Sample

The analytical sample was restricted to the cohorts first exposed to the CNRA wellness policies while in secondary school, that is, the 40,713 adolescents born in Utah between 1990 and 1992 residing within one of the 30 sample Utah school districts and receiving their drivers license after January 1, 2007, 4 months after those policies went into effect. This date was chosen on the basis of the findings in previous studies of lag between the implementation of health interventions and effect [22–24] of as little as 4 [22] to 8 weeks [23].

Subjects who moved from the state or had not yet applied for their drivers' license by 2009 were excluded, as no BMI data were available on them. The sample represented 37.2% of all births that took place between 1990 and 1992.

Although Utah is not as racially diverse as the nation as a whole, the state's ethnic and racial diversity has increased considerably in recent decades. About one-quarter of Utah's population growth during the 1990s was of Hispanic origin and over one-third of net migrants were foreign-born [25]. These demographic changes are reflected in Utah school districts. For instance, Hispanic students comprise 37.4% of the population in the Salt Lake City School District. Further evidence of the demographic and socioeconomic diversity across Utah school districts is reflected in Table 1.

Measures

Self-reported height and weight were taken from the child's first state-issued drivers license obtained between the ages 15 and 19 years. BMI was calculated (weight in kg divided by height in meters squared) and then converted to a percentile score using the 2000 Centers for Disease Control and Prevention (CDC) sex-and-age-specific growth curves for children [26,27]. In accordance with these guidelines, three dichotomous variables were created to indicate the child's obesity risk: overweight (at or above the 85th percentile), obese (at or above the 95th percentile), and severely obese (at or above the 98th percentile) [26,27]. Although less reliable than clinically assessed measures, self-reported BMIs are highly correlated with clinical measures. The use of self-report measures, including data from drivers license [28], is established in epidemiologic research on obesity [29,30].

Table 1
Selected characteristics of Utah school districts

	Mean or %	Median	Standard deviation	Minimum	Maximum
% Rural (binary)[a]	40%	0	49.6	0	1
% of students who are non-white	16%	12.8%	13.1	1.8%	58.4%
% of students who are ESL[b]	6.6%	4.8%	6.5	.0%	30.3%
% of students eligible for free/reduced price lunch	37%	38.9%	14.3	3.2%	72%
Median household income	$45,219	$41,641	10,516	$31,673	$88,029
% of students overweight[c]	17.9%	18.0%	5.1	8.5%	31.3%
% of students obese[c]	7.2%	7.2%	2.8	0%	13.3%
% of students severely obese[c]	2.8%	2.8%	1.6	0%	6.3%
Mean maternal BMI (mean BMI of all mothers in district)	23.42	23.44	.57	21.42	24.98

[a] Rural includes the geographic classifications used by the Common Core of Data (CCD) of: "rural remote," "rural fringe," and "rural distant" [19].
[b] ESL = English as a second language.
[c] Overweight is BMI ≥85th percentile, obese is BMI ≥95th percentile, and severely obese is BMI ≥98th percentile, based on growth curves and thresholds recommended by the Centers for Disease Control and Prevention [26,27]. School data were taken from CCD [19], collected in 2006–2007. BMI was calculated from reported height and weight on Utah Population Database (UPDB) [18] for children born between 1990 and 1992 who obtained their first Utah state drivers license after January 1, 2007.

Each district's wellness policy was assessed in terms of specific policy components associated with three broad policy domains: (1) physical activity and education, (2) competitive food, nutrition practices, and nutrition education, and (3) other wellness-related components. Table 2 provides a comprehensive list of the specific components within each of these three wellness policy domains. Domain subscales were generated by counting the number of separate components within each of the three wellness domains. Districts' policies contained from zero to nine mandated components related to "physical activity and education," with a mean of 2.3 mandated components per district (SD = 1.6). The range of mandated "competitive foods and nutrition practices and education" components was zero to seven, with a mean of 1.8 mandated components per district (SD = 1.62). The range of mandated "other wellness-related components" was zero to five, with a mean of 1.2 mandated components per district (SD = 1.02). Factor analysis was used to limit domain subscales to those components having high internal validity, as evidenced by Cronbach's alpha values of a minimum of .61.

Table 2
Description of school district wellness policies by domain

Did the district include language mandating the following components in their 2004 CNRA-mandated wellness policy?	% of districts mandating policy (n = 30)
Physical activity and education[a]	
Core PE curriculum in elementary schools	53%
Core PE curriculum in secondary schools	57%
150 min/wk aim for PE instruction and activity	17%
At least two recess or "active" periods each school day	7%
Prohibiting the use of recess as punishment	17%
Schedule recess before lunch	10%
Promote/establish safe walking and biking routes to/from school	13%
Lifelong fitness and activity instruction emphasis	33%
Intramural sports and activities promotion	23%
Competitive food and nutrition practices and education[a]	
Nutrition education core curriculum	47%
Ban/restrictions on all competitive foods, grades K-6	50%
Ban/restrictions on vending in elementary schools	50%
Ban/restrictions on vending in secondary schools	3%
Fruits/vegetables for sale where competitive foods sold	7%
Nutrition standards for all snacks, sweets, and side dishes sold outside of school meal programs	10%
Portion size standards for all foods served	17%
Other wellness related components[a]	
Participate in Gold Medal School Program (voluntary state wellness program)	30%
Food restriction on fundraising activities	13%
Wellness programs for staff	20%
Wellness programs for parents	20%
Yearly wellness program review/evaluation	33%

Notes: [a]Factor analysis was used to confirm the strength of the three domains. Cronbach's alphas, illustrating the internal validity of each scale, were .80 for the physical activity and education domain, .61 for competitive foods and nutrition practices and education, and .66 for other wellness related components domain. Source: Assessments based on evaluations of written wellness policies reported in previous publication [20].

Several demographic and household-level socioeconomic characteristics of the child, as well as sociodemographic characteristics of each school district, were included to control for confounding between school policy and childhood BMI. District-level characteristics, which were taken from the CCD, included designation of rural (remote, distant, and fringe) or nonrural (all other geographic classifications) school districts [19], the percentage of students within each district eligible for free and reduced price school meals, and the median income of school district residents. Individual and household-level characteristics included the child's precise age at the time of the drivers license, and race, sex, ethnicity, maternal marital status, education, and prepregnancy BMI from birth certificate information included on the UPDB. Sociodemographic and biometric information on parents subsequent to birth would have been desirable but was not available. A proxy for the community's propensity for obesity was also generated by calculating the mean pre-pregnancy maternal BMI between 1990 and 1992 associated with each school district.

Analysis

A series of multivariate logistic regressions was run on each BMI risk category (overweight, obese, severely obese). Sample weights were assigned to adjust for sample selection bias, and the Huber–White modified sandwich estimator was applied to adjust for biased standard errors that might arise given the non-independent nature of our observations (i.e., students nested within school districts) [31–33]. Hierarchical linear models are also commonly used to address the dependent nature of clustered observations. Although slight differences were manifest

between these two estimators, neither the statistical significance nor substantive interpretation of our findings changed when the models were estimated with hierarchical linear models. Analyses were performed in STATA 10.1 Intercooled, manufactured by StataCorp LP.

Results

Approximately 18% of the entire sample was overweight, with considerable variation across districts. For example, slightly more than 8.5% of adolescents were overweight within the Wayne County School District, whereas 31.3% of adolescents were overweight in the Tintic School District. Figure 1 provides a map summarizing variation in the sample prevalence of overweight across Utah school districts. The districts also varied in other dimensions as illustrated by those provided for the 12 selected districts in Figure 1. For instance, even among the highly urbanized school districts along the Wasatch front (north–central Utah), where 76% of Utah residents reside, there was substantial variation in SES and enrollment.

Odds ratios (ORs) highlighting the relationship between district wellness policies and overweight and obesity prevalence from the multivariate models are presented in Table 3. Model 1 included controls for socioeconomic and geographic differences across districts; model 2 included additional controls for individual (e.g., age, gender, race, ethnicity) and household environment characteristics (e.g., maternal education, marital status, and maternal prepregnancy BMI). Model 3 incorporated an additional control for the mean maternal BMI associated with each district.

In each of the models, stronger district-level policies, as measured by an additional mandated component within each domain, were associated with significantly lower odds of overweight, obesity, and severe obesity among children within each district (ORs ranged from .966 [CI = .938–.995] to .975 [CI = .955–.995]). Policy effects were dampened with the addition of controls, but the significant association between policy and lower odds of BMI remained in the completely adjusted specification (model 3). The significant effects associated with covariates describing the individual, household, school district, and community contexts (not shown) were all in the expected direction.

Additional models were estimated on cohorts born earlier and unexposed to the CNRA wellness provisions to test whether policy variables might be acting as proxies for unmeasured characteristics, such as a district's historical commitment to wellness-related activities. The models reported in Table 3, with the absence of maternal BMI which was not available before 1990, were run on a sample of Utah children born between 1983 and 1990 who obtained a Utah drivers license before September 2006. Several of the policy domains were significantly associated with lower odds of obesity risk in these regressions. However, when district-level maternal BMI between 1990 and 1992 cohorts was incorporated as an instrument for maternal BMI in these regressions only one significant policy effect remained. Figure 2 presents a visual comparison of the salient ORs from the entire models on the exposed versus the unexposed cohorts. Tabular results for this analysis are available from the authors on request.

Discussion

Given the sharp increase in childhood obesity over the past several decades [1,2], policy makers have looked toward the school environment as a potential venue for bending the obesity curve [3,7,34]. The Centers for Disease Control and Prevention [34], the Institute of Medicine [3], as well as a recent White House report [7] have all called for school-based interventions to reduce and prevent adolescent overweight and obesity. To date, these recommendations have largely been anchored in inconclusive empirical evidence regarding whether the school environment can make a significant difference in reducing childhood obesity risk [4,6,10]. Findings from the current study support the conclusion that district-based wellness policies, as mandated by the nationwide CNRA legislation, are associated with lower odds of adolescent overweight and obesity, effects that persisted even after controls were integrated for characteristics of the individual, family, school, and community.

This study suggests that certain types of wellness policies seem to be more effective for some at-risk groups than others. For example, policy components related to "competitive foods and nutrition practices and education" seem to have particular significance among obese children (BMI ≥95th percentile), whereas components related to both "competitive foods and nutrition practices and education" as well as "other wellness related components" were associated with lower odds of overweight (BMI ≥85th percentile). All three domains were associated with lower odds of severe obesity (BMI ≥98th percentile). These findings suggest that policy could be tailored to risks faced by particular schools when schools or districts are constructing wellness polices.

While uncovering an independent effect of school policy, the analysis also corroborates the large body of research that several other factors are clearly important in the risk of childhood obesity. Although not shown, maternal education and marital status, as well as the child's racial and ethnic identification, were all significantly associated with a child's propensity to be overweight, obese, or severely obese. Similarly, children from school districts with relatively high SES had lower odds of overweight, obesity, and severe obesity. The odds of overweight, obesity, and severe obesity were strongly correlated with whether the child's mother was obese as well, suggesting that there is a transmission of risk and lifestyle through a child's exposure to obesity at home and in the community [35,36]. Additional research on the interaction of school district wellness policies with these covariates will permit greater understanding of how policies differentially affect populations at greatest risk for obesity, and may provide additional insights into crafting policies that affect risk indirectly through interacting with these other critical covariates.

The significant effects associated with the "other wellness-related domain" indicate that some of the components contained in that domain, such as multilayered support and involvement from peers, parents, schools, and community, may contribute independently to a reduction in childhood obesity risk. Most of the policies in that domain consisted of programs encouraging behavioral changes that extended to a child's mentors, parents, and community members. Such "community" effects that extend beyond the local school level where parents are generally most invested were unexpected, but are intriguing and merit additional research.

Figure 1. Percentage of sample overweight by school district and sociodemographic profiles of selected school districts in Utah. Notes: Highlighted information on selected districts provides a geographic overview of statewide variation in district characteristics. Overweight is a BMI ≥85th percentile; free or reduced price meals indicate the percent of district students eligible for federally funded free and reduced priced meals; median income represents the median family income of the district (2000). Sources: UPDB [18], CCD [19], and wellness policy components based on evaluations of written wellness policies reported in a past publication [20].

Table 3
The effect of selected district-level wellness policies on the overweight, obese, and severely obesity risk among children in Utah (odds ratios)

District level wellness policy domains	Overweight[a]			Obese[a]			Severely obese[a]		
	Model 1[b]	Model 2[c]	Model 3[d]	Model 1[b]	Model 2[c]	Model 3[d]	Model 1[b]	Model 2[c]	Model 3[d]
Physical activity and education	1.01	1.01	1.00	1.00	.994	.990	.981	.973*	.970*
(95% confidence interval)/p	(.983–1.04)/.436	(.995–1.02)/.276	(.993–1.01)/.516	(.970–1.03)/.997	(.979–1.01)/.443	(.974–1.01)/.265	(.945–1.02)/.311	(.962–.984)/.000	(.959–.981)/.000
Competitive foods and nutrition practices and education	.954	.971**	.975**	.957	.971	.975**	.952	.963**	.966**
(95% confidence interval)/p	(.898–1.013)/.126	(.95–.994)/.013	(.955–.995)/.016	(.885–1.03)/.269	(.937–1.01)/.096	(.952–.997)/.03	(.881–1.03)/.219	(.932–.995)/.022	(.938–.995)/.023
Other wellness-related components	.907**	.949*	.968**	.905**	.959***	.98	.889**	.949*	.967***
(95% confidence interval)/p	(.834–.987)/.024	(.922–.976)/.000	(.941–.997)/.028	(.824–.994)/.038	(.930–.988)/.006	(.953–1.01)/.159	(.800–.988)/.029	(.921–.977)/.001	(.945–.989)/.004

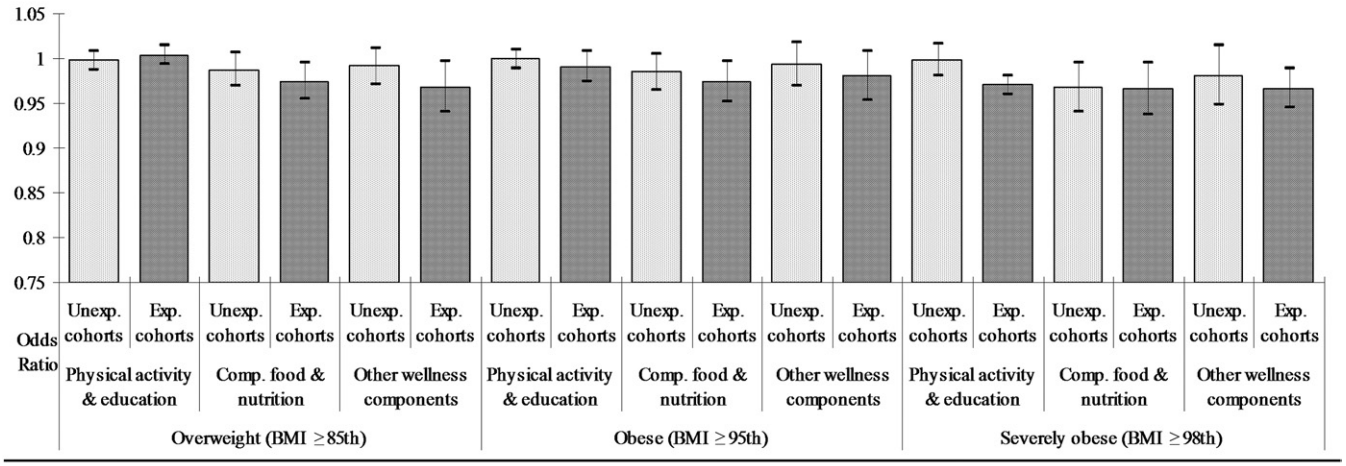
Odds ratios were based on transformed coefficients in multivariate logistic regressions with the Huber–White modified sandwich clustering connection.
[a] Overweight is BMI ≥85th percentile, obese is BMI ≥95th percentile, and severely obese is BMI ≥98th percentile, based on growth curves and thresholds recommended by the Centers for Disease Control and Prevention [26,27].
[b] Model 1 included additional controls for schools district-level median income, rural/nonrural designation, and total students eligible for free and reduced price lunch.
[c] In addition to model 1 characteristics, model 2 included additional controls for individual age, race, ethnicity, and sex, maternal education level, maternal prepregnancy body mass index, and maternal marital status.
[d] The completely adjusted, model 3 added mean mother's body mass index for each district to all controls included in model 2.
* $p < .001$.
** $p < .05$.
*** $p < .01$.

Sample students attending private schools, receiving home-schooling, or attending a school outside the district under "open enrollment" were not directly exposed to the policies under investigation, but could not be identified. Although a limitation, less than 3% of all Utah high schools students were enrolled in private school or home-schooled in 2006–2007, and the majority of open enrollment in Utah occurs within school districts, not across districts; such open enrollment students were therefore exposed to the policies under investigation. Additionally, in models incorporating the percentage of a district's eligible student population that was home-schooled and enrolled in private schools (not shown), policy impacts were nearly identical. Of course, there could have also been indirect effects of policy through residential social networks even on behavior of such students, but such spillover effects could not be analyzed.

As with nearly any observational study, an additional limitation of this study is that the findings are correlations, not causations. For instance, it is worth considering whether wellness policies adopted by Utah school districts under the guise of the 2004 CNRA were simply carryover policies from existing state and school board rules and regulations [20]. State-level regulations certainly play an influential role on structuring or changing the school environment [37]. Accordingly, Utah districts might have shared a basic policy "shell" before the passage of the 2004 CNRA. Limiting the sample to a single state in the current analysis, of course, controlled for any role that cross-sectional statewide regulations might have played in the creation of district-level wellness policies, and incorporation of cohort dummies to adjust for changes in state policy over time did not affect the results (data not shown). Extensive variation in policies across school districts, as documented, permitted the richness of this analysis.

Additionally, policy effects uncovered here may be partly attributable to an individual district's historical commitment to wellness being transmitted into the formal wellness policies adopted. An example would be membership in Utah's Gold Medal School Program, a voluntary program implemented in 2001/2002 that contained wellness components similar to those found in the districts' CNRA wellness policies. Although there might be some residual effects of individual district's historical commitment to wellness filtering into the results, the incorporation of the unexposed cohort into the analysis, and the results on that cohort (Figure 2) demonstrate that policies adopted concurrent to the CNRA legislation seem to have independent effects.

Certain elementary school components were permitted to load onto wellness policy domains, even though the sample of secondary school students was unexposed to such components. Although counterintuitive, deletion of the mandated elementary components from the model yielded weaker policy results (particularly for the competitive food, nutrition practices, and education domain). Further analysis of such elementary school mandates demonstrated a strong correlation with "suggested components" at the secondary school level, which were treated alongside "non-mandated components" in the dichotomous assignment of policy as simply "non-adopted." Therefore, it is likely that the mandated elementary school components acted as proxies for certain "suggested components" at the secondary school level that had significant effect on risk of adolescent obesity. Indeed, 100% of the districts mandating restrictions on elementary school vending practices recommended vending restrictions on the secondary school level. It would be valuable for future



Note: Odds ratios reflect the effect of an additional wellness policy component within each wellness policy domain in completely adjusted multivariate regressions (model three in table 3) which control for sociodemographic, maternal, and school district socioeconomic characteristics. The 1983 to August 1990 cohorts attended school (or obtained a drivers license) prior to introduction of the Child Nutrition Reauthorization Act (2004) wellness policies, which was implemented at the start of the 2006/07 school year. For the 1983 to August 1990 cohorts, mean pre-pregnancy maternal BMI at the district level from the September 1990 to 1992 cohorts was used as an instrument for maternal BMI.
*Results on exposed cohorts are also limited to those receiving their drivers license after January 1, 2007 to account for policy lag.
High-low bars indicate 95% confidence intervals.

Figure 2. Effect of district wellness policies on adolescent obesity by policy domain and BMI percentile threshold for birth cohorts exposed (exposed cohorts born between September 1990 and 1992, receiving a drivers license after January 1, 2007 [Results on exposed cohorts are also limited to those receiving their driver's license after January 1, 2007, to account for policy lag]) and unexposed (unexposed cohorts born between 1983 and August 1990) to wellness policies. Notes: Odds ratios reflect the effect of an additional wellness policy component within each wellness policy domain in completely adjusted multivariate regressions (model 3 in Table 3) which control for sociodemographic, maternal, and school district socioeconomic and demographic characteristics. The cohorts born between 1983 and August 1990, attended school (or obtained a drivers license) before introduction of the Child Nutrition Reauthorization Act (2004) wellness policies, which was implemented at the start of the 2006–2007 school year. For the cohort born between 1983 and August 1990, mean prepregnancy maternal BMI at the district-level between September 1990 and 1992 cohort was used as an instrument for maternal BMI.

research to analyze this more refined gradation of commitment on risk of obesity.

Additionally, policy adoption is dichotomous and does not convey evidence on rigor of enforcement, which is another reason why further data on enforcement and analysis of variation at the school level are of importance. Future research should not only evaluate a school's or district's de jure adoption of policies, but also de facto compliance and implementation of the policies.

Given the unparalleled richness of multilevel data, this analysis was limited to Utah, a state that, despite being one of the most urban states in the nation (76% of the population resides along the Northern Wasatch Front, Salt Lake City area) [38] is also more racially and ethnically homogenous and leaner than the country as a whole. However, the upward trajectory of obesity rates in Utah and the state's profile across SES and the growing racial and ethnic minority populations in the state closely mirrors that of the nation. However, studies focusing on other states and regions ought to replicate, to the extent possible, analyses of the type contained here to test the generalizability of our results.

Conclusion

The 2004 CNRA federal legislation mandating that all school districts write and implement a local wellness policy was premised on an assumption that changing the school environment to encourage healthy lifestyles might provide a counterweight to the childhood obesity epidemic in America. The robust associations between the CNRA wellness policy mandates and lower odds of overweight and obesity among Utah adolescents exposed to those policies in this analysis demonstrate that school district wellness policies can indeed be vital to obesity prevention efforts. Therefore, policy makers should remain focused on school-based wellness programs, while providing latitude in the specific types of policy components districts enact to ensure that the school environment is tailored to the characteristics of their respective populations. Furthermore, given the associations among a child's household and community environments and their BMI status, altering school environments should be only one part of an overall, comprehensive policy aimed at encouraging healthier behavior in a child's household and community.

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