HHS Public Access

Author manuscript

Child Obes. Author manuscript; available in PMC 2016 October 01.

Published in final edited form as:

Child Obes. 2015 October ; 11(5): 600–607. doi:10.1089/chi.2015.0005.

Healthier School Environment Leads to Decreases in Childhood Obesity – The Kearney Nebraska Story

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Abstract

Background—Schools play a role in addressing childhood obesity by implementing healthy eating and physical activity strategies. The primary aim of this case study was to describe prevalence of overweight and obesity among elementary school students in a rural Mid-western community between 2006 and 2012. The secondary aim was to use a novel approach called "population dose" to retrospectively evaluate the impact dose of each strategy implemented and its estimated potential population level impact on changes in overweight and obesity.

Methods—Weight and height were directly measured annually beginning in January 2006 to assess weight status, using body mass index ($kg \cdot m^2$), for all kindergarten – fifth grade students (N ≈ 2,400 per year). Multiple evidence-based strategies were implemented in nine schools to increase physical activity and healthy eating behaviors. BMI reporting and revised school meal programs were implemented district-wide. Comprehensive school physical activity programs

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Author Disclosure Statement

Kate A. Heelan: No competing financial interests exist
R. Todd Bartee: No competing financial interests exist
Betty Lou Sherry: No competing financial interests exist
Allison Nihiser: No competing financial interests exist

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

(CSPAP), school food environment, and supportive/promotional strategies were implemented at individual schools.

Results—The absolute change in prevalence of obesity (BMI ≥ 95th percentile) decreased from 16.4% to 13.9%, indicating a 15.2% relative change in prevalence of obesity in 6 years. There was an inverse relationship between the number of strategies implemented and prevalence of overweight and obesity over time.

Conclusions—District and school-level approaches have the potential to impact childhood obesity. Schools can successfully implement strategies to address overweight and obesity, but the extent of implementation between schools may vary. Population dose analysis can be used to estimate impact of clusters of strategies to address overweight/obesity.

Background

One-third (34.2%) of children aged six to eleven years are overweight or obese (1) and childhood obesity continues to be a major focus of public health efforts in the United States (2). Childhood obesity is associated with risks for developing conditions such as hyperlipidemia, hypertension, and type 2 diabetes (3–5), as well as social and emotional health challenges, including being bullied (6;7), poor self-esteem and depression (8). Good health and social outcomes are important goals for school health policy and program efforts (9), and a socio-ecological approach should be employed for achieving positive health and social outcomes in schools (10). Schools can play a vital role in addressing childhood obesity through the coordination of strategic planning, implementation, and evaluation of school-based healthy eating and physical activity policies and practices (11).

The Centers for Disease Control and Prevention (CDC) have synthesized research and best practices related to promoting healthy eating and physical activity in schools, providing nine guidelines with multiple strategies for implementation (11). Although it is unknown how many strategies are needed to achieve health outcomes, it is widely accepted that there should be multiple strategies implemented at multiple socio-ecological levels to increase physical activity and healthy eating, and reduce obesity (12–14). A recent review of evaluated obesity prevention studies and their impact on BMI found strong evidence to support the efficacy of school-based prevention programs, particularly for elementary school-aged children (15). Recommendations from the review suggest future studies should be designed to evaluate both impact (reduction in obesity) and process (implementation) (15).

It has been suggested that future research have more practical utility for decision makers and be broadened to enhance usability in the “real world” (12;16). A challenge to researchers implementing multi-strategy obesity prevention interventions is how best to compare and determine the overall impact of diverse intervention strategies using a common metric. The Center for Community Health and Evaluation [CCHE]) (17) has proposed an approach to estimate the impact of multi-strategy interventions on an average person’s behavior. In other words, the relative change in behavior of across both those who have been exposed to an intervention strategy, and those who have not been exposed.. CCHE refers to this estimated

impact as dose. Dose is a product of the intervention's reach and strength (a quantitative measure of impact based on frequency, intensity and outcomes from the literature).

The primary aim of this case study was to describe prevalence of overweight and obesity among elementary school students in a rural Mid-western community between 2006 and 2012. The secondary aim was to use a novel approach called population dose to retrospectively evaluate the impact dose of each strategy implemented and its estimated potential population level impact on changes in overweight and obesity.

Methods

Study Population

Kearney Public School (KPS) District is located in Kearney, Nebraska, a Mid-western community of approximately 30,000 people. Between 2006–2012, approximately 2400 elementary students were enrolled each year in grades kindergarten through fifth in nine schools. Five of the nine schools had over 40% of students receiving free or reduced federal meals, the threshold for Title I designation (18), and the district was primarily Caucasian (85%).

Intervention Strategies

A chronological view and description of the strategies included in this case study can be found in Table 1. KPS implemented the following strategies district-wide: body mass index (BMI) screening and referral program; local school wellness policy; the Carol M. White Physical Education Program grant (PEP grant # Q215F080323); district wellness team; healthier school meal program; and a new physical education curriculum. In addition to implementing the district-wide strategies, each of the nine individual schools implemented, to varying degrees, a comprehensive school physical activity program (CSPAP) and healthier school food environment strategies. Supportive and promotional education strategies including the implementation of the wellness policy, formation of wellness teams, school to family education programs, educational presentations to school staff, and data evaluation by administrators and teachers were implemented to build capacity in support of physical activity and healthy eating related strategies. All strategies were not implemented simultaneously, but were phased-in over the six years. Kearney Public Schools provided existing aggregate data for this study and the use of these data was approved by the University of Nebraska Kearney Institutional Review Board.

BMI Screening and Referral Program—KPS has been measuring each student's (k-5th grade) weight and height annually since 2006 as part of yearly health screenings completed by the school nurses and trained university volunteers. Individual student data were not followed over time; this was a series of seven annual, cross-sectional screenings from 2006–2012. Weight was measured using a Befour platform digital scale (PS6600, Befour Inc., Saukville, WI) to the nearest 0.1 pounds. Height was assessed using a standard portable stadiometer, measured to the nearest 0.25 inch. Both instruments were calibrated routinely. Both weight and height were measured without shoes and in normal street clothes without jackets and sweatshirts. These data were then entered into a BMI web application developed

at the University of Nebraska Kearney. Each student's BMI ($kg \cdot m^2$) was calculated and percentile determined using the gender specific BMI-for-age percentiles from the CDC 2000 Growth Charts. The accepted definition for normal weight was defined as a BMI percentile between the 5^{th} and 84.9^{th} percentile, overweight was defined as 85^{th}–94.9^{th} percentile, and obesity defined as equal or greater to the 95^{th} percentile (19). Each year, parents received a BMI report card describing their child's BMI. Students identified as obese were referred to a community-based child obesity treatment program (20).

Evaluation Procedures

Because there was variability in both district-wide and individual school strategy implementation and subsequent exposure among the schools, we calculated the dose using an approach developed by CCHE (17) with evidence for predictive validity (21). The dose was retrospectively calculated for four independent strategy groupings (set of coordinated activities (21): (1) CSPAP which included both quality physical education and physical activity opportunities outside of physical education (e.g., recess, classroom physical activity breaks, after school programs), (2) school food environment which included all food in school outside of the meal program such as classroom food rewards, classroom parties and fundraisers, (3) BMI screening, reporting and community obesity treatment program, and (4) school meal program.

The CCHE defines dose as an estimate of community-level change in the expected desirable outcome as a result of a community change strategy or strategies (21). We used implementation data regarding frequency, duration, magnitude of changes, and evidence from the literature to estimate behavior change and their estimated impact on BMI change. Behavioral outcomes of interest were increasing physical activity, decreasing unhealthy/high calorie foods, and increasing healthy food consumption. The dose of each strategy is the product of reach and strength of the strategy.

Reach calculation—Reach was equal to the percentage of students enrolled in KPS grades K-5 who were exposed to a strategy (number of students exposed (participated) / number enrolled in each school). Reach was calculated for each individual school (n=9). For example, if 50 students in a school with 150 enrollment participated in the lunchtime walking program, then reach of that strategy would be 33%.

Strength calculation—Strength is equal to the degree to which students exposed to a strategy might change their healthy eating and/or physical activity behaviors to make healthier choices as a result of being exposed. Frequency of exposure, intensity of exposure, degree to which the healthy choice is the only choice, and supporting promotional and educational strategies are all factors that can be used to determine strength (17).

Strength scores were based on empirical evidence collected and analyzed by CCHE (17). CCHE calculated strength scores in a blinded manner, only reviewing implementation data for each strategy without knowing the BMI trends over time, to help ensure an unbiased analysis. Strength was calculated for each individual school (n=9). For example, if a new physical education curriculum was implemented in a school and it increased moderate/ vigorous physical activity minutes from 10 minutes to 12 minutes every day, then the

strength of that strategy would be 1.1%. In the absence of baseline data, we use CDC estimates of physical activity that states that elementary aged children get an average of 85 minutes of MVPA per day (22). If we increase activity by 2 minutes to baseline on 5 of 7 days a week, during eight months a year that school is in session we get 1.1% change in physical activity overall.

Analysis

The absolute and relative change in percent of children whose BMI percentile was between the 85th and 94th percentile (overweight) and equal to or greater than the 95th percentile (obese) were calculated between 2006 and 2012. Each year, a census was collected from all students in grades k-5.

The number of district-level strategies were described each year between 2006 and 2012 in an additive format and graphed. A dose score was calculated at the end for individual school strategies based on level of implementation (reach x strength) as described above.

Results

Ninety-seven percent of the total student body was screened for height and weight each year with minimal fluctuation in percent of students receiving free and reduced lunch (7.1%) and a 9.75% mobility rate within the elementary schools (Table 3). Therefore, the change in the prevalence of overweight and obesity reflects the actual difference in the population. Figure 1 shows the percent of overweight and obese students attending KPS elementary schools annually from 2006–2012. The absolute change in prevalence of obesity decreased 2.5%, from 16.4% to 13.9%, indicating a 15.2% relative change in prevalence of obesity in 6 years. The prevalence of overweight decreased from 15.5% in 2006 to 14.3% in 2012 indicating a relative percent change of 7.6%. The prevalence of overweight and obesity combined from 2006–2012 decreased by 3.7% (31.9% to 28.2%, an 11.6% relative decrease). However, there was a wide range within schools of BMI trends over time with a range of overweight and obesity change from a 10% increase in school A to a 12% decrease in school F. Figure 2 illustrates the number of annual district-wide strategies implemented from 2006–2012 and the corresponding annual district-wide prevalence of overweight and obesity (≥85th percentile for BMI).

Table 2 provides a detailed schematic of how dose scores were calculated for each strategy based on estimated strength and reach within each school. The highest dose scores calculated were for CSPAP (5.6–9.7%), due to the relatively high reach AND strength of the strategies. The BMI screening, reporting, and obesity treatment program had the lowest dose (0.6% – 1.6%) due to the low reach of the treatment program even though the strength was very high for those who participated in the intensive obesity reduction classes.

Figure 3 represents the dose for each strategy implemented at the individual school-level from 2006–2012. As shown in Table 2, dose scores were calculated over the six years with frequency and duration impacting strength scores. Schools that showed absolute decreases in overweight and obesity prevalence of greater than 10% are noted in Figure 3.

Discussion

This retrospective case study revealed a 2.5% absolute decrease in obesity from 16.4% in 2006 to 13.9% in 2012, a 15.2% relative change. The prevalence of overweight and obesity combined decreased from 31.9% in 2006 to 28.2% in 2012, an 11.6% relative change. Although these changes only reflect one school district, they are in contrast to the NHANES national data that documented a 2.6% absolute increase in obesity prevalence between 2006 and 2012 among 6 to 11 year old children (15.1% [11.3–20.1] in 2005–2006 to 17.7% [14.5–21.4] in 2011–2012, $p>0.05$) (1). It is also worth noting that there was a wide range within schools, with some schools showing as much as a 12% reduction in overweight/obese and other schools showing as much as a 10% increase percent overweight/obese over this same time period.

The overall reduction of overweight and obesity prevalence from 2006 to 2012 may have been the result of several strategies being implemented across KPS. Establishing causality is difficult using a retrospective study design (23), and was not an aim of this study. Some strategies were district-wide and potentially reached all students, whereas other strategies were implemented at the school-level to varying degrees. The five school-level strategies included CSPAP, school food environment, BMI reporting and obesity treatment program, school meal program, and supportive/promotional education programs. These strategies are identified in the literature to have potential impact on obesity, physical activity, or nutrition, and represent a socio-ecological approach to obesity prevention (11;13;14;20;24–28). Multifaceted school-based programs for 6 to 11 year olds that include both nutrition and physical activity components have been found to both improve health and be cost saving (12). The current retrospective case study describes efforts to reduce obesity and would be considered a more natural intervention compared to past studies that were more controlled intervention studies. Each strategy was evaluated at the individual school-level, which allowed us to differentiate between the schools.

The dose scores derived in this study are based on all enrolled students at each elementary school in KPS, even those who were not exposed to all strategies (17). According to CCHE (17)(17)(17), cumulative dose scores for each school suggest that for all elementary students enrolled, there was an estimated 8.9% to 17.4% change in healthy eating and or physical activity behaviors (17). These estimates are not meant to be taken literally, but rather indicated to us that significant, measurable changes in behaviors that impact BMI were occurring in these schools. It is generally accepted that the main cause of obesity is due to imbalance between energy intake and energy expenditure. We would therefore expect that collectively the strategies implemented throughout KPS which had most impact on nutrition and physical activity behaviors to show greater reduction in overweight/obesity, and this inverse relationship is in fact what we found. The greatest reductions in overweight/obesity prevalence occurred in Schools F, H, and C (Figure 3). Dose scores for these schools were also higher, ranking 4th, 1st, and 2nd out of 9 and ranging from 12.8 to 17.4%. Comparatively, Schools A, D, G, and I with the least change in BMI or who showed increases, were ranked lowest in terms of dose scores (8.9% to 11.1%). One of the greater discrepancies in dose between School G and School F, H, or C include the participation rate in the obesity treatment program. School G had the highest school enrollment amongst all

schools and given their overweight/obesity rate translates into approximately 120 overweight/obese students of which only 9.0%, or approximately 11 students participated. Comparatively, School F had an average attendance of 290 students, a similar baseline overweight/obesity rate (30.6% to School G (29.0%), and 34% of students participate in the obesity treatment program. This would equate to approximately 30 students who participated in the obesity treatment program, nearly three times that of School G.

Interestingly, School C only reported 4.0% of obese students participating in the obesity treatment program, but it also had the highest overall dose score and the highest baseline overweight/obesity rate (42.8%). These findings suggest that it may be important to implement strategies at the primary (e.g., CSPAP), secondary (e.g., BMI screening program), and tertiary (e.g., obesity treatment program) levels of prevention. This hypothesis can be tested in future studies. Parents have reported supporting the BMI screening program in KPS (Heelan, et al., unpublished) and the family-based pediatric obesity treatment program has demonstrated efficacy (20). While we cannot pinpoint exact commonalities between schools with the greatest reduction in obesity, it does appear that having a high dose cluster of strategies, regardless of their makeup, is a common factor. The use of a retrospective study has certainly provided data to generate hypotheses for future research (23).

The adoption and implementation of district and school-level strategies were not uniform across schools. The district-level wellness policy was important for identifying specific physical activity and nutrition strategies that schools should implement. It was difficult to get individual school administrators to agree to make significant changes within their schools until they were presented with the district-wide and individual school overweight and obesity prevalence data in December 2009. The data demonstrated to school principals the importance of physical activity and healthy eating.

The discrepancy between schools in degree of implementation may be the result of differences in funding, teacher-student ratio, general infrastructure, and capacity for implementing the process of health promotion in schools using a socio-ecological approach (10). Any combination of these factors could lead to natural variation in the timing of adoption and degree of implementation of strategies (29). For example, all elementary schools changed their policies on classroom parties, snacks in the classroom and food rewards. However, level of implementation varied considerably as one school prohibited all food outside of school meals, while other schools required, to varying degrees, only healthy food brought into the school for snacks and fundraisers.

The findings of this retrospective case study are not generalizable to other school districts. Conversely, an advantage of retrospective case studies include the opportunity to study rare occurrences (23), in this case a school district whose prevalence of obesity decreased during the same period when obesity remained level nationally (1). Additionally, this type of study can act as a good pilot study to help identify feasibility issues and generate hypotheses for future studies (23). As a result of this case study, valuable insights into interpreting the differences in implementation of several strategies across a school district were gleaned. Calculating dose could allow stakeholders to better comprehend the differences in

implementation between schools and how each strategy could impact obesity prevalence, even in situations where yearly BMI measurements are not feasible. Community stakeholders can work together to determine the feasibility issues surrounding sustained measurement and reporting of strategy implementation.

The study has several limitations. First, the study did not evaluate changes in environments outside of the school setting such as the home or the community that may have also influenced a child's weight status over time. Changes in these environments may have also contributed to observed changes in obesity status. Second, while strategy exposure and participation data were collected throughout the years of the study, dose was assessed at the end of the study period and reflects an estimation of implementation at the end of the six years of the evaluation.

Finally, a quantitative number was assigned to categorize the often times qualitative implementation data for a given strategy. However, the calculated dose scores do allow for relative comparisons of strategy implementation between schools. The dose score has been helpful to visualize that a "district-wide" policy or strategy does not necessarily suggest that all strategies will be uniformly implemented. Future research should test approaches for implementing district policies at the school-level and their relationship to health-related outcomes. Future research should also continue to focus on developing data collection methods that are user-friendly to practitioners whom are conducting non-controlled studies in the area of obesity prevention, as well as, evaluating the validity of the method employed for this study.

Conclusion

This unique retrospective case study has revealed success at implementing school-based obesity prevention strategies. Dose data support that school based obesity prevention strategies may have contributed to decreases in the prevalence of overweight and obesity. In addition to district-wide policies, individual schools should evaluate their ability to adopt environmental, policy, or programmatic changes that meet their school's needs and resources. The evaluation approach used for this study allows decision makers compare impact of differentially implemented school-based strategies.

Acknowledgments

We would like to acknowledge Carol Renner, Associate Superintendent and Cari Franzen, Wellness Coordinator, and the students, staff and administration of Kearney Public Schools, Kearney NE. We would also like to acknowledge Elena Kuo, Evaluation Consultant for the Center for Community Health and Evaluation, for her assistance with using the CCHE approach to measuring population dose. Funding was provided by a Carol M White Physical Education Program Grant (# Q215F080323).

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of Childhood and Adult Obesity in the United States, 2011–2012. JAMA. 2014; 311(8):806–814. [PubMed: 24570244]
2. U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion. Healthy People 2020. Washington DC: Available at: http://www.healthypeople.gov/2020/LHI/nutrition.aspx [Accessed 10–9–2013]

3. American Diabetes Association. Type 2 diabetes in children and adolescents. Pediatr. 2000; 105:671–680.
4. Drake AJ, Smith A, Betts PR, Crowne EC, Shield JP. Type 2 diabetes in obese white children. Arch Dis Child. 2002; 86(3):207–208. [PubMed: 11861246]
5. Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatr. 1999; 103(6):1175–1182.
6. Neumark-Sztainer D, Falkner N, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: correlations with weight status and disordered eating behaviors. Int J Obes Relat Metab Disord. 2002; 26(1):123–131. [PubMed: 11791157]
7. Janssen I, Craig WM, Boyce WF, Pickett W. Associations between overweight and obesity with bullying behaviors in school-aged children. Pediatr. 2004; 113(5):1187–1194.
8. Koplan, JP.; Liverman, CT.; Kraak, VA. U.S. Department of Health and Human Services. Health in the Balance. 2001. The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity.
9. Kolbe LJ. A framework for school health programs in the 21st century. J Sch Health. 2005; 75(6): 226–228. [PubMed: 16014129]
10. Hoyle TB, Bartee RT, Allensworth DD. Applying the process of health promotion in schools: a commentary. J Sch Health. 2010; 80(4):163–166. [PubMed: 20433641]
11. Centers for Disease Control and Prevention. School health guidelines to promote healthy eating and physical activity. MMWR. 2011; 60(RR-5):1–76.
12. Gortmaker SL, Swinburn BA, Levy D, Carter R, Mabry PL, Finegood D, et al. Changing the future of obesity: science, policy, and action. Lancet. 2011; 378(9793):838–847. [PubMed: 21872752]
13. IOM (Institute of Medicine). Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation. Washington, DC: The National Academies Press; Sep 1. 2012
14. Foltz JL, May AL, Belay B, Nihiser AJ, Dooyema CA, Blanck HM. Population-level intervention strategies and examples for obesity prevention in children. Annu Rev Nutr. 2012; 32:391–415. [PubMed: 22540254]
15. Waters E, de Silva-Sanigorski A, Burford BJ, Brown T, Campbell KJ, Summerbell CD. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011; (12):CD001871. [PubMed: 22161367]
16. Kumanyika S, Brownson RC, Cheadle A. The L.E.A.D. framework: using tools from evidence-based public health to address evidence needs for obesity prevention. Prev Chronic Dis. 2012; 9:E125. [PubMed: 22789443]
17. Center for Community Health and Evaluation. Part of Group Health Research Institute. [Accessed 5–20–2012] Measuring and Increasing the "Dose" of Community Health Interventions. www.cche.org
18. US Department of Education. Improving basic programs operated by local educational agencies (Title I, Part A). Ed.gov. Available at: 12–10–0013.
19. Barlow SE. the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment, and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatr. 2007; 120(Supplement 4):S164–S192.
20. Ruebel ML, Heelan KA, Bartee RT, Foster N. Outcomes of a family based pediatric obesity program - preliminary results. Int J Exerc Sci. 2011; 4(4):217–228.
21. Cheadle A, Schwartz PM, Rauzon S, Bourcier E, Senter S, Spring R, et al. Using the concept of "Population Dose" in planning and evaluating community-level obesity prevention initiatives. Amer J Eval. 2012; 34(1):71–84.
22. Troiano RP, Berringan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc. 2008; 40(1):181–188. [PubMed: 18091006]
23. Hess DR. Retrospective Studies and Chart Reviews. Respir Care. 2004; 49(10):1171–1174. [PubMed: 15447798]
24. Aryana M, Li Z, Bommer WJ. Obesity and physical fitness in California school children. Am Heart J. 2012; 163(2):302–312. [PubMed: 22305851]

25. Verstraete SJM, Cardon GM, De Clercq DLR, De Bourdeaudhuij IMM. Increasing children's physical activity levels during recess periods in elementary schools: the effects of providing game equipment. Eur J Public Health. 2006; 16(4):415–419. [PubMed: 16431866]

26. Isoldi KK, Dalton S. Calories in the Classroom: celebration foods offered and consumed during classroom parties at an elementary school in a low-income, urban community. Child Obes. 2012; 8(4):378–383. [PubMed: 22867078]

27. Heelan KA, Abbey BM, Donnelly JE, Mayo MS, Welk GJ. Evaluation of a walking school bus for promoting physical activity in youth. J Phys Act Health. 2009; 6(5):560–567. [PubMed: 19953832]

28. Pitt Barnes S, Robin L, O'Toole TP, Dawkins N, Kettel Khan L, Leviton LC. Results of Evaluability Assessments of Local Wellness Policies in 6 US School Districts. J Sch Health. 2011; 81(8):502–511. [PubMed: 21740436]

29. Ramanathan S, Allison KR, Faulkner G, Dwyer JJM. Challenges in assessing the implementation and effectiveness of physical activity and nutrition policy interventions as natural experiments. Health Promot Int. 2008; 23(3):290–297. [PubMed: 18728110]

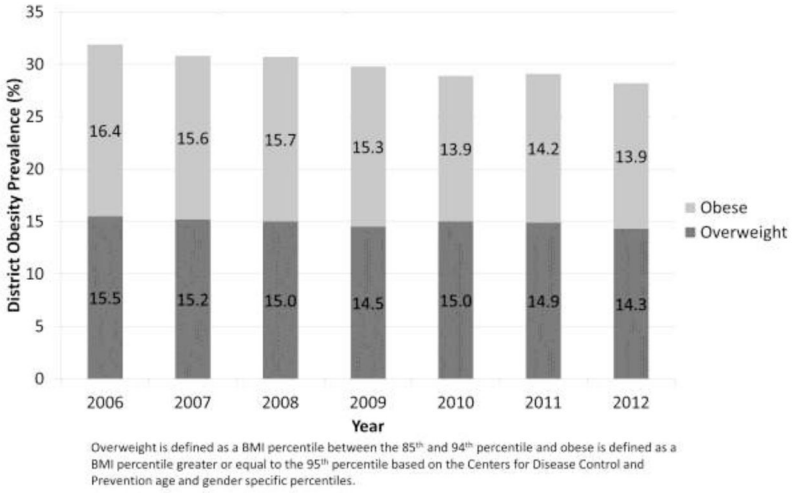

Figure 1.

Prevalence of Overweight and Obese Students Attending Elementary School between 2006–2012

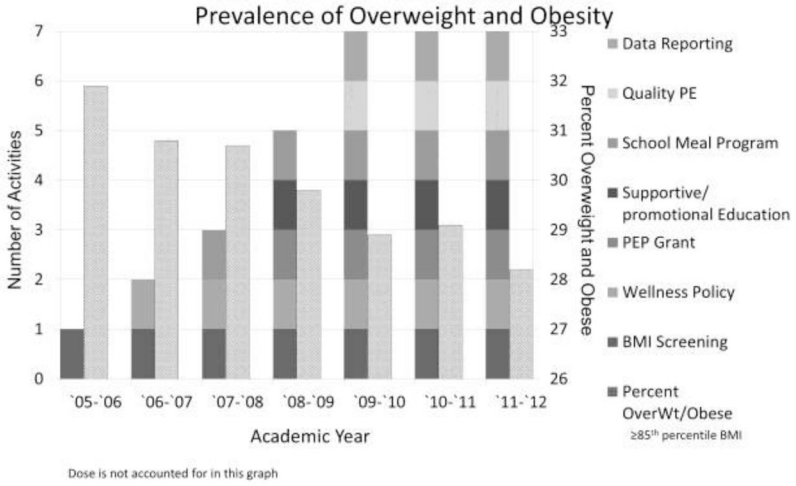

Figure 2.

Number of District-wide Obesity Prevention Activities from 2005–2012 and Corresponding Prevalence of Overweight and Obesity

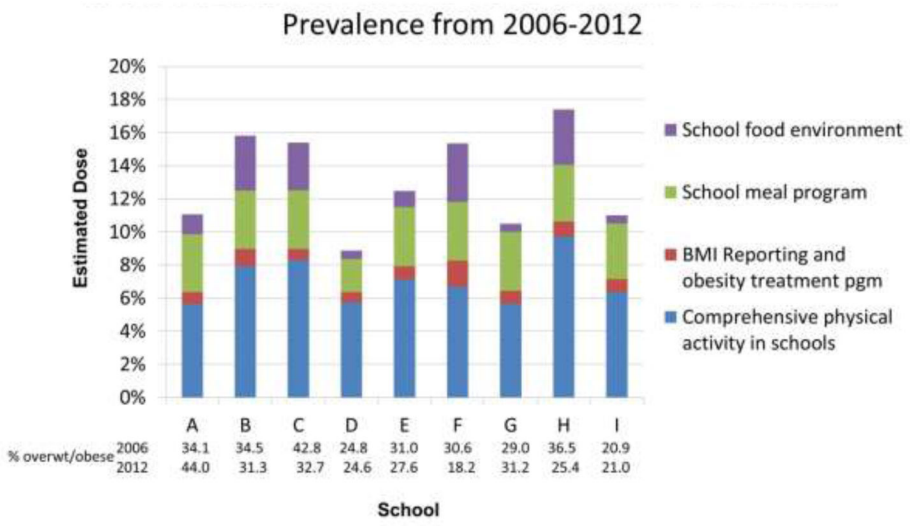

Figure 3.

Dose (Estimated Impact) for Each Strategy Implemented at the Individual School level with Overweight and Obesity Prevalence from 2006–2012

Table 1

Overview of District-Wide and Individual School Strategies Implemented In Kearney Public Schools (KPS) Between 2006 and 2012

Date of Initiation	*District-Wide Strategies Implemented*
Spring 2006	***Body Mass Index (BMI)*** measures completed on 100% of students and results shared with parents as an awareness program through BMI Report Cards.
Fall 2006	***District-wide Wellness Policy*** approved by KPS Board of Education to include promotion of student wellness through nutrition education, physical activity opportunities and healthy school environments. wellness.kearneypublicschools.org
Spring 2008	***PEP Grant*** allowed the district to hire a wellness coordinator and a program evaluator to promote physical activity and a healthy environment within the district. The primary goal of the PEP grant was to enhance the physical education program with an objective to decrease prevalence of overweight and obesity.
	District Wellness Team formed and met quarterly to discuss ideas, initiatives, implementation and evaluation of strategies to increase healthy eating and physical activity within i the elementary schools.
Fall 2008	***School Meal Program*** changes were made by the food service provider. • Fruit & vegetable salads bars available daily • Salad dressing replaced with reduced fat or fat free • Only low-fat or skim milks provided
Spring 2009	***Body Mass Index (BMI)*** screenings continue and a community-based child obesity treatment program available as a referral program for the school health services program in all schools.
Fall 2009	***Quality Physical Education:*** A new physical education curriculum was implemented that incorporated components of the SPARK curriculum, best practices from experience and common interests in the district. The new curriculum is a K-12 sequential curriculum with instructional practices that are consistent with national standards and provides students with a greater percentage of time spent in physical activity in PE class. Although physical education is not offered daily, in all KPS Elementary schools, each student receives 50-70 minutes per week of Physical Education.
Spring 2010	***Data Reporting:*** Prevalence of obesity in KPS presented to administrative council. The district Wellness policy was shared and encouraged administrators to evaluate individual schools fidelity.
	School Meal Program additional changes were made by the food service provider. • Increased whole grains • Nutrient content of menus provided on website • Nutrition Advisory Council with students, teachers, and parents developed

Individual School Strategies Implemented
***Comprehensive Physical Activity Program*:** Includes all physical activity opportunities outside of physical education class that do not replace PE, but provide additive physical activity opportunities. • Recess equipment provided, games implemented, indoor options provided • Before and after school physical activity clubs implemented • Integration of physical activity into the classroom environment.
School Food Environment: Nutrition standards were established for food in school outside of meal program: • Foods consumed as snacks during the day • Classroom food rewards • Classroom parties • School based food fundraisers including bake sales
Supportive/promotional Education Strategies • Healthy school environment education provided to teachers/ parent organizations and students

Strategies were implemented during the academic semester indicated in the timeline and continued through the 2012 academic year.

Table 2

Calculation of Dose Scores Including Strength Categories for each Strategy Implemented, Factors Influencing Strength Ratings, Estimated Reach and Dose Ranges

Strategy	Higher Strength Characteristics:	Individual School Strength Ranges	Estimated Reach	Individual School Reach Ranges	Individual School Dose Ranges Strength X Reach
Comprehensive physical activity in schools: • Quality physical education • Active recess • Before and after school programs • Classroom physical activity	• Frequency/duration of program offerings • Evidence-based curriculum, well implemented • Teacher professional development	5.6%–10.7%	Percent of students participating in each area (active recess, before and after school activity programs, etc).	0%–100%	5.6%–9.7%
School food environment: • Classroom snacks • Classroom food rewards • Fundraisers • Classroom parties	• Unhealthy foods no longer offered as rewards • Classroom snacks eliminated or replaced with healthier options • Fresh fruit and vegetable snack program in schools (USDA grant) • Elimination of bake sales, food sales, unhealthy promotions • Limit number of class parties	0.5%–5.1%	Percent of students exposed to the change in competitive food environments.	50–100%	2.0%–3.6%
BMI screening, reporting, obesity treatment program	• High proportion of obese students referred • Enrollment in effective, evidence-based pediatric obesity treatment program	0.5–20.0%	Percent of obese children referred by school nurse. Percent of children who are obese that enrolled in treatment program.	100% 0.8% –5%	0.6%–1.6%
School meal program • Lunch program • Fruit & Vegetable Salads Daily/No Entrée 2nds • Only low-fat or skim milks; more whole grain	• Breakfast program offered at some schools, increased fruit offerings and whole grains.	2.4%–5.1%	Percent of students participating in the school meal programs calculated separately for breakfast and lunch.	0%–91%	2.0%–3.6%

Strategy	Higher Strength Characteristics:	Individual School Strength Ranges	Estimated Reach	Individual School Reach Ranges	Individual School Dose Ranges Strength X Reach
• Nutrient content of menus on website					

Dose was calculated for each individual school by multiplying Reach X Strength. The classification of strength is based on criteria adopted by the Center for Community Health and Evaluation “Measuring and Increasing the ‘Dose’ of Community Health Interventions” (www.cche.org, September 2014).

Table 3

Individual School Demographic Characteristics by Year

	Academic Year					
School	**2006–07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**
A	n= 250 FRL= 82% Mobility= N/A	n= 231 FRL= 82% Mobility= N/A	n= 246 FRL= 79% Mobility= 18.9%	n= 242 FRL= 78% Mobility= 15%	n= 263 FRL= 71% Mobility= 13.4%	n= 245 FRL= 80% Mobility= 11.9%
B	n= 228 FRL= 66% Mobility= N/A	n= 259 FRL= 65% Mobility= N/A	n= 239 FRL= 60% Mobility= 17.4%	n= 272 FRL= 60% Mobility= 19.2%	n= 329 FRL= 70% Mobility= 13.3%	n= 270 FRL= 63% Mobility= 11.6%
C	n=222 FRL= 73% Mobility= N/A	n= 224 FRL= 77% Mobility= N/A	n= 245 FRL= 73% Mobility= 18.8%	n= 251 FRL= 75% Mobility= 16.5%	n= 253 FRL= 73% Mobility= 17.9%	n= 229 FRL= 71% Moblilty= 13.4%
D	n= 134 FRL= 12% Mobility= N/A	n= 137 FRL= 10% Mobility= N/A	n= 142 FRL= 12% Mobility= N/A	n= 138 FRL= 11% Mobility= N/A	n= 135 FRL= 13% Mobility= N/A	n= 139 FRL= 11% Mobility= N/A
E	n= 247 FRL= 46% Mobility= N/A	n= 229 FRL= 40% Mobility= N/A	n= 264 FRL= 38% Mobility= 6.1%	n= 270 FRL= 36% Mobility= 7.8%	n= 275 FRL= 38% Mobility= 9.9%	n= 364 FRL= 43% Mobility= 5.2%
F	n= 250 FRL= 6% Mobility= N/A	n= 270 FRL= 6% Mobility= N/A	n= 285 FRL= 8% Mobility= 6.3%	n= 284 FRL= 11% Mobility= N/A	n= 299 FRL= 14% Mobility= 4.4%	n= 352 FRL= 17% Mobility= 6.9%
G	n= 380 FRL= 33% Mobility= N/A	n= 443 FRL= 38% Mobility= N/A	n= 384 FRL= 33% Mobility= 13.0%	n= 417 FRL= 38% Mobility= 8.7%	n= 413 FRL= 38% Mobility= 11.5%	n= 436 FRL= 41% Mobility= 6.6%
H	n= 265 FRL= 20% Mobility= N/A	n= 277 FRL= 25% Mobility= N/A	n= 281 FRL= 26% Mobility= 8.3%	n= 287 FRL= 28% Mobility= 8.3%	n= 288 FRL= 26% Mobility= 5.2%	n= 284 FRL= 27% Mobility= 4.7%
I	n= 258 FRL= 12% Mobility= N/A	n= 272 FRL= 11% Mobility= N/A	n= 279 FRL= 13% Mobility= 4.4%	n= 284 FRL= 14% Mobility= 4.6%	n= 289 FRL= 11% Mobility= 7.3%	n= 283 FRL= 9% Mobility= 10.9%

n= school enrollment

FRL = percent of students receiving free or reduced lunch

N/A =Mobility rates were not available