A Randomized Controlled Study of a Healthy Corner Store Initiative on the Purchases of Urban, Low-Income Youth

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Objective: Although many initiatives exist to improve the availability of healthy foods in corner stores, few randomized trials have assessed their effects. This study evaluated, in a randomized controlled trial, the effects of a first-generation healthy corner store intervention on students’ food and beverage purchases over a 2-year period.

Methods: Participants (n = 767) were fourth-, fifth-, and sixth-grade students. Ten schools and their nearby corner stores (n = 24) were randomly assigned to the healthy corner store intervention or an assessment-only control. Intercept surveys directly assessed the nutritional characteristics of students’ corner store purchases at baseline, 1 and 2 years. Students’ weight and heights were measured at baseline, 1 and 2 years.

Results: There were no differences in energy content per intercept purchased from control or intervention schools at year 1 (P = 0.12) or 2 (P = 0.58). There were no differences between control and intervention students in BMI z score (year 1, P = 0.83; year 2, P = 0.98) or obesity prevalence (year 1, P = 0.96; year 2, P = 0.58).

Conclusions: A healthy corner store initiative did not result in significant changes in the energy content of corner store purchases or in continuous or categorical measures of obesity. These data will help to inform future interventions.
intervention studies sampled only adults (15) or assessed consumer purchasing behavior through store owner and/or consumer self-report surveys (14,16) or sales estimates (17) instead of direct consumer observations. Only one study (18) of children directly observed beverage purchases before \((n = 142)\) and 6 months after \((n = 176)\) a healthy beverage corner store intervention (with no control group) and found no significant change in the rates of sugar-sweetened beverages purchased by children. Moreover, while select corner store intervention trials used comparison groups in pre-post or quasi-experimental designs (16,17,19-21), only one trial to date has used a randomized controlled design to examine the impact of interventions on adult purchases and used consumer self-report (22). This 4-month trial (22) followed primarily Latino customers and did not find significant increases in fruit and vegetable intake in the intervention group. As Gittelsohn et al. (14) noted in a recent review of corner store interventions, “the ability to influence health outcomes will require a more systematic evidenced-based approach to modifying the food environment, greater use of randomized controlled trials (RCTs) to evaluate program effectiveness, and publication in peer-reviewed literature to communicate findings” (p. 5).

To the best of our knowledge, the current study is the first RCT to use direct observations of corner store purchases and the first RCT to evaluate corner store purchases in children. Additionally, the current study includes objective measures of height and weight in children. This 2-year study assessed the impact of a healthy food and beverage intervention on fourth-, fifth-, and sixth-grade urban students’ purchases in corner stores located near their schools. Given that energy intake (23) is a principal contributing factor in the development of childhood overweight and obesity, our primary outcome was the energy content (calories) of students’ corner store purchases. We hypothesized that students in the healthy corner store intervention group would purchase significantly fewer calories \([200 \text{ kcal}; \text{i.e., replacing one sugar-sweetened beverage and snack of candy/chips (~360 kcal)} \text{ with water and fruit salad (~160 kcal)}\] \) at corner stores than control students at 2 years. Our secondary aims were to: (1) examine differences between groups in other nutritional characteristics of food and beverage purchases (i.e., fat content, fiber, carbohydrates, sugar and sodium); (2) assess differences between groups in students’ BMI, BMI percentile and BMI \(z\) score; and (3) examine differences between groups in the prevalence of obesity (\(\geq 95\text{th BMI percentile}\)) at 1 and 2 years.

Methods

Participants

Schools and students. All fourth-, fifth-, and sixth-grade students from 10 schools in low-income neighborhoods in Philadelphia were eligible to participate \((n = 1,802)\). Of the eligible students, 43.8% consented \((n = 790)\) and 42.6% \((n = 767)\) completed height and weight assessments. Eligible schools had: (1) \(\geq 50\%\) of students qualifying for free/reduced meals (income \(\leq 185\%\) of the poverty level adjusted for household size); (2) \(\geq 2\) corner stores within a four-block radius; and (3) no existing programs to target obesity. Schools were matched on size \((\geq 70 \text{ students})\) and corner store density (two to four stores per school). Staff approached principals in a pre-determined random order. Of the 20 eligible schools, 13 were approached, 3 declined and 10 were randomized. The seven schools not approached were in close proximity to other schools or had limited nearby corner stores. The principal of each school sent a letter home describing the study and inviting parents to consent and children to assent for assessments of the child’s height and weight, as well as to assessments (intercepts) of corner store purchases made by the children. All children were encouraged to return the consent/assent form regardless of whether or not they agreed to participate.

Corner stores. Corner stores were businesses that primarily sold food and beverages, had 1–4 aisles, and had only 1 cash register. Study staff approached the owners of all corner stores within a four-block radius of each school. Owners signed a letter specifying that if randomized to a treatment cluster, they would: (1) display marketing materials provided by the study; (2) stock a minimum number of products targeted by the intervention; and (3) group healthier items for easy identification. Store owners were paid \$200 per year for their participation and were introduced to study staff, who wore identifiable clothing (shirts and/or jackets) and stood outside of corner stores to collect intercepts.

Randomization

A “school-store” cluster was defined as one school and its surrounding corner stores within a four-block radius. From the pool of 10 enrolled schools, 5 schools and their proximal corner stores \((n = 12)\) were randomized to the intervention and 5 schools and their proximal corner stores \((n = 12)\) were randomized to an assessment-only control. Students were not blind to their status as an intervention school.

Measurement

Baseline assessments of height, weight and corner store intercepts were collected from January-June 2008. Assessments were taken again 1 and 2 years following intervention initiation, which began in September 2008.

Nutrition information. The primary outcome, the energy content (calories) of corner store purchases made by students, was based on directly intercepting students outside of the 24 corner stores. Staff approached students outside of the 24 participating corner stores and asked if they attended the corner store’s cluster school, and if they consented to participate in this study. If students said yes or were unsure, their consent status was verified later using a list of consented students. Staff collected intercepts anonymously on students not consented to participate in this study if they provided verbal assent and were in the fourth, fifth, and sixth grades at the participating school. Staff then conducted the intercept interview, which lasted \(\sim 1–2\) min. Interviewers asked how much they spent and then looked in students’ bags at each of the purchased items. Interviewers did not ask for receipts because most corner stores were all cash businesses and did not provide receipts. Staff recorded the students’ responses, noting each purchased item’s product category, name, size, and quantity. One intercept was equal to one corner store visit by one student and may have included more than one food and beverage item.

Staff obtained the energy content and other nutritive characteristics of items purchased at corner stores by inventorying all of the purchased food and beverage items in the selected corner stores. Staff developed a database of the nutrient content of these items. For
TABLE 1 Characteristics of consented and measured students in grades 4–6 in control and intervention school-store clusters at baseline

|                       | Control cluster (n = 332) | Intervention cluster (n = 435) |
|-----------------------|---------------------------|--------------------------------|
| Age (M ± SD, years)   | 10.99 ± 0.92              | 10.97 ± 1.02                   |
| Gender (% female)     | 57.8%                     | 55.4%                          |
| Race/ethnicity (%)    |                           |                                |
| Black/African American| 38.3%                     | 46.2%                          |
| White                 | 13.2%                     | 0.5%                           |
| Hispanic/Latino       | 16.2%                     | 43.2%                          |
| Asian                 | 15.9%                     | 0.5%                           |
| Native American/Alaskan Native | 1.5% | 0.2%                        |
| Other/Mixed/Unknown   | 15.0%                     | 9.4%                           |

Note: Control versus intervention groups, significant at P < 0.01. Of all consented students (N = 790), 23 students did not attend school when baseline measures were collected.

Packaged items, the package’s nutrition label was the primary source of nutrient content. When the item did not have a printed nutrition label, staff contacted the manufacturer or distributor directly for nutrition information. If the manufacturer could not be contacted, online food databases such as CalorieKing.com were utilized. In the case of prepared items (e.g., sandwiches), staff purchased identical sandwiches, with the condiments on the side, from the corner store, and asked the store owner what brands of products were used. Staff then de-composed the sandwiches in the office to weigh each component (bread, deli meat) and calculated the nutrition information using similar methods as noted above.

BMI, BMI z score, and BMI percentile. Trained research staff used a standardized protocol to collect weight and height data in schools on consented students. Students’ weight and height were measured in light indoor clothing without shoes. Weight was measured with a digital scale (SECA Alpha 882 and HD SECA 634, Hamburg, Germany) to the nearest 0.1 kg. Height was measured with a portable stadiometer (PE-AIM-101) to the nearest 0.1 cm. BMI [weight (kg)/height$^2$ (m$^2$)], BMI z scores and BMI percentiles (a comparison of the student’s BMI with children of the same sex and age) were calculated for each student (23, 24).

Weight categories. Obesity was defined as a BMI percentile ≥95th based on age- and gender-specific norms (24), overweight as ≥85th-94.9th BMI percentile, healthy weight as 5th< 85th BMI percentile, and underweight as <5th BMI percentile.

Healthy corner store intervention
The Snackin’ Fresh intervention, developed by The Food Trust (http://thefoodtrust.org), was based on social cognitive theory and was designed to promote healthier snack and beverage purchases in students shopping in corner stores. This study followed fourth-, fifth-, and sixth-graders for 2 years through the sixth, seventh, and eighth grades and included an emphasis on bottled water and prepared fruit salad for sale in the corner stores.

There were three main intervention components. First, the intervention included classroom-based nutrition education lessons on identifying healthy snacks (i.e., fruit, single-serving packages and water), energy intake, tracking consumption, goal-setting and label reading taught by project staff (seven 45-min lessons). Second, a branded social marketing campaign communicated messaging regarding healthy eating and well-being. The Snackin’ Fresh logo was imprinted on small giveaways and banners, and was displayed in corner stores. A branded Web site, comic book and video were also developed. Third, corner store-level initiatives included store owner trainings, adding healthier items, and signage identifying healthy items.

All store owners received training on buying, handling and selling fresh produce to reduce food costs, promote proper display and maintain produce quality. Whole produce, which was usually sold by weight, was sold per unit to students so they could more easily purchase them as snacks. Whole fruit was priced competitively with retail prices in comparable stores. Owners were encouraged to group healthy snacks together. Fruit salads were sold in two sizes ($1.00 for 8 oz., $2.00 for 16 oz.). Bottled water (20 oz.) was sold for 60¢ to match the price of other commercially available waters. Intervention staff provided 11 Snackin’ Fresh branded refrigerated barrels and one branded countertop refrigerator to intervention stores to

![Figure 1 Participant flow.](http://www.obesityjournal.org)
stock fruit and water, respectively. Youth leaders provided feedback on which healthy items to introduce and on marketing messaging.

Statistical analyses

Regression analyses were done with generalized linear mixed models (PROC GLIMMIX in SAS, v9.2, SAS Institute, Cary, NC) with schools and corner stores as separate random effects to accommodate for the clustering of children who attended the same schools and/or shopped at the same stores. An additional adjustment for serial dependence was achieved with a repeated statement that applied to only consented participants, since non-consented children were not uniquely identifiable over time. Therefore, the regressions utilized a hybrid approach with both repeated and cross-sectional measures collected over time. Because the default starting values for the covariance parameters failed, variables were dichotomized at their baseline medians. Between-group comparisons (control versus intervention) were based on differences in proportions falling above or below the median.

Results

Participants

Schools and students. The 10 schools had 82.1% ± 7.4% of students that qualified for free or reduced-price meals. At baseline, 790 students provided consent and 767 students completed assessments. Characteristics of the student sample are in Table 1. Participating
TABLE 3 Means ± SD\(^a\) of student corner store intercept characteristics in control and intervention school-store clusters at baseline enrollment and at 1 and 2 years after intervention initiation

|                     | Baseline | Year 1 | Year 2 |
|---------------------|----------|--------|--------|
|                     | N intercepts | Mean ± SD | N intercepts | Mean ± SD | N intercepts | Mean ± SD |
| **Intercepts**      |           |        |        |          |           |        |
| Energy (kcal)       |           |        |        |          |           |        |
| Intervention        | 385       | 354.0 ± 314.7 | 223       | 417.8 ± 373.1 | 263       | 381.1 ± 361.8 |
| Control             | 448       | 358.9 ± 267.9 | 451       | 413.0 ± 359.0 | 445       | 406.1 ± 311.6 |
| Fat (g)             |           |        |        |          |           |        |
| Intervention        | 385       | 14.6 ± 17.6 | 223       | 15.3 ± 16.5 | 263       | 14.5 ± 16.6 |
| Control             | 448       | 12.5 ± 13.3 | 451       | 14.1 ± 14.7 | 445       | 14.6 ± 16.1 |
| Sodium (mg)         |           |        |        |          |           |        |
| Intervention        | 385       | 457.9 ± 682.4 | 223       | 486.7 ± 594.9 | 263       | 448.2 ± 671.8 |
| Control             | 448       | 602.7 ± 845.4 | 451       | 644.0 ± 756.7 | 445       | 721.6 ± 899.5 |
| Carbohydrates (g)   |           |        |        |          |           |        |
| Intervention        | 385       | 50.7 ± 46.8 | 223       | 63.8 ± 66.8 | 263       | 58.4 ± 62.8 |
| Control             | 448       | 58.0 ± 43.4 | 451       | 66.8 ± 65.6 | 445       | 63.9 ± 44.9 |
| Sugar (g)           |           |        |        |          |           |        |
| Intervention        | 385       | 28.0 ± 36.9 | 223       | 37.9 ± 48.4 | 263       | 35.2 ± 51.9 |
| Control             | 448       | 35.0 ± 34.5 | 451       | 38.7 ± 51.4 | 445       | 34.0 ± 34.0 |
| Protein (g)         |           |        |        |          |           |        |
| Intervention        | 385       | 5.1 ± 9.1  | 223       | 5.4 ± 9.1  | 263       | 4.3 ± 6.8 |
| Control             | 447       | 5.7 ± 9.5  | 450       | 6.6 ± 10.3 | 444       | 6.8 ± 9.5 |
| Fiber (g)           |           |        |        |          |           |        |
| Intervention        | 385       | 1.2 ± 1.7  | 223       | 1.3 ± 2.7  | 262       | 1.2 ± 1.7 |
| Control             | 448       | 1.2 ± 1.6  | 451       | 1.2 ± 1.6  | 445       | 1.2 ± 1.6 |

\(^a\)For ease of interpretation, mean values are presented. Means were reported but not compared between groups.

There were no baseline differences in age (P = 0.72), gender (P = 0.50) or weight category (P = 0.66) between students from control or intervention schools. When comparing race/ethnicity between groups, there were significantly more Asian students in the control group and significantly more Hispanic/Latino students in the intervention group (Table 1), which reflects the predominant races/ethnicities of the 10 neighborhoods.

**Corner stores.** Stores were on average 172.9 ± 70.4 square feet, had 2.1 ± 0.5 aisles, and 2.4 ± 1.0 employees on site. Among the 24 corner stores (n = 12 control, n = 12 intervention) who began the study, 21 (n = 11 intervention, n = 10 control) and 20 (n = 10 intervention, n = 10 control) remained at years 1 and 2, respectively. The four stores (n = 2 intervention, n = 2 control) that discontinued their participation did so because of a change in store ownership.

**Intercepts.** Items were analyzed by intercepts. The mean number of intercepts per store was 34.7 ± 31.3 at baseline, 32.1 ± 29.1 at year 1 and 35.4 ± 32.2 at year 2. Staff collected 833 intercepts at the initial assessment (484 intercepts from consented students, 349 intercepts from non-consented students). At 1 year, staff collected 674 student intercepts (n = 250 consented, n = 424 unconsented) and at year 2, staff collected 708 intercepts (n = 237 consented, n = 471 unconsented) (Table 2). Average items per intercept at year 1 were 2.8 ± 2.8 and 2.7 ± 2.8 at year 2.

**Nutrition information on corner store purchases**
There was no difference in energy content per intercept in control or intervention purchases at baseline. Similarly, there were no significant differences in energy per intercept between control and intervention store purchases at years 1 or 2 (Table 2). There were also no significant differences between control and intervention corner store purchases in fat, sodium, carbohydrate, sugar, protein or fiber at baseline, year 1 or 2 (Table 2). Typical items purchased by students were beverages, chips and candy. Means for nutritional information are - in Table 3.

**BMI, BMI Z score, and BMI percentile**
Weight measurements were available only for consented students (see Figure 1). There were no differences between groups in BMI, BMI z score or BMI percentile at baseline, year 1 or 2 (Table 4).

There were no differences in the prevalence of obesity between control and intervention students at years 1 or 2 (Table 4).
TABLE 4 Body mass index (BMI) of consented students in grades 4-6 in control and intervention school-store clusters

|                  | Baseline |       |       |       |       |       |       |       |       |       |       |       |
|------------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                  | n        | %     | Mean ± SD |       |       | n     | %     | Mean ± SD |       | n     | %     | Mean ± SD |
| **BMI (kg m⁻²)** |          |       |       |       |       |       |       |       |       |       |       |       |
| Intervention     | 435      | 21.4  | ± 6.0 |       |       | 331   | 22.3  | ± 6.5 | 0.73  | 262   | 23.5  | ± 6.8 | 0.64  |
| Control          | 332      | 21.3  | ± 5.1 |       |       | 265   | 22.3  | ± 5.6 |       | 249   | 23.3  | ± 5.7 |       |
| **BMI z score**  |          |       |       |       |       |       |       |       |       |       |       |       |
| Intervention     | 435      | 0.8   | ± 1.2 |       |       | 331   | 0.8   | ± 1.2 | 0.83  | 262   | 0.8   | ± 1.2 | 0.98  |
| Control          | 332      | 0.8   | ± 1.1 |       |       | 265   | 0.8   | ± 1.1 |       | 249   | 0.9   | ± 1.1 |       |
| **BMI percentile (%ile)*** | |       |       |       |       |       |       |       |       |       |       |       |
| Intervention     | 435      | 69.3  | ± 29.7|       |       | 331   | 69.1  | ± 29.9| 0.80  | 262   | 71.3  | ± 28.7| 0.99  |
| Control          | 332      | 70.8  | ± 28.3|       |       | 265   | 70.3  | ± 29.2|       | 249   | 72.6  | ± 27.0|       |

| Weight category | Year 1 |       |       |       | Year 2 |       |       |       |       |       |       |       |
|------------------|--------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
|                  | n      | %     | Mean ± SD |       | n      | %     | Mean ± SD |
| Intervention     | 4      | 1.2%  | ± 1.9% |       | 2      | 0.8%  | ± 1.9% |
| Healthy (5-85 %ile) | 179    | 53.3% | ± 50.9% |       | 129    | 51.8% | ± 50.9% |
| Overweight (85-95 %ile) | 58     | 17.5% | ± 18.5% |       | 48     | 19.3% | ± 18.5% |
| Obese (≥95th %ile) | 91     | 27.4% | ± 28.7% |       | 70     | 28.1% | ± 28.7% |
| Control          | 10     | 2.3%  | ± 3.0% |       | 4      | 1.5%  | ± 3.0% |
| Healthy (5-85 %ile) | 224    | 51.5% | ± 52.0% |       | 134    | 51.1% | ± 52.0% |
| Overweight (85-95 %ile) | 81     | 18.6% | ± 17.8% |       | 44     | 16.8% | ± 17.8% |
| Obese (≥95th %ile) | 120    | 27.6% | ± 27.2% |       | 80     | 30.5% | ± 27.2% |

**Note:**
*P<0.05 = control versus intervention comparison of means, year 1.
*P<0.01 = control versus intervention comparison of means, year 2.
*Based on gender- and age-specific norms (24).

**Discussion**

There were three principal findings from this study. First, a first-generation corner store intervention did not result in significant differences in the energy content purchased at corner stores by urban, low-income fourth-, fifth-, and sixth-graders compared to control stores. It is unclear why the intervention did not impact the energy content of purchases. One potential reason may be the challenge of stocking fresh items in a corner store environment with limited space and equipment. It is also possible that students saw less value in the items targeted by the intervention (i.e., fruit salad was $1.00) given their high cost relative to popular alternatives (0.75-1.0 oz. chips for $0.25-$0.50). Additionally, students may have been reluctant to purchase water given that water is widely available at no cost. It is possible that fourth-, fifth-, and sixth-graders were not the primary demographic purchasing fruit salad, as students typically bought beverages, chips, and candy. Some shoppers in intervention stores may have been from non-participating schools, potentially diluting the intervention. Finally, it is possible that students were not motivated to make healthier decisions when less expensive, highly palatable items were still readily available. Finally, due to the challenges in working with national snack distributors, space and equipment. It is also possible that students saw less value in the items targeted by the intervention (i.e., fruit salad was $1.00) given their high cost relative to popular alternatives (0.75-1.0 oz. chips for $0.25-$0.50).

Second, there were no differences in the fat, carbohydrate, sugar, fiber, or sodium content of corner store purchases of control or intervention students. At year 2, intervention corner store purchases remained high in sugar (35.2 g) and sodium (448 mg) and low in fiber (1.2 g)—the sugar content of purchases almost doubled the maximum intake of 12–20 g day⁻¹ of added sugar recommended by the American Heart Association (AHA) based on a 1,400-1,800 kcal day⁻¹ diet (26). At baseline, more than 88% of beverages purchased were sugar-sweetened beverages (SSB) (9). SSBs were not specifically targeted in our intervention, and future corner store interventions may benefit from focusing on reducing SSB consumption.

Third, there were no differences in relative weight or obesity prevalence between students in the control and intervention school-corner stores. There has only been one other evaluation of corner store interventions among children, and it was not randomized. Similar to our findings, The Boston Middle School Corner Store Initiative (18), a joint effort of middle schools (n = 6) and nearby corner stores (n = 8) to promote healthier beverage choices via in-class lessons and social marketing, found no significant change in the frequency of sugar-sweetened beverage purchases made by students from pre- to post-intervention using direct observation of corner store purchases.

Interventions to meet the specific store needs to maximize healthy corner store initiative efficacy and sustainability.

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store clusters. Obesity prevalence in the overall sample also did not change significantly over the 2 years. Obesity nationally appears to be plateauing or declining (1,27) and recent epidemiological data from Philadelphia also show this trend (28). Future school-corner store interventions may benefit from focusing on physical activity in addition to targeting intake to effect meaningful changes in weight.

Our study has several strengths. It is the first randomized controlled study of a healthy corner store initiative that utilized direct observation of corner store purchases, included assessment of height and weight, and evaluated children. Previous trials utilized non-randomized control groups (19,20) or relied on self-report and store sales data rather than direct observation to measure consumer purchasing behaviors in corner stores (22). Our study also had several limitations. Students changed schools or were absent on days study staff conducted height and weight measurements, leading to 22% attrition in year 1 and 33% in year 2. Additionally, it is possible that students changed their purchasing behaviors knowing that their items would be recorded by evaluation staff; however, this would have occurred across control and intervention groups and be unlikely to influence between-group findings. Only 43.8% of eligible students consented to participate, though our sample was similar to the overall racial and ethnic composition of students in these schools. We did not record whether students shopped in corner stores alone or with others. Detecting differences in corner store purchasing patterns between individual students versus students shopping with parents or in groups may help identify future intervention targets. Finally, our study examined only urban and predominately minority fourth-, fifth-, and sixth-graders students in a small number of schools (n = 10) and may not represent the behaviors of children of other ages, geographic locals or races/ethnicities.

Future studies may benefit from developing more robust interventions that work with corner store owners to make more substantive changes in stocking healthier snacks and beverages, and in marketing these items (14). Findings from this first-generation study will inform subsequent programs (28) and future studies. There is already work under way in Philadelphia to improve and strengthen corner store initiatives to effect meaningful change (i.e., additional store owner training, refrigeration capabilities and infrastructure changes) (29). Future studies are needed to assess their efficacy. Larger studies with a wider age span may also help provide insights on how to promote more healthful eating behaviors in urban children. It is also possible that corner store efforts need to be part of larger comprehensive efforts to impact healthy eating in schools and communities.

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References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the united states, 2011–2012. JAMA 2014;311:808-814.
2. Kumanyika S, Grier S. Targeting interventions for ethnic minority and low-income populations. Future Child 2006;16:187-207.
3. Ogden CL, Lamb MM, Carroll MD, Flegal KM. Obesity and socioeconomic status in children and adults: United States, 2005–2008. In: Statistics NCHS, ed. Washington, D.C.: US Department of Health and Human Services; 2010.
4. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics 1998;101:518-525.
5. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. Circulation 2005;111:1999-2012.
6. Benjamin RM. The Surgeon General’s vision for a healthy and fit nation. Public Health Rep 2010;125:514-515.
7. Kaufman FR, Hirsh K, Linder B, et al. Risk factors for type 2 diabetes in a sixth-grade multiethnic cohort: the HEALTHY study. Diabetes Care 2009;32:953-955.
8. Puhl RM, Latner JD. Stigma, obesity, and the health of the nation’s children. Psychol Bull 2007;133:557-580.
9. Borradale KE, Sherman S, Vander Veur SS, et al. Snacking in children: the role of urban corner stores. Pediatrics 2009;124:1293-1298.
10. Sturm R. Disparities in the food environment surrounding US middle and high schools. Public Health 2008;122:681-690.
11. Lucan SC, Karpyn A, Sherman S. Storing empty calories and chronic disease risk: snack-food products, nutritive content, and manufacturers in Philadelphia corner stores. J Urban Health 2010;87:394-409.
12. Cavanaugh E, Mallya G, Bresnisser C, Tierney A, Glanz K. Nutrition environments in corner stores in Philadelphia. Prev Med 2013;56:149-151.
13. Vander Veur SS, Sherman S, Lent MR, McCoy T, Wojtanowski A, Sandoval B, et al. Corner store purchasing, corner store spending and commuting patterns of low-income, urban elementary school students. Curr Urban Stud 2013;1:166-170.
14. Gittelsohn J, Rowan M, Gadboke P. Interventions in small food stores to change the food environment, improve diet, and reduce risk of chronic disease. Prev Chronic Dis 2012;9:E59.
15. Dannefer R, Williams DA, Baronerg B, Silver L. Healthy bodegas: increasing and promoting healthy foods at corner stores in New York City. Am J Public Health 2012;102:e27-e31.
16. Curran S, Gittelsohn J, Anilker J, et al. Process evaluation of a store-based environmental obesity intervention on two American Indian Reservations. Health Educ Res 2005;20:719-729.
17. Song HJ, Gittelsohn J, Kim M, Suratkar S, Sharma S, Anilker J. A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. Public Health Nutr 2009;12:2006-2007.
18. Hoffman JA, Morris V, Cook J. The Boston middle school-corner store initiative: development, implementation, and initial evaluation of a program designed to improve adolescents’ beverage-purchasing behaviors. Psychol Schools 2009;46:756-766.
19. Gittelsohn J, Vijayadeva V, Davison N, et al. A food store intervention trial improves caregiver psychosocial factors and children’s dietary intake in Hawaii. Obesity (Silver Spring) 2010;18 (Suppl 1):S84-S90.
20. Gittelsohn J, Song HJ, Suratkar S, et al. An urban food store intervention positively improves food-related psychosocial variables and food behaviors. Health Educ Behav 2010;37:390-402.
21. Paek H-JO, Hyun J, Jung Y, Thompson T, Alaimo K, Risley J, et al. Assessment of a healthy corner store program (FIT Store) in low-income, urban, and ethnically diverse neighborhoods in Michigan. Family Commun Health 2014;37:86-99.
22. Ayala GX, Baquero B, Laraia BA, B M, Linnan L. Efficacy of a store-based environmental change intervention compared with a delayed treatment control condition on store customers’ intake of fruits and vegetables. Public Health Nutr 2013;16:1953-1960.
23. CDC. Childhood obesity facts. Division of Adolescent and School Health and National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. (Accessed December 9, 2013. Available at: http://www.cdc.gov/healthyyouth/obesity/facts.htm.)
24. Growth charts. Accessed December 9, 2013. Available at: http://www.cdc.gov/growthcharts/cdc_charts.htm.
25. Gittelsohn J, Laska MN, Karpyn A, Klingler K, Ayala GX. Lessons learned from small store programs to increase healthy food access. Am J Health Behav 2014;38:307-315.
26. Johnson RK, Appel LJ, Brands M, et al. Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. Circulation 2009;120:1011-1020.
27. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. JAMA 2012;307:483-490.
28. Robbins JM, Mallya G, Polansky M, Schwarz DF. Prevalence, disparities, and trends in obesity and severe obesity among students in the Philadelphia, Pennsylvania, school district, 2006–2010. Prev Chronic Dis 2012;9:E145.
29. Healthy Corner Stores: Food Fit Philly. Accessed July 22, 2014. Available at: http://foodfitphilly.org/eat-healthy/healthy-corner-stores/.