Programme Paper

Development and implementation of Baltimore Healthy Eating Zones: a youth-targeted intervention to improve the urban food environment

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Abstract

Poor accessibility to affordable healthy foods is associated with higher rates of obesity and diet-related chronic diseases. We present our process evaluation of a youth-targeted environmental intervention (Baltimore Healthy Eating Zones) that aimed to increase the availability of healthy foods and promote these foods through signage, taste tests and other interactive activities in low-income Baltimore City. Trained peer educators reinforced program messages. Dose, fidelity and reach—as measured by food stocking, posting of print materials, distribution of giveaways and number of interactions with community members—were collected in six recreation centers and 21 nearby corner stores and carryouts. Participating stores stocked promoted foods and promotional print materials with moderate fidelity. Interactive sessions were implemented with high reach and dose among both adults and youth aged 10–14 years, with more than 4000 interactions. Recreation centers appear to be a promising location to interact with low-income youth and reinforce exposure to messages.

Introduction

Pediatric obesity in the United States disproportionately affects urban minority youth [1]. National Health Assessment and Nutrition Examination Survey 2007–2008 shows that 22% of African-Americans aged 6–19 years are obese and 17% are overweight [2]. Pediatric obesity increases the risk of chronic diseases during adulthood, including type II diabetes, hypertension and heart disease [3, 4]. African-American adults had a diabetes prevalence of 15% in 2007, compared with 9% in Caucasians [5].

African-American obesity has been associated with environmental factors that perpetuate low availability of healthy foods [6–8]. In low-income, urban settings, the low cost of high-fat, high-sugar foods compromises the purchasing of more expensive, healthier alternatives [9]. A study of Baltimore City food sources shows low healthy food availability in 43% of African-American neighborhoods, compared with 4% of white neighborhoods [10]. In Baltimore, youth report purchasing food primarily in corner stores and carryouts [11]. Corner stores occupy a small space (less than 500 square feet) and are located near schools and community recreation
centers. They carry a limited availability of healthy choices (e.g. fresh produce, low-fat milk, lean meat), while having many high-fat, high-sugar foods (e.g. candy, chips, ice creams, beverages) [10, 12]. Carryouts are locally owned (i.e. not part of a chain) fast-food and customers are usually not provided seating. Youth often purchase foods such as French fries, burgers and fried chicken. In addition to frequent use by youth, both corner stores and carryouts also serve as regular food sources for families in communities with low access to supermarkets [12].

Interventions seeking to improve the food environment have been implemented recently [13–18]; however, most of these programs targeted the retail food environment utilized by adult consumers. For example, our previous trial, Baltimore Healthy Stores, targeted African-American adults and was successful in increasing healthy food availability and overall sales in corner stores [19], but had modest impacts on consumer psychosocial factors (food-related knowledge, self-efficacy and behavioral intentions) and food-purchasing behaviors. We attributed low levels of change to a lack of material reinforcement (posters, taste tests, flyers, conversations) in additional community venues [13] and sought to address this limitation in a follow-up youth-targeted trial, Baltimore Healthy Eating Zones (BHEZ).

Little published information is available about food purchasing in urban African-American youth. One intervention in African-American predominant areas of Baltimore placed signs in corner stores indicating caloric information about sugar-sweetened beverages. Purchases after the implementation of these signs was decreased compared with prior. Providing the physical activity equivalent to caloric intake showed the most significant impact [20]. Furthermore, few interventions aimed to modify broader community settings, including after-school recreation centers or neighborhood venues, which may impact youth dietary behaviors [21]. After-school programs have shown promise for youth-based interventions regarding obesity [22, 23] and in 2011, the National AfterSchool Association adopted healthy eating and physical activity quality standards (HEPAQS) for use in out-of-school programs [24]. In Baltimore, after-school programs are commonly attended at recreation centers. These programs are free, located in low-income areas, open to new programming, provide oversight to activities and foods consumed and are considered ‘safe’ places to spend time.

The following discussion details the BHEZ trial and analyzes process evaluation components (dose, fidelity and reach). The implementation of our program aimed to influence youth food-purchasing patterns through point-of-purchase interventions (e.g. intervention activities in the venue in which food purchases are made) strengthened with behavioral messages in additional community settings (i.e. youth recreation centers). We hypothesized that interventions in recreation centers would enhance exposure and detail to youth-targeted health communication, reinforce key health messages and increase youth consumption of healthy foods.

Methods

BHEZ Intervention Trial

Formative research, including in-depth interviews and direct observations, was conducted in African-American neighborhoods of Baltimore and aimed to uncover youth dietary behaviors, variables affecting those behaviors and the most appropriate intervention strategies [11]. Baltimore City has approximately 64% of African-Americans with 19% of the population living below the poverty line [25]. Our baseline data showed that 43% of African-American youth were obese or overweight [26]. The BHEZ study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

Prior to the start of the BHEZ intervention, a baseline survey of youth and caregiver purchasing and consumption patterns was completed. Participants were African-American youth aged 10–14 years recruited from 14 recreation centers in low-income Baltimore City. One child per household, and the caregiver who did the majority of the food shopping and preparation, was interviewed. Written adult
consent and youth assent were obtained prior to the interview. More detailed methods have been described elsewhere [26]. Of the 432 children selected for participation, 176 did not return the consent form and 14 child–caregiver dyads had incomplete interviews, resulting in a response rate of 56% (242 completed interviews).

The BHEZ intervention was then implemented between October 2009 and May 2010. The program was informed by Social Cognitive Theory, which has been used in dietary intervention studies [27]. Social Cognitive Theory emphasizes individual, behavioral and environmental variables [28]. In accordance with this theory, BHEZ attempted to create environmental level changes by working with storeowners in corner stores and carryouts to increase the stocking of healthier food. BHEZ also supported individual-level changes to influence youth's knowledge, self-efficacy and behavioral intentions associated with the consumption of those foods via taste tests, cooking demonstrations and communications (verbal and visual) in both corner stores and recreational centers. Peer educators were recruited to promote observational learning and self-efficacy for healthy behaviors.

Fourteen recreation centers in low-income neighborhoods in East and West Baltimore were recruited, and seven centers were randomized as intervention centers; two neighboring centers were combined given low recruitment levels and close proximity, providing six intervention zones. In order to assess program impact, the remaining seven centers served as controls and did not receive intervention activities. For each zone, BHEZ identified three corner stores and/or carryouts that were within a half-mile and were reported by youth as frequently visited for food purchases, for a total of 21 corner stores and carryouts surrounding the recreation centers. A few of the participating corner stores were part of our previous trial, Baltimore Healthy Stores, which was completed 2 years earlier. No intervention materials (posters, shelf labels, etc.) were still present in these stores.

Five themed phases were used. Activities in Phases 1–4 (each 10 weeks) were conducted both in corner stores and recreation centers, while Phase 5 (3 weeks) focused on activities within carryouts. Each phase focused on specific behavioral messages, commonly eaten foods, promoted food alternatives and food-related behaviors (Table I). Water, diet soda and 100% juice were emphasized as a replacement for regular soda; low-fat milk and low-sugar cereals were deemed healthier breakfast options; 100% whole wheat bread and cooking spray were encouraged for food preparation; fresh fruits and sunflower seeds were promoted as healthy snack foods, and light mayonnaise was substituted in prepared foods.

Interventionists were all graduate students at the Johns Hopkins Bloomberg School of Public Health; all were trained by the principal investigator over a 2-day period, with period booster sessions. They regularly visited (at least once per week) each recreation center and corner store location to conduct taste tests, handout flyers and giveaways and discuss behavioral messages with members of the community. Taste tests provided the opportunity to sample promoted foods, and in the case of low-fat milk and diet soda compare them with whole milk and regular soda. Giveaways included a phase-specific item to promote the behavioral message (Table I).

To reinforce BHEZ messages, youth from a local community organization, Kids on the Hill, were provided behavioral messages for each phase and created illustrations for posters and flyers. These posters were placed in participating stores and recreation centers. Flyers were one-page, color promotions of phase-specific messages that targeted youth or adult caregivers. Because the flyers could be taken home and read at a later time, they included more detailed information than posters.

**Corner store and carryout-only interventions**

During the intervention, storeowners were asked to stock a minimum quantity of promoted food options (Table I). The health and community benefits for stocking foods were communicated to storeowners and, in order to incentivize stocking and
To minimize financial risk, storeowners who did not already stock the promoted item(s) received one $25 gift card to purchase the promoted foods from wholesale stores for the phase. Gift cards were given to carryout locations in Phase 5. Small quantities of promoted foods (i.e. one to two cases of diet soda, one to two cases of fruit and two large jars of light mayonnaise) were also provided.

To identify and promote the selected foods, BHEZ implemented a variety of in-store strategies, successfully implemented in the Baltimore Healthy Stores program [29]. Four brightly colored shelf labels (lower in fat, lower in sugar, higher in fiber, healthy choice) were placed below the appropriate promoted food at the start of the phase with the aim of maintaining them throughout the entire intervention. For the purposes of this program, low fat was <10% daily value per serving, low sugar was <10 g sugar per serving, high fiber was >10% daily value per serving and healthy choice included fruits, vegetables and bottled water. For Phase 5, we modified carryout menus using picture displays.
to emphasize healthier options. Menus were pre-tested in Baltimore African-American focus groups and modified combined with storeowners’ preferences.

Recreation center-only interventions
In addition to the aforementioned intervention activities, since recreation centers offered space and resources, children additionally were taught how to prepare healthy items (i.e. cooking classes).

Peer educators
The final component of the intervention was the use of peer educators, who were trained to assist interventionists in program delivery and could support peer changes. Two to three youth, aged 13–18 years, were chosen per center. Peer educators completed an application, which included a list of relevant experiences, a statement of interest and at least one reference. Recreation center directors were asked to choose among applicants at their discretion. Prior to the start of the intervention, a training session was provided and educators were given a Manual of Procedures for reference. Individuals were provided with a small monthly honorarium of $100. Peer educators were to initially accompany interventionists, helping to conduct intervention activities and communication with customers and eventually lead the activities independently.

Process evaluation
The process evaluation sought to assess three primary constructs: fidelity, reach and dose [30]. We developed a series of implementation standards for each component of the intervention, based largely on our previous experience with program implementation in Baltimore. Fidelity was defined as the extent to which the intervention was implemented as planned and was assessed at store and community levels. We set our standard for number of intervention visits at 246, a 25% increase over the number achieved in Baltimore Health Stores [29]. Reach was defined as the number of 10- to 14-year-old youth and 18+ year-old adults that we interacted with during intervention visits. Although our primary target was youth, 18+ year olds were included due to the assumed role for adults being the primary food shoppers of the household. Our standard was set at 3678 total contacts or 736 per phase, again representing a 25% increase from our prior program. Dose was defined as the number of various intervention components (taste tests, giveaways, flyers or long interactions, implying the discussion of health messages) delivered to each participant at the interactive sessions. Intervention participants were to receive an average of at least 3.5 of the 4 intervention components, representing a 25% increase.

Instruments
Process evaluation data were collected by trained public health graduate students using two primary instruments. Students were trained by the principal investigator.

Store visit evaluation form
Four data collectors, separate from interventionists, administered unannounced store visit evaluations, which were to be completed in corner stores and carryouts at least twice per phase per store (approximately once per month), for Phases 1–4, and at least once in Phase 5. The form assessed fidelity by indicating the availability of promoted foods, proper placement of shelf labels, presence and visibility of promotional posters and, for carryouts, presence of an intervention menu. Availability of foods was assessed during and after its promotional phase.

Interventionist logs
Five BHEZ interventionists recorded activities during each interactive session, including the distributed number of communication materials (e.g. flyers, giveaways), taste test samples, interactions with store visitors (by age and gender) and duration of these interactions (brief: 10–60 s, prolonged: >1 min). Interventionists wrote field notes to describe the implementation of the intervention, success of the interactions with storeowners and
customers and any additional comments that may impact the intervention (e.g. day of the week in which stocking occurred). They ensured shelf labels and posters were correctly positioned and replaced those that were missing or damaged. Visits were to be conducted at least three times per phase (approximately once every three weeks) at each intervention venue.

Data management and analysis
Microsoft Excel 2007 (Microsoft, Redmond, WA, USA) was used to calculate summary statistics for quantitative data. Availability of promoted foods was the percentage of times a food was available during process evaluators’ visits. Placement of shelf labels was indicated as the percentage of times the label was correctly or incorrectly placed directly under the promoted food, given that the food was in stock. Incorrect shelf label placement occurred when the food label was present in the store, but not directly underneath the indicated item. The combined correct and incorrect placement of shelf labels was reported to provide indication of whether the food had initially been labeled, but had been relocated during restocking. All shelf label percentages are reported during and after the given phase for the foods being promoted. Poster placement was presented as stores who had at least one intervention poster visible from any of the five phases and stores who had at least one phase-specific intervention poster placed. Numbers of flyers, material giveaways and food giveaways are described by visit and phase, in order to illustrate trends. Number of intervention participants is presented by visit, location and phase in three categories: total number of participants, total number of target youth (10–14 years) and total number of adults aged 18 years or older (potential caregivers). Presence of peer educators was calculated as the percentage of recreation center visits during which at least one peer educator was present. Standards for peer educator presence were set at one attended session per week for a total of 10 attendances per phase. Reach of the program was calculated from the total number of recreation center and store visitors communicated with, separated by age and sex.

Fidelity, reach and dose for each component were calculated as a percentage of a set standard met, when available. Low fidelity was defined ad hoc as 0–49%, moderate as 50–74% and high as 75–100%, in order to be comparable to interventions in similar settings [29, 31].

Results
Stores and recreation centers overview
The intervention was conducted in six recreation center zones, a total of 15 corner stores, 3 corner stores with carryout options and 3 carryout-only locations and was delivered with high dose. A total of 328 intervention visits were made over five phases, with 78 recreation center and 250 corner store/carryout visits, for an average of 13 per center and 12 per store. Of the 250 store visits, 62 were to ensure print materials were posted, while 188 involved communicative interactions with customers. In total, 129 store process evaluation visits were made, with an average of 26 per phase, or 1.5 per store per phase for Phases 1–4 and 0.8 visits per store in Phase 5.

Stocking of foods in corner stores
Fidelity of healthy food availability ranged from 0% to 100% in participating stores, with a mean availability of 74% among all food items, indicating moderate fidelity overall (Table II). Excluding drink mixes, which were not available at any of the stores during the intervention, availability of promoted foods was 82%, indicating high fidelity overall.

Print materials in corner stores
Shelf label placement had low to moderate fidelity (Table II). Little improvement in increasing the placement of labels was seen throughout the program. At least one poster was visible in 81% of stores throughout the five phases (Table II). As phases progressed and more posters were added
to the walls of the stores, the percentage of stores with phase-specific posters decreased, although moderate fidelity was maintained overall.

**Interactive sessions and giveaways in stores and recreation centers**

Standards for fidelity, reach and dose were exceeded for interactive sessions (Tables III and IV). Interventionists held a total of 266 interactive sessions with 38% held in recreation centers. The average taste test lasted 49 min. Total reach was 4079 interactions.

At either venue, approximately 15 contacts were made per intervention visit (Table IV). On average, each interactive session in corner stores included 7 brief and 8 long interactions with visitors, whereas recreation center visits had 3 brief and 13 long interactions. In corner stores, interventionists had one brief and two long interactions with target youth and three brief and four long interactions with adult caregivers. Recreation centers showed one brief and five long interactions with target youth and zero brief and one long interaction with adult caregivers.

The dose delivered was moderate to high, with an average of 2.8 intervention components delivered to each visitor, achieving previous Baltimore Healthy Stores levels. An average of 8 flyers (5 recreation centers, 9 corner stores), 18 material giveaways (20 recreation centers, 17 corner stores) and 8 food giveaways (10 recreation centers, 7 corner stores) were distributed per interactive visit.

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**Table II. Fidelity for availability of promoted foods and placement of shelf labels and posters by phase**

<table>
<thead>
<tr>
<th>Foods promoted</th>
<th>Availability of foods during the phase and thereafter (% times stocked)</th>
<th>Shelf labels (% times shelf labels correctly placed)</th>
<th>Shelf labels (% times shelf labels correctly or incorrectly placed)</th>
<th>% of stores with at least one visible poster</th>
<th>% of stores with at least one visible phase-specific poster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Diet soda</td>
<td>100</td>
<td>41</td>
<td>41</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Water</td>
<td>100</td>
<td>40</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% juice</td>
<td>100</td>
<td>25</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drink mixes</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-sugar/high-fiber cereals</td>
<td>100</td>
<td>38</td>
<td>52</td>
<td>86</td>
<td>64</td>
</tr>
<tr>
<td>Low-fat milk</td>
<td>52</td>
<td>29</td>
<td>50</td>
<td></td>
<td></td>
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<tr>
<td>Phase 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cooking spray</td>
<td>50</td>
<td>55</td>
<td>55</td>
<td>79</td>
<td>75</td>
</tr>
<tr>
<td>100% whole wheat bread</td>
<td>50</td>
<td>26</td>
<td>44</td>
<td></td>
<td></td>
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<tr>
<td>Phase 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fruit</td>
<td>52</td>
<td>12</td>
<td>16</td>
<td>90</td>
<td>54</td>
</tr>
<tr>
<td>Low-sugar fruit cups</td>
<td>100</td>
<td>23</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any fresh vegetables</td>
<td>77</td>
<td>9</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretzels</td>
<td>73</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baked chips</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granola bars</td>
<td>69</td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuts and/or seeds</td>
<td>96</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other low-sugar/low-fat snacks</td>
<td>94</td>
<td>12</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanut butter</td>
<td>81</td>
<td>38</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>74</td>
<td>30</td>
<td>36</td>
<td>81</td>
<td>62</td>
</tr>
</tbody>
</table>

*Total number of store visits by the process evaluators: Phase 1: 27; Phase 2: 28; Phase 3: 23; Phase 4 Only: 31; Phase 4/5 Overlap: 17. Since Phase 4 and Phase 5 overlapped, process evaluation for Phase 4 includes evaluations completed during the Phase 4-only component and the Phase 4 and Phase 5 overlap. Shelf label percentages are reported as the combined average of the promoted item during its own phase and subsequent phases. aThe combined percentage of when a shelf label was present directly under the indicated item (i.e. correct) and when the label was present in the store, but not directly underneath the promoted item (i.e. incorrect). bAny of 100% Everfresh Juice, Juicy Juice or Other 100% Juice. cCrystal Light or other low-sugar drink mixes. dEither 2% milk or 1%/skim milk. eAny of: apples, oranges or bananas. fAny of: Lay’s Baked, Utz Baked, Utz DeLite, Sun Chips, Sunflower Chips, Reduced Fat Pringles, Chex Mix. gOther snacks includes snack foods that have <10% daily value of fat or <10 grams of sugar per serving.
than 2400 buttons were distributed. For a given phase, an average of 291 brief and 525 long visits occurred and 2169 flyers and 4697 giveaways were delivered throughout the centers and stores.

**Carryout-specific component**
Phase 5 focused on healthy carryout decisions. In the three carryout-only venues, BHEZ intervention menu boards were erected. The menu revision used photos to emphasize healthier foods on the menu, such as grilled chicken and salads. Posters promoting the use of light mayo were displayed in carryouts and corner stores. In addition, store-owners were provided with light mayonnaise, which they substituted for regular mayonnaise without informing customers. Owners reported that most customers did not taste the difference, which was supported by results of light mayo taste tests (results not shown).

**Peer educator component**
Thirteen peer educators were selected, of which, eight attended the introductory training sessions and five remained involved for the majority of the
intervention (working with the interventionists a minimum of two times per phase). Educators were significantly more involved at recreation centers than corner stores. Delivery of the peer component of the intervention was moderate, with 58% of recreation center visits having the presence of at least one individual (Table III). Two of the six recreation centers had a peer educator present at all recreation center sessions, while the remaining four centers had educators drop out gradually. In Phases 1 and 2, only eight store visits (7%) had the presence of at least one educator; none was present at any store visits thereafter.

**Comparison to Baltimore Healthy Stores**

BHEZ exceeded the number of visits to recreation centers and stores as well as the number of interaction session visitors, when compared with prior program standards (Table V). It did not, however, meet goals surrounding the availability of promoted foods during the individual phases or the number of items distributed during the interactive sessions.

**Discussion**

The BHEZ program was implemented with overall high reach and dose, but moderate fidelity in terms of intervention delivery at the store level. We made 328 intervention visits contacting more than 4000 individuals. We attribute the higher number of contacts to intervention activities in recreation centers in addition to corner stores and carryouts. Centers provided opportunities to interact with youth during consistent times and allowed interactions of longer duration. Interventionist activities could be expanded to include cooking demonstrations and educational games, due to space and kitchen facilities. Using such venues allows for reinforcement of messages, compared with briefer point-of-purchase interactions.

BHEZ was slightly less successful at intervention implementation within stores than our prior program (Table V) [29]. The availability of healthier foods within stores and the number of giveaways distributed was not improved. One possible reason for lower availability of food was the lack of interventionists of appropriate ethnic background. The majority of small storeowners in Baltimore City are Korean American, with a growing number of Hispanic storeowners. Misunderstandings have been noted to occur within the local community due to culture and language [32]; previously, storeowners indicated hesitation to change orders because of language barriers [29]. During the prior trial, a Korean project coordinator recruited and maintained strong relationships with storeowners.
Unfortunately, a Korean-speaking staff person was not available to our research team during the BHEZ intervention. Employing interventionists who can communicate clearly may have improved stocking foods and fidelity of signage. As in our earlier trial, some storeowners limited the times and duration interventionists could work in the stores [19]. Comments from some owners indicated they did not fully understand interventionist activities and those activities could lead to increased sales. In addition, some storeowners worried about theft and interventionists’ safety. As the trial progressed, interventionists developed stronger relationships with storeowners, who became more comfortable with activities, although a Korean-speaking team member would have greatly enhanced rapport building.

Other reasons for moderate fidelity of intervention components arose from lack of refrigeration, limited shelf space, storeowners’ perceived lack of customer demand, lack of availability at wholesalers and the high cost of keeping these foods in stock despite subsidization. Sugar-free drink mixes, although provided as free samples for storeowners to sell, were never actually purchased by storeowners. This may have been due to aforementioned reasons or that drink mixes were a novel item compared with common substitutions (e.g. diet soda).

Shelf labels were often found to be incorrectly placed or missing, which varied from other studies [13, 31, 33]. In corner stores, items are often crowded into shelves and refrigerator units, with frequent movement of items by multiple stocking individuals, who did not move the corresponding shelf labels. If all shelf labels had been placed at the intervention start, it may have increased vendors’ awareness of their presence and improved fidelity of placement. Although prior interventions have shown similar barriers [13, 31], they have indicated success. Community culture or language of storeowners may affect successful change. Shelf labels have been shown to increase knowledge of and purchasing of healthy foods [34–36].

A novel component was the use of peer educators to engage youth. Similar mentoring approaches have been used successfully in other trials aimed at promoting nutrition and reducing childhood obesity [21, 37–39]. Peer education offers the benefit of providing an alternative to an ‘authoritarian’ adult figure, while developing positive role models [39, 40]. These programs also have the advantage of empowering the peer educators and have been shown to increase student’s self-esteem, self-efficacy and sense of effectiveness [40–42].

We initially planned that peer educators would have a high level of contact with youth and be able to conduct independent sessions. As the intervention progressed, educators were generally present only during interactive sessions in recreation centers and not at corner stores. One explanation may be safety, which was raised as a concern during formative research [11]. The presence of educators at recreation centers reinforces recreation centers as a safe place and an effective venue to reach youth in urban settings. Another explanation was scheduling conflicts. Many took public transportation and were not available until evenings. Retention of peer educators during the school year was difficult, due to growing involvement in other after-school activities. The ways in which roles were defined at the single training session and enforced throughout the year may not have been sufficient to keep them involved at the level anticipated. Holding regular meetings would have likely increased ownership, confidence and commitment.

Our use of Social Cognitive Theory led to a multi-pronged intervention approach that intervened at environmental, psychosocial and behavioral levels. Our emphasis on skill-building via cooking classes for children was intended to improve self-efficacy in children, but may have reached a small number of children, despite being well received. A downside to emphasizing small group intervention activities was reduced attention to environmental changes in stores, as recreation centers had a smaller reach overall than corner store activities. Addressing both improved supply and demand is important for improving the small store food environment [27].

The BHEZ trial was partially successful (A. H. Shin, P. J. Surkan, A. J. Coutinho et al., under review). Participation in the program was associated
with reductions in BMI percentile among girls who were obese/overweight at baseline only and some limited improvements in psychosocial factors. We attribute these findings to challenges in implementation in specific components of the program described above.

The BHEZ trial used several approaches that contribute to the literature on process evaluations. Chief among these was the development of set standards for implementation of each program component and rating implementation success against these standards [29]. We sought to increase our implementation of intervention components at level at or above previous similar programs [29]. Finally, we compared the level of implementation of our program with that of another, similar program (Table V). Comparing implementation between trials component by component is needed to advance the field.

The study does have limitations. It was not feasible to record intervention reach and dose delivered to the entire target population (all youth and caregivers of low-income neighborhoods in Baltimore City) as a proportion of the total population. As a proxy, we set standards for the numbers of individuals we interacted with and the number of intervention elements to be delivered to each contact. Additionally, because youth are not restricted to a single location after school, there may have been some level of intervention contamination. Youth visit different recreation centers for after-school commitments, potentially exposing control individuals to intervention activities. It is also possible that individuals attended a control recreation center, but lived near intervention corner stores. Finally, we did not get formalized feedback from peer educators, since many stopped participating early on. This would have been helpful to determine conclusive reasons for drop out and increasing participation.

Lessons learned from BHEZ have been applied to new childhood obesity prevention trial in Baltimore City. B'More Healthy: Communities for Kids will expand on the BHEZ approach by adding food policy and wholesaler components, which will permit us to increase access to healthier foods in corner stores and carryouts in more intensive and sustainable ways.

**Conclusions**

The use of multiple community venues is an appropriate means to influence youth and adults, as illustrated by the number of in-depth interactions with participants. While not all BHEZ set standards were met for overall program delivery, it is likely that exposure to program components was higher at an individual level, particularly among youth. Improved program implementation in food stores is needed. Interventionists who can speak with store-owners in their preferred language may provide better communication of the goals and process of the intervention. Store size, refrigerator space and availability at wholesalers should also be considered when choosing items to introduce. Future research should examine more effective ways to incorporate peer educators into youth interventions. Having increased individual time with peers may allow behavioral messages to be more effective.

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**Conflict of interest statement**

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References


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