A Pilot, Community-Based Interventional Study in a Local Convenience Store to Improve Dietary Outcomes in Children

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Abstract: *Introduction*: One contributor to the epidemic of obesity is an unhealthful food environment. This study was designed to assess the feasibility of a community-level intervention in a convenience store on improving the food environment.

Methods: This community-based interventional study took place in an urban, low-income, ethnic-minority neighborhood. Children who reported visiting either the intervention store or another neighborhood control store were enrolled. The healthfulness of store offerings was measured, and a diet survey was completed by subjects from both intervention and control stores.

Results: At the nine-month follow-up, the intervention store promoted and advertised more healthful items than the community-control store. There was a trend toward increased fruit and vegetable consumption and lower sugar-sweetened soda consumption among the intervention store subjects but not in the control subjects.

Conclusions: Improving the food environment is feasible via a community-based intervention utilizing the influence of a community health center.

Keywords: Childhood obesity, built environment, convenience store, nutrition, community-based research.

INTRODUCTION

Obesity has many drivers including an unhealthful food environment, especially among low-income neighborhoods [1-3]. Environments with more convenience stores have been associated with lower fruit and vegetable intake [4] and higher body mass index (BMI) [5, 6]. The prevalence of overweight and obesity among adolescents in the south Bronx is estimated to be 38%, higher than both the rest of the Bronx and New York City as a whole [7]. The south Bronx is inundated with small convenience stores, known colloquially as bodegas. Bodegas can serve as a community gathering point, but most of the bodegas' food offerings are not healthful [8, 9].

Since 2006, the New York City Department of Health and Mental Hygiene (DOHMH) has spearheaded the Healthy Bodegas Initiative [9], a coordination and support effort for community groups to partner with bodegas and improve their food offerings. Reports from the DOHMH [9] and other cities [10] have shown encouraging results in improved stocking of healthier items and increased purchase of those items. Community health centers are uniquely positioned to be partners in improving the food environment through their expertise and influence in the local community, and a partnership between a community health center and a local convenience store has not been described previously. Furthermore, data on children and the effect of a public health intervention in a bodega on individual-level dietary outcomes have not been measured. This study aimed at assessing the feasibility of a community-level intervention in a bodega on improving the food environment and diet of children who frequent the bodega.

METHODS

Study Design

This pilot, community-based interventional study was conducted in the south Bronx, New York during 2010-2012. This study was approved by the Montefiore Medical Center Institutional Review Board. All subjects' parents provided oral consent, and all subjects provided oral assent.

Partnering with Bodegas

Bodegas were recruited from a 10-block radius around a Federally Qualified Community Health Center in the south Bronx. The study was explained to the bodega owners, and they were asked for their participation to make suggested changes to their stores. Of the bodegas who agreed to participate, one bodega was chosen for the intervention, and another neighborhood bodega served as a control for community-level changes. At the intervention bodega, weekly meetings were conducted with the store's

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owner to encourage, educate and facilitate change in stocking and shelving. With the bodega owner's participation, signs demarcating healthier food items were posted, and a healthier options menu was created from the offerings they already had. Community members were also encouraged to ask for healthier items in the bodega.

Subject Eligibility and Recruitment

Children ages 9-18 were eligible to participate if they reported living in the 10-block radius around the community health center, had a valid phone number and reported no plans to leave the area. Age nine was used as a lower cut-off to ensure reliable data collection of food intake [11], and this is also when children begin to make food decisions on their own. Subjects were recruited via posters and physician referrals.

Outcome Measures

Outcome measures were collected at baseline and nine months post-intervention on both the intervention and control bodegas as well as subjects who visited them. Control and intervention bodegas were assessed onsite for healthfulness of offerings using a standardized instrument developed by the DOHMH, the Star Criteria [9]. To assess diet, survey questions were adapted from the New York City Community Health Survey [12].

Height and weight data were based on self-report. Subjects were grouped into the intervention or control bodega group based on self-reported shopping habits. The community-control bodega was one of the control bodegas used to track store-level outcomes.

Data Analysis

BMI was calculated using self-reported height and weight [13]. BMI percentiles were calculated using growth curves [13]. The definitions of $\geq 85^{th}$ percentile for overweight and $\geq 95^{th}$ percentile for obese were used. The dietary survey outcomes were reported as frequencies with variable denominators (e.g. 2 per day, 4 per week). These frequencies were categorized into four groups of never, less than 1 per day, 1 per day, and greater than 1 per day. The proportion who consumed greater than 1 per day is reported as per custom in the literature.

Descriptive statistics were used to analyze the subjects' demographic characteristics and diet patterns. T-tests, Fisher's exact or Mann-Whitney U test statistics were used to compare outcomes at baseline and nine-month follow-up. Within-group paired analyses between the two time points were conducted using McNemar's and paired t-tests.

RESULTS

Store-Level Outcomes

The baseline assessment of the intervention bodega did not significantly differ from the community-control bodega (Table **1**). The intervention bodega owner was very reluctant to make any changes to his offerings because of his perceptions of customer demand, though this did improve over time. The owner was willing to make changes in stocking and displays. For example, he was willing to rearrange and demarcate low-salt and low-sugar canned goods, and he displayed posters advertising water as a healthier choice than sugar-sweetened beverages. Most of the changes seen at the nine-month follow-up in the intervention bodega reflect signage and rearrangement of the store rather than changes in purchasing patterns (Table **1**).

Individual-Level Outcomes

Survey data were completed on thirty-eight subjects at baseline and twenty-two at follow-up. The primary reason for loss to follow-up was lack of a working telephone number or being unable to reach the person after five attempts.

The mean age of subjects at baseline was 14 years (SD=2.6), 65.8% were female; they reported frequenting their bodega on average two to three times per week. Overall, 45.7% were overweight or obese with no significant difference between intervention and control subjects and no change at the nine-month follow-up. Food assistance program use was high with 42.1% reporting use at baseline and 59.1% at the nine-month follow-up; 28.9% of subjects at baseline perceived needing greater than ten minutes to travel to buy fresh fruits and vegetables (36.4% at follow-up).

Reported fruit and vegetable intake increased from a median of one to a median of three servings per day in subjects frequenting the intervention bodega ($p=0.25$, Mann-Whitney U test) while remaining stable at a median of two servings per day in the controls ($p=1.00$, Mann-Whitney U test) between the baseline and nine-month follow-up. Sugar-sweetened soda consumption was reduced in the intervention group

Table 1: Characteristics of the Intervention and Community-Control Bodegas at Baseline and Nine-Month Follow-Up Using a Standardized Instrument

Criterion:	Intervention bodega		Control bodega	
	Baseline	Follow-up	Baseline	Follow-up
Stock no-sugar canned fruit	few	yes	yes	no
Stock fresh fruit	5 varieties	6 varieties	4 varieties	4 varieties
Stock fresh vegetables	3 varieties	2 varieties	2 varieties	1 variety
Stock low-fat milk	yes	yes	yes	yes
Stock low-salt canned vegetables	few	few	yes	no
Display posters promoting healthy foods	no	yes	no	no
Minimum produce display standards	yes	yes	yes	yes
Stock whole-grain bread	yes	yes	yes	yes
Stock healthier snack items	no	no	no	no
Implement strategies to increase healthy offerings	no	yes	no	no
Display water at eye-level	no	no	yes	yes
Stock dark-green leafy vegetable	no	no	no	no
Clearly identify healthier items	no	yes	no	no

from 41.7% consuming greater than 1 soda per day at baseline to only 11.1% post-intervention (p=0.25, McNemar's), while in the control bodega participant group, 26.9% were consuming more than 1 soda per day at baseline versus 23.1% at follow-up (p=1.00, McNemar's). Diet soda consumption, sugar-sweetened non-soda consumption and sweet snack consumption showed non-significant, downward trends in both the intervention and control groups.

DISCUSSION

This study found that after a significant investment of time and trust-building efforts with a local bodega, a community-based intervention can have a positive impact as shown by the upward trend in fruit and vegetable intake and the downward trend in sugar-sweetened soda consumption in the intervention group. Prior studies have documented the significant caloric contribution that convenience stores have on children's diet [14]. Song *et al.* demonstrated some success in improving what stores offer [10]. To our knowledge, this is the first study to examine individual dietary outcomes after a community-level intervention at a local convenience store (bodega). Moreover, this is the first study to report outcomes in children.

Importantly, this study also demonstrates that a partnership between a community health center and a local convenience store is feasible. As the baseline data suggest, the community with whom we worked overall has a poor diet and a high prevalence of overweight and obesity. The food environment is largely unhealthy which makes both the need for change greater and the challenges in doing so more abundant. As the community health center's commitment to the partnership became more apparent over time, the suggestions on potential changes to the bodega were better received and implemented. However, implementing a health education and advocacy program in an economically driven environment such as a bodega faces significant challenges. While efforts were made to influence the demand side via encouraging parents and subjects to ask for healthier items, the effect of such efforts was not clear. Future projects should use innovative means of leveraging the demand side such as school-based interventions or other community groups.

Of note, 41.7% of subjects reported needing more than 10 minutes to access fresh fruits and vegetables while nearly every corner bodega sells some fruits and vegetables. This shows evidence that the perception of what the bodega sells may be as important for encouraging consumption as getting the bodega to supply them, which has been recently demonstrated elsewhere [15]. Significant changes to displays including permits for displaying fruits and vegetables outside the store may help with this perception.

This study is limited by its small sample size, since it was a pilot study. We had significant loss to follow-up due to changing contact information. This should inform future projects using phone-based follow-up among low-income communities. We attempted to control for larger community effects by surveying control subjects and a community-control bodega, but a differential effect aside from our intervention with the bodega cannot be ruled out. Finally, the intervention and control stores were in the same community. Therefore it is possible that there was cross-over shopping between stores that was not reported in the self-report survey. However, this would likely have led to a reduction in the observed difference rather than an inflation of the intervention results.

If children are to consume five fruits and vegetables a day and not drink two cans of soda a day as per guidelines [16], then the food environment around them must change. Future efforts to form partnerships between health authorities and local convenience stores should be strongly encouraged and carefully planned with a recognition of the economic dynamics at play.

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