Using Mobile Fruit Vendors to Increase Access to Fresh Fruit and Vegetables for Schoolchildren

June M. Tester, MD, MPH; Irene H. Yen, PhD, MPH; Barbara Laraia, PhD

Abstract
This study explored the extent to which schoolchildren purchased precut and bagged fruits and vegetables from a mobile fruit vendor (frutero). During 14 days in fall 2008, a frutero sold fruits and vegetables at the entrance of an elementary school; 59% of the frutero’s 233 consumers of 248 items were elementary-school students. With each successive day, an average of 1 additional bag of fruits and vegetables was sold by the frutero and 1.5 fewer nonnutritious foods by a competing vendor. Policies encouraging the sale of nutritious foods from mobile food vendors may increase access for schoolchildren.

Objective
Mobile food vendors are sometimes found in Hispanic and African American neighborhoods, often where there are few large food outlets (1,2). Since 2008, the Green Carts program in New York City has provided incentives to vendors to sell whole fruits and vegetables in areas that have limited access to such food (3). There is value in exploring public health strategies that encourage the sale of nutritious food by mobile vendors, including such approaches as broadening the zones and locations in which vendors are permitted to sell (4,5).

In Oakland, California, mobile vendors known as fruteros sell fresh, precut, and bagged fruit (6-9). Since 2001, these vendors have complied with city regulations and health codes requiring a central kitchen (9). However, local regulations prohibit mobile food vendors — including these fruteros — from selling near schools and parks (10). Such regulations exist in other cities such as Phoenix, Arizona; San Antonio, Texas; San Diego, California; and San Jose, California (4). We are unaware of any school or city policies that encourage improved food access for schoolchildren through mobile vendors.

The objective of this study was to examine the extent to which schoolchildren purchased fruits and vegetables from a frutero after school. Secondary objectives were to compare frutero sales with those of competing vendors and examine the effect of the frutero on the greater mobile vending environment.

Methods
We conducted this pilot intervention outside an elementary school campus (kindergarten through 5th grade) in Oakland, California. During the 2008–2009 academic year, there were 279 students; 41% were Hispanic, 33% were African American, 15% were Asian, less than 1% were white, and 74% were eligible for free or reduced price lunch (11).

Intervention
In October 2008, we obtained school permission for a single frutero to sell fruits (eg, mango) and vegetables (eg, jicama) at the entrance to the school property at the close of each school day. The frutero sold products that had been precut and packaged in a central kitchen into snack-sized bags holding a one-half–cup serving. Bags were chilled with ice and sold for $1.50. We based the design of this intervention on observations of sales at fruteros (2) and with input from the frutero vendor’s association. Neither the school nor the teachers actively promoted this intervention among students. This study was approved by the institutional review board of Children’s Hospital & Research Center Oakland.
Observations of consumers and transactions
Using methods described elsewhere (2), research staff counted consumers at the frutero and at competing vendors within 1 block of the frutero. They characterized consumers according to best guess of race/ethnicity and age and categorized them as preschoolers, elementary school students, teenagers, or adults. They also counted the number of transactions and characterized the type and cost of each item sold at each vendor.

Each afternoon for 10 days (5 baseline days, 14 intervention days), at least 3 research staff simultaneously observed all vendors within 1 block of the school entrance, beginning when the school bell rang and ending whenever the vendor left because sales had dwindled.

Observations of nonintervention vendors
To determine whether the presence of the frutero would affect the greater mobile vending environment, we also counted the number of (nonintervention) vendors within a quarter-mile of the school entrance (not including the competing vendors within 1 block). We created a one-quarter–mile network buffer around the school using Arc View 9.2 (ESRI, Redlands, California). Pairs of researchers counted all such vendors on 17 days after school (6 days before, 7 days during, and 4 days after the intervention); they did not observe sales.

Analysis
We conducted linear regression using day of the intervention as a predictor for sales per afternoon of bags of fruits and vegetables at the frutero (1–14 d) and for sales at the competing vendors within 1 block of the frutero (1–19 d). We used Stata 9.2 (StataCorp LP, College Station, Texas).

Results
We found 2 types of competing vendors: an ice cream vendor and a cotton candy vendor. At least 1 competing vendor was present for 12 afternoons (Table 1). Of the frutero’s 233 consumers, 59% were elementary school students; for 27% of frutero transactions, no adults were present (Table 2).

The frutero sold an average of 17.7 bags of fruits and vegetables each afternoon during an average of 26 minutes of sales, and for the last 5 days of observation, at least 20 bags were sold each afternoon. Overall, the frutero sold 248 bags during 324 minutes of observed sales (an approximate rate of 0.8 bags per minute) (Table 1). A β coefficient of 0.95 ($P < .001$) for frutero sales suggests 1 additional bag was sold on each successive day; a β coefficient of −1.48 ($P = .02$) for sales of competing vendors suggests 1.5 fewer nonnutritious items were sold on each successive day.

We completed quarter-mile buffer observations in an average of 12.8 minutes. The mean number of nonintervention vendors decreased: 2.3 (range, 0–4; standard deviation [SD], 1.3) before, 1.4 (range, 0–3; SD, 1.1) during, and 0.8 (range, 0–2; SD, 0.9) after the intervention.

Conclusion
Fruteros are found in neighborhoods that have a high density of Hispanic immigrants; children and adults buy precut fruits and vegetables from these vendors even in the presence of other vendors selling nonnutritious options (2). Students in our study also made purchases on their own. The number items sold by fruteros per minute in our study was higher than that previously observed in the community (0.4 items per min) (2).

This study has limitations. It was a brief intervention at a single school. We cannot confirm that children purchased fruits and vegetables instead of high-calorie energy-dense snacks; future research on how “healthy” mobile vendors affect overall consumption is warranted. By study end, we found fewer competing vendors, perhaps because of competition from the frutero, who had a prime location, or perhaps because the other vendors, who are not permitted to sell near the school, were concerned about scrutiny.

We demonstrated the feasibility of a sanctioned vendor to sell nutritious food items after school and suggest that the presence of this vendor may decrease sales at vendors selling less healthful items. Interventions like ours have the potential to increase access to healthful food to children in the after-school environment.

Acknowledgments
Funding for this research was provided by Healthy Eating Research (grant ID 63049), a national program of the Robert Wood Johnson Foundation. We thank the Oakland Unified School District for their cooperation and assistance.
Author Information
Corresponding Author: June M. Tester, MD, MPH, Preventive Cardiology, Department of Cardiology, Children’s Hospital & Research Center Oakland, 747 52nd St, Oakland, CA 94609. Telephone: 510-428-3885, ext. 2052. E-mail: jtester@chori.org.

Author Affiliations: Irene H. Yen, Barbara Laraia, University of California, San Francisco, California.

References
1. Odoms-Young AM, Zenk S, Mason M. Measuring food availability and access in African-American communities: implications for intervention and policy. Am J Prev Med 2009;36(4 Suppl):S145-50. CrossRef PubMed
2. Tester JM, Yen IH, Laraia B. Mobile food vending and the after-school food environment. Am J Prev Med 2010;38 (1):70-3. CrossRef PubMed
3. New York City, New York Local Law 9, 2008. Amendment to Municipal Code §17-306.
4. Tester JM, Stevens SA, Yen IH, Laraia BA. Is it time for nutritious food on wheels?: an analysis of public health policy and legal issues relevant to mobile food vending. Am J Public Health 2010;100(11):2038-46. CrossRef PubMed
5. Model produce cart ordinance: increasing access to fresh produce by creating a permit program for sidewalk produce vendors. National Policy and Legal Analysis Network to Prevent Childhood Obesity (NPLAN), a project of Public Health Law and Policy (PHLP). http://www.nplanonline.org/nplan/products/model-produce-cart-ordinance. Accessed January 5, 2012.
6. Mindlin A. Declaring war on street cuisine. New York Times September 3, 2006. http://query.nytimes.com/gst/fullpage.html?res=9E0CE6DF1F3EF930A3575AC0A9609C8B63. Accessed March 23, 2012.
7. Taylor DS, Fishell VK, Derstine JL, Hargrove RL, Patterson NR, Moriarty KW, et al. Street foods in America — a true melting pot. In: Simopoulos AP, Bhat RV, editors. Street foods. Vol 86, World Review of Nutrition and Dietetics. Basel (CH): Karger; 2000; p. 25-44.
8. Scattergood A. Will brake for fruit carts. Los Angeles Times May 30, 2008.
9. Vitale L. Fruteros organizing project: an innovative approach to reducing an environmental health hazard by using principles of asset-based community development. Washington (DC): American Public Health Association; 2004.
10. Oakland, California, Municipal Code Chapter 5.49 — Pushcart Food Vending Pilot Program.
11. California Department of Education. 2008-2009 Data and statistics. http://www.ed-data.k12.ca.us/App_Resx/EdDataClassic/fsTwoPanel.aspx?v!bottom=./_layouts/EdDataClassic/profile.asp?tab=1&level=07&ReportNumber=16&County=i&fyr=0809&District=61259&School=6002042. Accessed March 1, 2011.

Tables

Table 1. Items Sold by a Frutero and Competing Vendors Within a Block of an Elementary School, Oakland, California, 2008

| Day     | Frutero | Ice Cream Vendor | Cotton Candy Vendor |
|---------|---------|------------------|---------------------|
| **Baseline** |         |                  |                     |
| Day 1   | NP      | 19               | NP                  |
| Day 2   | NP      | 15               | 3                   |
| Day 3   | NP      | 44               | NP                  |
| Day 4   | NP      | 32               | NP                  |
| Day 5   | NP      | 39               | NP                  |
| **Intervention** |         |                  |                     |
| Day 6   | 14      | NP               | NP                  |
### Table 2. Transactions, Consumers, and Items Sold by a *Frutero* and Competing Vendors Within a Block of an Elementary School, Oakland, California, 2008

| Day     | **Frutero** | **Ice Cream Vendor** | **Cotton Candy Vendor** |
|---------|-------------|----------------------|-------------------------|
| Day 7   | 9           | 35                   | NP                      |
| Day 8   | 4           | 18                   | NP                      |
| Day 9   | 17          | 24                   | 1                       |
| Day 10  | 17          | NP                   | NP                      |
| Day 11  | 15          | NP                   | NP                      |
| Day 12  | 28          | 2                    | NP                      |
| Day 13  | 21          | 36                   | NP                      |
| Day 14  | 15          | NP                   | NP                      |
| Day 15  | 23          | NP                   | NP                      |
| Day 16  | 23          | 7                    | NP                      |
| Day 17  | 20          | NP                   | NP                      |
| Day 18  | 21          | NP                   | NP                      |
| Day 19  | 21          | 17                   | NP                      |

Abbreviations: NP, not present.

**Transactions**

| Variable                                           | **Frutero** | **Competing Vendors** |
|----------------------------------------------------|-------------|-----------------------|
| Mean duration of sales (per vendor) per afternoon, min | 26          | 16                    |
| Mean number of vendors per afternoon                | 1           | 1.1                   |
| Total transactions, n                               | 193         | 212                   |
| Transactions with children only, n (%)              | 52 (27)     | 76 (36)               |
| Transactions with adults only, n (%)                | 44 (23)     | 21 (10)               |
| Transactions with children and adults, n (%)        | 97 (50)     | 115 (54)              |

**Consumers**

| Variable                                           | **Frutero** | **Competing Vendors** |
|----------------------------------------------------|-------------|-----------------------|
| Total, n                                            | 233         | 266                   |
| Female, n (%)                                       | 151 (65)    | 144 (54)              |
| Male, n (%)                                         | 82 (35)     | 122 (46)              |

**Age group, n (%)**

| Age group                     | **Frutero** | **Competing Vendors** |
|-------------------------------|-------------|-----------------------|
| Preschooler                   | 10 (4)      | 14 (5)                |
| Elementary school student     | 138 (59)    | 193 (73)              |
| Teenager                      | 9 (4)       | 7 (3)                 |
| Adult                         | 74 (32)     | 48 (18)               |
| Observer unsure of age group  | 2 (1)       | 4 (1)                 |

**Race/ethnicity of elementary school students, a n (%)**

| Race/ethnicity                | **Frutero** | **Competing Vendors** |
|-------------------------------|-------------|-----------------------|
| Hispanic                      | 75 (54)     | 113 (59)              |
| African American              | 50 (36)     | 44 (23)               |
| Variable                        | Frutero | Competing Vendors |
|--------------------------------|---------|-------------------|
| Asian                          | 13 (9)  | 2 (1)             |
| White                          | 0       | 24 (12)           |
| Observer unsure of race/ethnicity | 0       | 10 (5)            |

### Items sold

|                                | Frutero | Competing Vendors |
|--------------------------------|---------|-------------------|
| Total, n                       | 248     | 292               |
| Items sold per afternoon, mean (range), n | 18 (4–28) | 24 (2–44) |
| Cost per item, mean (SD), $     | 1.50 (0) | 1.13 (0.24)       |
| Items sold per minute, n        | 0.8     | 1.5               |

Abbreviation: SD, standard deviation.

a The race/ethnicity of the school population was 41% Hispanic, 33% African American, 15% Asian, and <1% white.

The opinions expressed by authors contributing to this journal do not necessarily reflect the opinions of the U.S. Department of Health and Human Services, the Public Health Service, the Centers for Disease Control and Prevention, or the authors' affiliated institutions.