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# Tradition of healthy food access in low-income neighborhoods: Price and variety of curbside produce vending compared to conventional retailers

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## Abstract
This paper describes the longstanding, naturally emergent model of curbside vending of whole fruit and vegetable produce across several low-income, low-health Philadelphia neighborhoods. We conducted open-ended interviews with managers of 11 curbside produce vendors and compared prices and varieties of fruits and vegetables with the 11 closest conventional outlets. We find that produce trucks offer significantly lower prices on common fruit and vegetable items and they carry a variety of items comparable to that carried by limited-assortment grocery stores. We conclude with recommendations regarding zoning, licensing, and Supplemental Nutrition Assistance Program (SNAP) authorization that could stabilize and expand this model of healthy food access.

## Keywords
food access, health disparities, mobile vendors, produce, spatial intervention

## Introduction
Over recent years, a broad literature has documented and described the nature of urban health disparities, including racial, ethnic, and income disparities in access to healthful foods (Beaulac, Kristjansson, & Cummins, 2009; Bodor, Rice, Farley, Swalm, & Rose, 2010; Treuhaft & Karpyn, 2010). Researchers have quantified negative health outcomes associated with poor access to healthy foods, including high instances of obesity and other diet-related disease (Ingami, Cohen, Finch, & Asch, 2006; Larson, Story, & Nelson, 2009). Moti-

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vated by these findings, a broad range of stakeholders have proposed and implemented numerous responses, including financing for food retailers in underserved areas (e.g., the federal Healthy Food Financing Initiative, Pennsylvania's Fresh Food Financing Initiative, and California's FreshWorks Fund); incentives for existing convenience and corner store retailers to stock more healthful foods (Gittelsohn, Rowan, & Gadhoke, 2012; Laska, Borradaile, Tester, Foster, & Gittlesohn, 2010); and "pop-up" food retail, such as mobile produce trucks and farmers' markets (American Planning Association [APA], 2007; Cannuscio, Weiss, & Asch, 2010; Dunkley, Helling, & Sawicki, 2004; Larsen & Gilliland, 2009; Markowitz, 2010; Raja, Born, & Russell, 2008; Raja, Yin, Roemmich, Ma, Epstein, Yadav, & Ticoalu, 2010; Short, Guthman, & Raskin, 2007). Researchers are beginning to note that small, mobile retailers such as produce trucks and healthy street food vendors may offer better food environment interventions because they require little start-up, can easily target schools and neighborhoods with poor access to healthful foods, and circumvent the need to own real estate (Algert, Agrawal, & Lewis, 2006; Evans et al., 2012; Leggat, Kerker, Nonas, & Marcus, 2012; Tester, Yen, & Laraia, 2010; Yasmeen, 2006).

Thus far, researchers have paid little attention to curbside whole fruit and vegetable produce vendors, which are long-standing traditions in many cities (Bhowmik, 2005; Vallianatos, 2009), despite the fact that many have operated in neighborhoods, including West Philadelphia, for over a decade, many in the same location and regularly used by residents, particularly low-income residents. In a 2010 door-to-door survey about food shopping habits of 514 residents of West and Southwest Philadelphia, 48 percent of participants said they purchased fruits and vegetables from curbside produce vendors. This percentage is comparable to the use of farmers' markets (48.2 percent), and far greater than the use of corner stores (10 percent), co-ops (8.7 percent), community supported agriculture (less than 5 percent), and urban gardens (20 percent) (Karpyn, Tappe, Hillier, Cannuscio, Koprak, & Glanz, in press). Several other studies have referenced the 2008 New York "Green Carts" initiative that allow permits for mobile vendors to sell raw, whole fresh fruit and vegetables in underserved areas of the city. Researchers have found that carts locate on the most trafficked streets (Lucan, Maroko, Shanker, & Jordan, 2011). Produce carts are also thought to increase overall demand for fresh fruits and vegetables (Leggat et al., 2012), though these studies did not document vendors sales, profitability, or prices compared with nearby food outlets.

The purpose of this paper is to (1) describe curbside produce vendors and how they operate in West Philadelphia, and the policies and fees that regulate these small businesses; (2) analyze their location relative to demographic patterns, health outcomes, and other food outlets; and (3) compare the prices and varieties of whole fresh fruits and vegetables between curbside produce vendors and conventional outlets, including full-service supermarkets, limited-assortment grocery stores, and produce stores. We conclude with recommendations regarding zoning, licensing, and Supplemental Nutrition Assistant Program (SNAP) authorization that would help stabilize and expand this long-standing and popular model.

## Methods

### *Identifying Whole-produce Vendors*

We acquired a citywide list of fruit and vegetable vendors from the city of Philadelphia Department of Public Health's environmental health division. We chose the area in West Philadelphia defined by six ZIP codes as our study area because it had the highest concentration of curbside vendors. Motivated by previous research identifying the need to verify administrative data about food stores with on-the-ground observations (Lucan, Maroko, Bumol, Torrens, Varona, & Berke, 2013; Rossen, Pollack, & Curriero, 2012), we ground-truthed the list for vendors inside the study area by visiting each site and taking a photograph of what vendors sold. Of the 107 vendors on the city's list in our study area, 12 sold whole fruit and vegetables, 27 sold cut-up fruit salad, and the rest were not at the registered location or sold prepared food and not fresh produce exclusively. We focused on whole-produce vending in this study, and not carts that sell prepared or cut-up fruit. Whole-produce

vending is not considered "street food," which is prepared to eat upon purchase and is comparable to restaurant food. Mobile vendors who sell cut-up fruit salad operate under different licensing, while whole-produce vending mimics the function of and is more readily compared to supermarkets.

Combining our own knowledge of the neighborhood and that of long-term residents with the list from the Department of Public Health, we identified 11 whole-produce, curbside vendors in six ZIP codes in West and Southwest Philadelphia. Using a U.S. Department of Agriculture (USDA) list of all SNAP-authorized vendors, we identified the food outlets (including 4 full-service supermarkets, 3 discount supermarkets, 3 produce stores, and 1 co-op) closest to the whole fruit and vegetable trucks in order to compare prices and variety of fresh produce. We did not include farmers' markets in the comparison because they are not daily, year-round alternatives for produce access.

*Study Area*

Philadelphia has a vibrant fresh produce supply system. The Port of Philadelphia specializes in importing fresh produce, and the regional transit system moves more food into the Philadelphia region than out of or within it (Delaware Valley Regional Planning Commission, 2011). Philadelphia also has the largest cold-storage produce terminal market in the United States (Marder, 2011; Philadelphia Wholesale Produce Market [PWPM], 2012). The PWPM relocated from its old warehouse, built in 1959, to a new 700,000 square foot (65,000 square meter), cold-storage facility, built in 2011. PWPM houses operations for 26 merchants who set their prices hourly according to fluctuations in USDA food index reports, weather-related ripening, local demand, and personal relationships with buyers (PWPM, 2012). Produce from the PWPM goes to restaurants, smaller grocers, and private individuals. Not all produce sold in Philadelphia, however, flows through the PWPM. Some supermarkets fill their orders at the PWPM, but many also contract directly with wholesale distributors.

The population of the study area is 75 percent Black/African American, 15 percent White, 6 percent Asian, and 1 percent Hispanic (U.S. Census Bureau, 2010). The area has a poverty rate of 28 percent, slightly above the citywide average (U.S. Census Bureau, 2005–2009), and a homeownership rate of 47 percent, substantially lower than the citywide rate of 54 percent (U.S. Census Bureau, 2010). Findings from the 2010 Public Health Management Corporation (PHMC) Community Health Survey (CHS) show that residents in this area are less likely to eat three or more servings of fruits and vegetables per day, more likely to suffer from higher rates of obesity and diabetes, and less likely to be satisfied with the quality of their grocery stores than resident averages for the city and region (see table 1) (PHMC, 2012).

**Table 1. Health Indicators for Study Area Versus Citywide and Regional Averages**

| ZIP Code | Less Than 3 Servings FV/Day | Obesity Prevalence | Diabetes Prevalence | Feel Grocery Quality Is Fair or Poor |
|---|---|---|---|---|
| **19104** | 49.5% | 29.0% | 13.6% | 24.6% |
| **19131** | 60.6% | 27.9% | 14.9% | 16.5% |
| **19139** | 66.3% | 46.6% | 16.1% | 38.4% |
| **19142** | 78.9% | 36.8% | 13.9% | 36.6% |
| **19143** | 60.5% | 34.0% | 15.6% | 43.2% |
| **19151** | 60.0% | 29.8% | 19.7% | 23.0% |
| **Study Area** | 62.3% | 33.9% | 15.6% | 31.9% |
| **Citywide Average** | 57.9% | 32.1% | 13.4% | 22.2% |
| **Regional Average** | 48.6% | 26.3% | 10.9% | 12.8% |

Source: Public Health Management Corporation. (2012). Community health data base (2000, 2002, 2004, 2006, 2008, 2010, 2012) Southeastern Pennsylvania Household Health Survey. Retrieved from http://www.chdbdata.org/

*Location of Curbside Produce Vendors*

We geocoded the location of the 11 curbside produce vendors along with conventional food outlets (supermarkets, limited-assortment grocery stores, corner stores, and produce stores) and farmers' markets using ArcGIS 10.1. The list of food outlets was based on a list of all SNAP-authorized vendors and was ground-truthed for a USDA-funded study on food shopping and physical activity (Hillier, Cannuscio, Griffin, Thomas, & Glanz, 2012). Vendors were mapped relative to census tract–level rates of household participation in SNAP within the study area using data from the 2006–2010 American Community Survey. We conducted a spatial join between the curbside produce vendors and conventional outlets to identify the closest conventional outlet to each curbside produce vendor.

We created a 0.25-mile (0.4 km) buffer around the 11 vendors and 11 food outlets in order to consider the immediate surroundings of vendors and supermarkets. This distance was chosen to allow the buffer to incorporate the area immediately around the vendor, even if he or she was located at the intersection of several census tracts. We conducted a spatial join in ArcGIS 10.1 to connect these buffers to underlying SNAP participation rates by census tract; buffers that included more than one census tract were assigned an area-weighted average. Every buffer provides a very general idea of surrounding neighborhood characteristics, enabling some comparison of mobile vendor locations versus conventional supermarket retailers.

*Manager Interviews*

We visited each truck vendor in July 2012 and conducted an informal interview with the manager. The manager was asked about days and hours of operation, staffing, location, years of operation, source of produce sold, whether the business was authorized to accept SNAP, and barriers to maintaining and expanding the business. Managers were also asked about their country of birth.

*License and Regulations*

There is no single source for citywide licensing and regulations surrounding whole-produce curbside vending. Researchers scanned multiple city websites pertaining to health and zoning ordinances and verified their findings with city officials.

*Price and Variety Inventories*

To compare price and variety stability, we conducted the produce inventory at the whole fruit and vegetable vendors and conventional outlets in July 2012 (T1) and September 2012 (T2). To limit temporal and weather-related variability, the inventory and price of produce from trucks were compared with that of the 11 supermarkets within the same week. We used the following culinary categories to organize the varieties of produce identified through our inventory: squash, leafy green vegetables, tomatoes, green vegetables, peppers, root vegetables, citrus, melon, tree fruit, tropical fruit, grapes, berries, and herbs (see the appendix for a list of specific produce items included in each category). We conducted pricing surveys at TI and T2 for only the most common produce varieties in each of the culinary categories that also map onto USDA fruit and vegetable categories (dark greens: cucumbers; red/orange vegetables: sweet potato; starchy: bananas; other vegetables: cabbage; berries: blueberries; melons: cantaloupe; and other fruit: navel oranges). The USDA produce categories are commonly used in public health literature, and by including them in our study we hope to make this novel methods approach more translatable and transferable (USDA, n.d.a , n.d.b).

We compared prices between and among produce trucks and conventional outlets at T1 and T2. To standardize fruit and vegetable prices, we used the USDA nutrient database for conversion factors for the number of fruits or vegetables in a pound.[1] We used standardized one-tailed paired t-tests assuming unequal variance to test for significant differences between prices for each outlet at T1 and T2. We used a two-tailed t-test for independent groups to compare average prices and varieties by fruit and vegetable category across curbside produce vendors and conventional outlets. This research protocol was approved by the University of Pennsylvania Internal Review Board.

[1] See http://www.nal.usda.gov/fnic/foodcomp/search

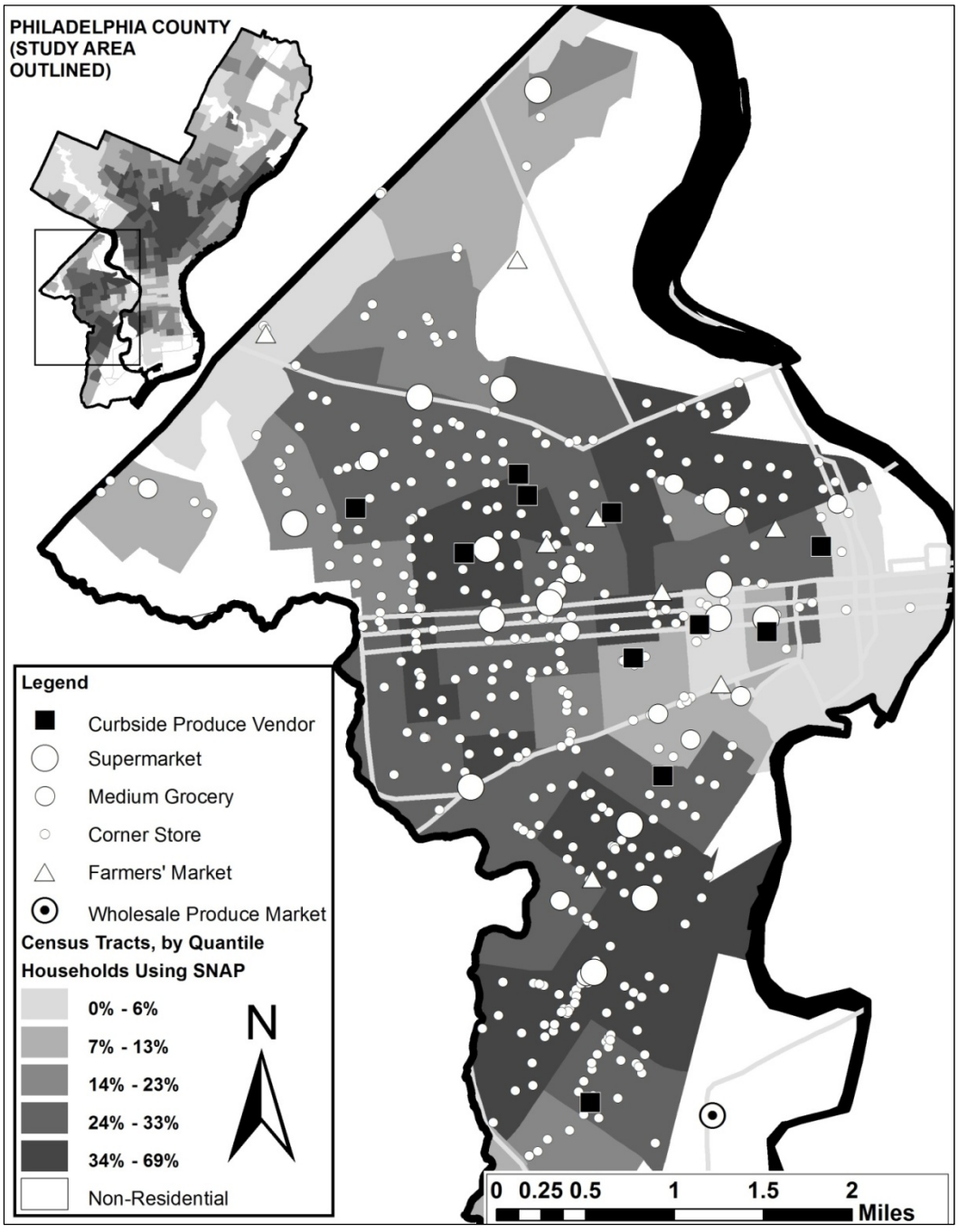
## Findings

*Location of Curbside Produce Vendors*

The study area included 330 SNAP-authorized food outlets, including 10 chain convenience stores, six chain pharmacies, seven full-service chain supermarkets, nine limited-assortment grocery stores, 13 dollar stores, 15 medium-sized independent grocery stores, and 270 corner stores. Many of the curbside whole-produce vendors were located within a few blocks of a supermarket (see map 1).

Many vendors are located next to a

**Map 1. Location of Curbside Produce Trucks Relative to Conventional Outlets, with Median SNAP Usage By Census Tract**



supermarket. Three vendors are currently located less than a block from a supermarket, and two operate in a location where a supermarket opened within three blocks during their tenure. The four produce trucks that are not located near supermarkets are located on commercial arterials (see map 1). On average, vendors were located 0.41 miles (0.66 km) away (standard deviation ± 0.22 miles or 0.35 km) from a conventional supermarket, with a maximum distance of 0.78 miles (1.26 km). Additionally, vendors were located an average of 0.60 miles (1.0 km) away from their nearest curbside produce vendor competitor (std. dev. ± 0.50 mile or 0.8 km, nearly the same as the average distance between supermarkets within the study area (0.57 miles or 0.92 km, std. dev. ± 0.42 miles or 0.68 km). Because curbside produce vendors were located so close to other food outlets, there was little difference in neighborhood-level SNAP participation. The average percent of SNAP-participating households within a quarter mile (0.4 km) of curbside produce vendors was found to be 25.5; for supermarkets, the figure was highly comparable, 26.3 percent.

*Curbside Model*

Most of the curbside produce vendors within the study area operate from the back of a single stationary box truck, as shown in figure 1. As shown in figure 1 at left, auxiliary wooden stands were set up on the sidewalk for all but two of the produce trucks. Two operators use only the auxiliary stand, and two operators have multiple auxiliary stands (figure 1, at right). Typically, produce is displayed in crates and often bagged on site to be sold in US$1.00 units. Most operators use vans to deliver produce from the PWPM to these stationary curbside operations; the tires of the box truck are often deflated. When the produce vendors are not open, operators close and padlock the metal lift gate on the back of the truck and empty the stands. The newest curbside produce vendor, the West Philadelphia Food Hub (WPFH), is the primary exception in how it operates. Rather than a box truck, WPFH uses a mobile ice cream car, moving to different scheduled locations on different days. It is also sells eggs, milk, bread, and a limited amount of dry goods (Taurino, 2012).

*Survey Responses*

Ten of the produce trucks were open 6 or 7 days a week, roughly from 9 am to 8 pm. None of the trucks post hours of operation. Eight of the trucks were managed by African immigrants, from Mali, Eritrea, and the Ivory Cost. One was managed by a Vietnamese immigrant, and the other two were managed by people who were U.S.-born. All of the vendors are male and bought the majority of their produce from the PWPM, with the exception of the WPFH, which purchases food from local farms.

**Figure 1. Examples of Two Curbside Produce Vendors**


The left image shows auxiliary wooden display units outside the box truck. The right image shows a consumer view into the truck. Photo credit: Catherine Brinkley.

Most operations employed one full-time and one part-time worker. Managers estimated profits at US$150–US$200 daily, though most managers emphasized the uneven nature of the fresh produce business by noting that they may operate at a loss for weeks if the weather is hot and food spoils. Sales are also influenced by the time of month that customers receive their paychecks and SNAP or other food benefits.

While most vendors had moved their location over their first years to find a busy street, the majority of trucks had occupied their current location for over 15 years, with some in continual operation in the same location for as much as 40 years. The more established vendors emphasized that they were dependent on word-of-mouth and community relations for their success. While we did not systematically analyze who was shopping at the trucks, it was apparent that managers knew many of their customers. Vendors reported offering informal credit lines to customers, leaving spoiled produce for neighbors to make smoothies or compost, and donating food to neighborhood functions such as block parties.

The relationship to nearby supermarkets is tenuous. Vendors indicated a preference for locating near a supermarket so that customers who are already food shopping can also do business with them. At the same time, two vendors said they were forced to move away from a supermarket due to zoning litigation and a nuisance petition believed to have been started by supermarket management. In one situation, the vendor explained that he opened in a location where a supermarket had closed. When another supermarket chain bought the property two years later, the new owners used a nuisance petition to force the curbside vendor to relocate. The vendor estimates that he lost 60 percent of his business due to the relocation and indicated that other produce vendors had faced similar relocation mandates and lost business. Several other vendors described facing similar issues with real estate developers. Some hired attorneys and were able to stay in the contested location, but at least two were forced to move to less favorable locations. At least two other produce trucks (not included in this study) went out of business altogether after relocating. Vendors complained about these conflicts with supermarkets and developers. As one vending manager noted, "It's not like I'm standing on the corner selling cocaine. I'm selling fresh fruits and vegetables."

At the same time, whole fruit and vegetable vendors remain solvent while some neighborhood supermarkets close. Two vendors currently operate in a location where a supermarket closed during their tenure. When a grocery store near one vendor closed, he lost business due to a decrease in foot and car traffic, yet his business continued.

While whole-produce vendors emphasized the daily hardship of managing a business that is subject to variable produce pricing, weather, and personal relationships with sellers and buyers, most thought that the new PWPM improved their business and the city regulations, licensure and inspection did not hinder their operations. They agreed that the new PWPM had a better facility with better produce, but this ultimately drove up the final cost of their inventory.

Six of the produce trucks are authorized to accept SNAP benefits, redeemed with customers' Electronic Benefit Transfer (EBT) cards, which operate functionally as a debit account. Vendors indicated that being able to accept SNAP had an impact on their business, with one noting that nearly 80 percent of the business during the previous summer came through SNAP, while another estimated that US$100,000 annually came from SNAP sales. Two other vendors reported that they had applied for SNAP authorization and the wireless system required to accept SNAP benefits, although they were unlikely to use it because the monthly transaction fees would be financially burdensome. Currently, SNAP provides support for wireless transaction services to supermarkets and retailers with landline access, but most curbside or mobile vendors do not have an occupancy license to run a landline to their business location.

*Mobile Produce Vending Policy Framework*

As part of the Get Healthy Philly initiative funded through the Centers for Disease Control and Prevention (CDC), the city of Philadelphia Health Department has been reviewing and revising the permitting process for stationary food businesses and mobile vending (Department of Public Health,

City of Philadelphia, n.d.). At present, the annual permitting fees for running a wholesale produce truck are between US$570 and US$3,570, not including the cost of fuel, overhead maintenance of the site, and salaries (table 2). According to city code (Philadelphia City Code Regulating Street Vendors, §9-203), all street vendors are required to be licensed by the Department of Licenses and Inspections contingent on compliance with the provisions of Title 6 (Health Code). Trucks must present to an inspection station during designated times and days for license renewal, which carries a US$150 fee. The health department requires a health department vendor ID# (US$650 for filing and US$190 for inspection). This is included in the US$340 annual food license application, contingent upon a US$50 annual Philadelphia business privilege license (which requires a federal employer identification number, a city of Philadelphia tax account number, and a Pennsylvania state sales and use tax number) and a license eligibility report issued by the health department. Alternatively, vendors may obtain a one-time business privilege license for US$300. The food license application requires a one-time department of health plan review with a US$65 filing fee, US$190 submission fee, and a US$150 mobile vending fee. All food handling requires that an individual with a valid city of Philadelphia food establishment personnel food safety certificate (initial issuance fee of US$30, annual replacement fee of US$50) contingent upon presenting the copy of licensure from an approved commissary or service support facility that has passed inspection. Produce trucks must also conform to all applicable local or state agency codes or requirements, such as those from the state of Pennsylvania Department of Labor and Industry, state Department of Environmental Protection, state Liquor Control Board, and Philadelphia zoning, building or plumbing codes.

Multiple sections (§ 9–205) of the city are off-limits to street vendors, or limited to a few vendors who pay an additional annual fee of US$3,000 to operate in special districts or US$300 to operate in neighborhood vending districts. The regulations also have provisions for the size of auxiliary carts (shall not exceed four feet [1.2 m] in width, eight feet [2.4 m] in length and eight feet [2.4 m] in height) and do not allow vending between midnight and 7:00 a.m. Our study did not investigate how vendors become aware of these regulations or the extent of compliance.

*Price and Variety Comparison*

The 11 curbside produce vendors offered between 18 and 71 different varieties of fresh produce (mean = 35 varieties, std. dev. = 19). On average, the produce trucks offered 21 varieties of vegetables (± 12) and 19 varieties of fruit (± 11). All of the curbside vendors offered cucumber, tomato, navel orange, apple, and potato. Eight of the 11 curbside produce vendors offered cabbage, lemon, lime, banana, peach, plum, grape, mango, garlic, carrot, sweet potato, yellow onion, and peanut. Most items sold in units for US$1.00, and the most expensive item, watermelon (US$4.00–6.50), also had the largest price range among produce trucks.

Using the USDA's vegetable and fruit categories, we chose the most common variety sold at the curbside produce vendors in each category on which to base our price comparison. Selected food items ranged from staple market-basket options such as navel oranges to blueberries and cantaloupe, which are more expensive and therefore potentially more illustrative of price differentials.

A paired t-test comparing varieties and prices at T1 and T2 at each of the 11 produce trucks and 11 conventional outlets showed no significant difference across time; subsequent prices and

**Table 2. Annual Fees and Permits for Curbside Whole-Produce Vendors**

| Permit | Fee (all US$) |
|---|---|
| Food license from the Department of Licenses and Inspections | $150 |
| Health Department approval for food license | $340 |
| Philadelphia business privilege license (commercial activity license) | $300 lifetime or $50/year |
| City of Philadelphia food establishment personnel food safety certificate | $30 |
| Special district or neighborhood vending fee | $300–3,000 |

**Table 3. Varieties of Fruit and Vegetables by Outlet Type**

| | Co-op (n = 1) | Discount Supermarket (n = 3) | | WPFH Truck (n = 1) | Curbside Truck (n = 10) | | Produce Store (n = 3) | | Supermarket (n = 4) | | All Outlets | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Dev. | | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| Squash | 3 | 1.0 | 1.00 | 3 | 0.6 | 0.70 | 1.7 | 2.08 | 6.3 | 0.96 | 2.0 | 2.34 |
| Green Vegetable | 10 | 4.0 | 1.73 | 3 | 4.2 | 2.78 | 6.3 | 6.66 | 9.8 | 1.50 | 5.7 | 3.75 |
| Tomato | 4 | 2.7 | 1.53 | 1 | 1.7 | 0.67 | 2.3 | 1.53 | 5.0 | 0.82 | 2.6 | 1.56 |
| Pepper | 3 | 3.3 | 0.58 | 1 | 1.9 | 1.73 | 4.3 | 1.53 | 6.8 | 1.71 | 3.3 | 2.36 |
| Leafy Greens | 6 | 2.7 | 2.08 | 3 | 1.2 | 1.03 | 2.7 | 3.79 | 8.0 | 2.16 | 3.1 | 3.11 |
| Lettuce | 6 | 2.7 | 1.15 | 0 | 1.7 | 1.25 | 6.3 | 6.66 | 10.5 | 3.00 | 4.2 | 4.34 |
| Mushroom | 5 | 1.7 | 1.53 | 1 | 0.6 | 0.84 | 1.3 | 2.31 | 6.3 | 3.77 | 2.1 | 2.83 |
| Root Vegetable | 6 | 2.0 | 1.00 | 4 | 2.9 | 2.08 | 2.3 | 3.21 | 6.0 | 1.83 | 3.5 | 2.36 |
| Sweet Potato/Yam | 4 | 4.0 | 1.73 | 3 | 2.1 | 1.29 | 3.0 | 1.00 | 6.0 | 1.63 | 3.3 | 1.91 |
| Onion | 5 | 2.7 | 1.15 | 2 | 3.0 | 1.89 | 2.3 | 0.58 | 7.0 | 2.94 | 3.6 | 2.42 |
| Citrus Fruit | 5 | 3.0 | 1.00 | 2 | 2.9 | 0.57 | 3.3 | 1.53 | 6.5 | 0.58 | 3.7 | 1.62 |
| Apple | 4 | 3.0 | 1.00 | 2 | 2.8 | 1.55 | 3.3 | 1.53 | 8.8 | 0.96 | 4.0 | 2.62 |
| Other Tree Fruits | 10 | 3.7 | 0.58 | 2 | 2.5 | 1.27 | 4.7 | 6.35 | 8.8 | 4.27 | 4.4 | 3.79 |
| Tropical Fruit | 6 | 2.3 | 1.15 | 2 | 3.7 | 2.00 | 4.3 | 1.53 | 6.5 | 1.91 | 4.1 | 2.14 |
| Grape/Cherry | 3 | 3.0 | 0.00 | 1 | 1.6 | 1.17 | 2.7 | 1.53 | 4.8 | 0.50 | 2.5 | 1.53 |
| Berry | 3 | 2.0 | 0.00 | 0 | 1.6 | 1.35 | 1.7 | 0.58 | 3.0 | 1.41 | 1.9 | 1.27 |
| Melon | 3 | 3.0 | 1.00 | 0 | 1.4 | 0.97 | 3.0 | 1.00 | 3.8 | 0.50 | 2.3 | 1.35 |
| Herb | 2 | 0.0 | 0.00 | 2 | 0.6 | 1.26 | 0.3 | 0.58 | 1.8 | 2.87 | 0.8 | 1.53 |
| Total Vegetable | 54 | 26.7 | 10.07 | 23 | 20.5 | 12.13 | 33.0 | 28.58 | 73.3 | 17.06 | 34.3 | 24.59 |
| Total Fruit | 34 | 20.0 | 3.61 | 9 | 16.5 | 6.22 | 23.0 | 12.77 | 42.0 | 6.16 | 23.0 | 12.00 |
| Total Fruit and Vegetable | 92 | 48.7 | 14.64 | 33 | 38.3 | 18.62 | 58.7 | 42.91 | 118.8 | 22.77 | 59.3 | 37.44 |

variety comparisons were based on T1 data only.

The number of varieties offered at curbside produce vendors was significantly less than that offered at all food outlets ($p < 0.05$) for all culinary categories except root vegetables, tropical fruits, berries, and herbs. When conventional outlets were subdivided into categories, curbside vendors were shown to offer a similar number of varieties of fruits and vegetables as limited-discount supermarkets (tables 3 and 4).

While the curbside produce vendors had fewer varieties of fruits and vegetables, they offered lower prices and less price variance than conventional outlets for all items except cantaloupe. Prices for cucumber, navel orange and sweet

**Table 4. Comparison of Prices Between Fruit and Vegetable Trucks and Supermarkets**

| Pricing Unit | Outlet Type | N | Mean | Std. Dev. |
|---|---|---|---|---|
| **Per Cucumber** | Curbside Truck | 11 | $0.37 | (0.14) |
| | Conventional | 11 | $0.73 | (0.71) |
| **Per Cantaloupe** | Curbside Truck | 7 | $2.18 | (0.72) |
| | Conventional | 11 | $1.73 | (0.50) |
| **Per Cabbage** | Curbside Truck | 8 | $1.09 | (0.27) |
| | Conventional | 11 | $1.03 | (0.38) |
| **Per Pound Sweet Potato** | Curbside Truck | 9 | $0.35 | (0.12)** |
| | Conventional | 9 | $0.86 | (0.25)** |
| **Per Granny Smith Apple** | Curbside Truck | 4 | $0.33 | (0.12) |
| | Conventional | 6 | $0.44 | (0.17) |
| **Per Navel Orange** | Curbside Truck | 10 | $0.33 | (0.08)** |
| | Conventional | 10 | $0.50 | (0.21)** |
| **Per Banana** | Curbside Truck | 11 | $0.51 | (0.17)* |
| | Conventional | 11 | $0.67 | (0.18)* |
| **Per Pint Blueberries** | Curbside Truck | 7 | $1.89 | (0.67)** |
| | Conventional | 7 | $3.71 | (1.34)** |

* marginally significant at $p < 0.06$ ** significant at $p < 0.05$

potato were significantly lower at the $p < 0.05$ level and marginally significant at the $p < 0.06$ level for bananas (table 4).

## Discussion

This study demonstrates that curbside produce vendors successfully supply a range of whole fruits and vegetables in a predominantly low- and middle-income African American section of Philadelphia at prices lower than conventional food outlets. Other commonly cited interventions such as mobile farmers' markets (e.g., Markowitz, 2010) may not offer the same low prices as these naturally emergent produce trucks, which are not a result of specific healthy food policy initiatives. Curbside vendors, unlike regional or national supermarket chains, cater to neighborhood shopping preferences. To this end, curbside produce vendors offer some unusual food items, such as sugar cane and aloe, which are not commonly sold in supermarkets and may be carried in order to match neighborhood cultural culinary tastes. Moreover, because the majority of produce trucks have operated as stable and profitable businesses for decades and survived where neighborhood supermarkets have closed, they may present a viable long-term solution for providing low-income neighborhoods with fresh produce.

This neighborhood-based phenomenon of curbside, immigrant-run, low-cost, fresh whole fruit and vegetable vending in low-income neighborhoods is neither well documented in the literature nor prescribed in policy for improving healthy food access. This research gap may cause public officials, advocates, and researchers to overlook low-cost, sustainable approaches to improve neighborhood health. Some researchers caution that forcing supermarkets into neighborhoods that cannot support viable financial outcomes is not a sustainable development policy and that corporate supermarket chains displace local food retailers (Boarnet, Crane, Chatman, & Manville, 2005; Dixon, Omwega, Friel, Burns, Donati, & Carlisle, 2007; Short et al., 2007). Thus alternative tools for improving access to fresh food should be also explored and developed.

Planning instruments, including municipal-level policies, health regulations, and zoning codes, can all be used to promote healthy food environments (Tester, Stevens, Yen, & Laraia, 2010). In order to reduce the health burden of easy access to cheap, unhealthful foods, some cities have pioneered using zoning ordinances to restrict fast food outlets (Ashe, Jernigan, Kline, & Galaz, 2003; Black, Macinko, Dixon, & Fryer, 2010). Alternatively, New York City has had success with promotion of small, mobile, curbside healthful food vending in "underserved" neighborhoods (Leggat et al., 2012). In many other cities around the world, curbside vendors service a large portion of the urban population and in particular reach the urban poor through the sale of low-cost foods (Bhowmik, 2005). For this reason, planning policies to encourage low-cost healthful food are not without precedent and stand to further encourage sustainable small businesses like curbside produce vendors.

### *Barriers to Curbside Produce Operations*

Curbside produce vendors listed land use regulations and SNAP accessibility as challenges to their business model. Despite the many steps and fees involved in city permitting, none of the vendors we interviewed identified the permitting process as an impediment to their operations. That said, we noticed that one vendor was closed for several weeks during the study period due to a wait for a scheduled health inspection, resulting in a loss of business. Also, the fact that operating vendors seemed comfortable with existing regulations does not account for the fact that the regulations may dissuade others from opening new mobile businesses. The degree to which citywide permitting processes can be streamlined may help vendors even if they do not see permitting as a major obstacle compared to land use rights and SNAP access. Regulations to protect or clarify the rights of curbside vendors within existing zoning districts would provide these small businesses with additional security to compete with bricks-and-mortar retailers.

Vendors without landline telephone access were chiefly concerned with wireless SNAP/EBT access and transaction fees. Past research in the same neighborhood has found that providing farmers' market vendors with individual wireless point-of-sale (POS) terminals and subsidizing EBT

fees increased SNAP/EBT purchases by 38 percent (Buttenheim, Havassy, Fang, Glyn, & Karpyn, 2012). This opportunity, along with outreach, offers an easy policy intervention to make vendors aware of local grants and other options. The newest curbside produce vendor, West Philadelphia's Fresh Food Hub, has made use of these opportunities through its connections to nonprofit groups such as Greensgrow Farms, urban agriculture organizations like the Urban Garden Initiative, and the Philadelphia Health Department (Taurino, 2012).

Social networks are important for vendor relationships with customers, suppliers, and each other. Many vendors emphasized that their relationships with sellers at the PWPM are key to obtaining low-cost produce. The informal relationships between vendors and neighborhood consumers through informal credit lines may also positively influence customer reliability and loyalty. It is this network of customers that is lost when vendors are forced to relocate, usually harming their business. With the exception of the newest produce truck, all the vendors knew each other and several were related. It is not uncommon for street vendors to rely solely on social networks for raising capital (Bhowmik, 2005; Devlin, 2011), but access to formal credit lines and government programs could greatly aid in scaling up this model. To this end, vendor-to-vendor social networks may play a key role in sustaining these businesses, particularly if vendors pool assets and share costs for produce purchases and delivery. That WPFH garnered public and private financial support where the other vendors did not points to limitations in the established vendor network. Financial backers interested in fresh food may wish to examine whether there is already an established network of produce vending in operation before re-creating a similar, higher cost model (see table 3).

We suggest that the current supply of curbside produce vendors is limited by the ability of vendors to operate. When asked about business constraints, vendors pointed to logistical and facilities issues, not the size of their customer base. Vendors are limited by what equipment they can afford and maintain, as well as permitting and other nuisance regulations. One could speculate that streamlining or easing logistical and regulatory challenges would increase the prevalence of produce trucks across the city, and thus the availability of low-cost fresh fruits and vegetables.

*Future Studies*

With this study, we would like to issue a national call for cases of curbside whole-produce vending in other cities to ascertain the extent of this model and any case similarities. Collaborating researchers could replicate the methods in this study to ascertain model variance and extent. For example, do central wholesale produce terminals play an important role nationally in supporting these models? Do vendors tend to be related in other cities? Are price differentials between curbside and conventional retailers found in other cases?

In deepening the potential implications of this model, we propose to assess shopping habits and health differentials in the customer base for conventional markets and curbside produce markets. There is already extensive literature that supports the notion that store type can influence shopping habits and subsequent health outcomes in customers. If curbside produce vending is found to increase produce purchases or correlate with lower diet-related disease risk, it would merit policies to fast-track adoption of this model.

Last, we hope to undertake an ethnographic study on the origin of the curbside model in West Philadelphia and modes of business start-up for new vendors. This research would elucidate the importance of familial relationships in sustaining the model and may also give insight into how to scale up or transfer this vending model.

## Conclusion

Curbside produce trucks emerged as an immigrant-run, long-standing business model in a low-income area of Philadelphia with poor health outcomes, and they offer lower cost fruits and vegetables when compared to supermarket outlets. Critical success factors for produce truck vendors are supportive city land use codes that allow curbside vending, a central wholesale produce market, and a network of personal relations with vendors, suppliers, and consumers. Because nearly all of the curbside produce vendors buy from the PWPM, a

central market appears to be fundamental in small-scale, low-cost fresh produce wholesale. For policy transferability, policy-makers should consider whether their city has a centralized market for fresh produce and already has a network of vendors operating on this model.

Anecdotal evidence suggests that many cities have similar curbside produce vending models. The methods in this paper lend themselves to a comparative study across cities. Additional follow-up studies should examine the health impacts on consumers of curbside produce vending to see if fruit and vegetable intake is influenced, grocery costs decreased, or overall health improved; the findings of such studies could have implications for future policies affecting produce vendors.

Based on these findings, we offer several policy recommendations. Though they are context-specific to Philadelphia, we believe that the model, and thus the recommendations, may hold relevance beyond our study area.

*Policy Recommendations*

- Supply vendors with wireless SNAP/EBT access and subsidize transaction fees. The ability to redeem food assistance benefits is a critical factor for many customers; lowering barriers to EBT access will support both vendors and their customer base.
- Review land use controls and ensure protection for curbside produce vendors. Clearly delineated areas where produce vending can occur as-of-right give greater legitimacy to vendors and may decrease the risk of nuisance complaints.
- Conduct outreach to support truck maintenance, insulation or cooling, and facilitate inspection on-site. High capital costs may prevent vendors from upgrading or adequately maintaining their vital equipment, and knowledge of new funding sources and grants, like those made available to the Food Hub truck, could benefit many vendors.

The long-standing tradition of produce trucks in Philadelphia indicates that curbside whole-produce vending is a low-cost, entrepreneurial market-based response for broadening fresh food access in low-income, low-health neighborhoods. This model is unique for its responsiveness to community needs and preferences, flexibility, and economic sustainability. Curbside produce models could be a cost-effective, neighborhood-targeted, bottom-up method of delivering fresh fruits and vegetables in other communities, and may also play an important role in the fight against nutrition-related disease.

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## Appendix. Culinary Categories of Fruits and Vegetables

| Culinary Category | Item |
|---|---|
| Squash | Eggplant |
| | Cauliflower |
| | Corn |
| | Yellow Squash |
| | Zucchini |
| | Patty Pom (Artisan Squash) |
| | Jamaican Pumpkin |
| Green Vegetable | Cucumber |
| | Broccoli |
| | Okra |
| | String Bean |
| | Avocado |
| | Asparagus |
| | Celery |
| | Chuchu |
| | Green Peanut |
| | Peanut, Salted/Roasted |
| Tomato | Tomato |
| | Roma Tomato |
| | Cherry Tomato |
| | Yellow Tomato |
| | Grape Tomato |
| Pepper | Habanera Pepper (Orange) |
| | Habanera Pepper (Green) |
| | Jalapeno |
| | Green Pepper |
| | Red Pepper |
| Leafy Green | Mustard Green |
| | Kale |
| | Collard |
| | Lettuce Head |
| | Spinach |
| | Mixed Greens |
| | Romaine Lettuce |
| | Cabbage Head |

| Culinary Category | Item |
|---|---|
| Root Vegetable | Baby Portobello |
| | White Button Mushrooms |
| | Garlic Scape |
| | Garlic Clove |
| | Garlic Sleeve |
| | Baby Carrot |
| | Carrot |
| | Beets |
| | Redo |
| | Iata |
| | Turnip |
| | Yellow Yam |
| | White Yam |
| | Sweet Potato |
| | Potato |
| | Red Potato |
| | Yucca/Cassava |
| | Large White Onion |
| | Small White Onion |
| | Yellow Onion |
| | Red Onion |
| | Scallion Bunch |
| | Daikon |
| | Ginger |
| | Leek |
| Citrus | Navel Orange |
| | Grapefruit |
| | Clementine |
| | Lemon |
| | Lime |
| Tropical | Kiwi |
| | Plantain |
| | Banana |
| | Papaya |
| | Tomasina Mango |
| | Champagne Mango |
| | Mango |
| | Pineapple |
| | Coconut |

| Culinary Category | Item |
|---|---|
| Tree Fruit | Nectarine |
| | Apricot |
| | Peach |
| | Gala Apple |
| | Small Golden Apple |
| | Fuji Apple |
| | Pink Lady Apple |
| | Macintosh Apple |
| | Golden Delicious Apple |
| | Red Delicious Apple |
| | Granny Smith Apple |
| | Bosc Pear |
| | Plum |
| | Small Plum |
| | Cherry |
| Grape | Green Grape |
| | Black Grape |
| | Red Grape |
| Berry | Strawberry |
| | Raspberry |
| | Blackberry |
| | Blueberry |
| Melon | Watermelon |
| | Honeydew |
| | Cantaloupe |
| Herb | Thyme |
| | Basil |
| | Cilantro |
| | Rosemary |
| | Parsley |