Increasing Access to Fruits and Vegetables: Perspectives From the New York City Experience

Rachel Sacks, MPH, Stella S. Yi, PhD, and Cathy Nonas, MS, RD

Broad recognition now exists that price, availability, and other structural factors are meaningful barriers to fruit and vegetable consumption, particularly among low-income adults. Beginning in 2005, the New York City Department of Health and Mental Hygiene used the social–ecological model to develop a multifaceted effort to increase fruit and vegetable access citywide, with emphasis in low-income neighborhoods. Overall, the percentage of New York City adults who reported consuming no fruits and vegetables in the previous day decreased slightly over a 10-year period (2002: 14.3% [95% confidence interval = 13.4%, 15.2%]; 2012: 12.5% [95% confidence interval = 11.4%, 13.6%]; *P* for trend < .001). Our approach hypothesizes that complementary initiatives, implemented simultaneously, will create a citywide food environment that fuels changes in social norms and cultural preferences, increases consumer demand, and supports sustainable access to affordable produce. (*Am J Public Health.* 2015;105:e29–e37. doi:10.2105/AJPH.2015.302587)

Fruit and vegetable consumption is recommended by the American Heart Association and others as part of a healthy diet and specifically for reducing cardiovascular disease, the leading cause of morbidity and mortality in the United States.[1–3] However, broad recognition now exists that price, availability, and other structural factors are meaningful barriers to fruit and vegetable consumption in the general population, and particularly among low-income adults.[4,5]

Previously published studies have documented disparities in access to healthy foods, with the most limited access being observed in neighborhoods of high poverty and high minority composition.[5–7] In a systematic review of environmental determinants of fruit and vegetable consumption among adults, in which environment was defined as "all factors external to the individual," household income was shown to be the most widely studied variable and also highly predictive of fruit and vegetable consumption.[4] More recent studies have corroborated these findings, demonstrating that healthier diets, which include higher produce consumption, are more expensive, and that price is a meaningful barrier.[8–12] When price is reduced by using coupons and discounts as incentives to buy more fruits and vegetables, purchasing is increased.[13,14] In addition, individual-level factors, including limited cooking skills and lack of familiarity with a variety of fruits and vegetables, may influence food choices.[15,16] In sum, addressing both availability and income, as well as other barriers, such as lack of food preparation knowledge, should be considered in the development of broader strategies to increase fruit and vegetable consumption in diverse urban communities.

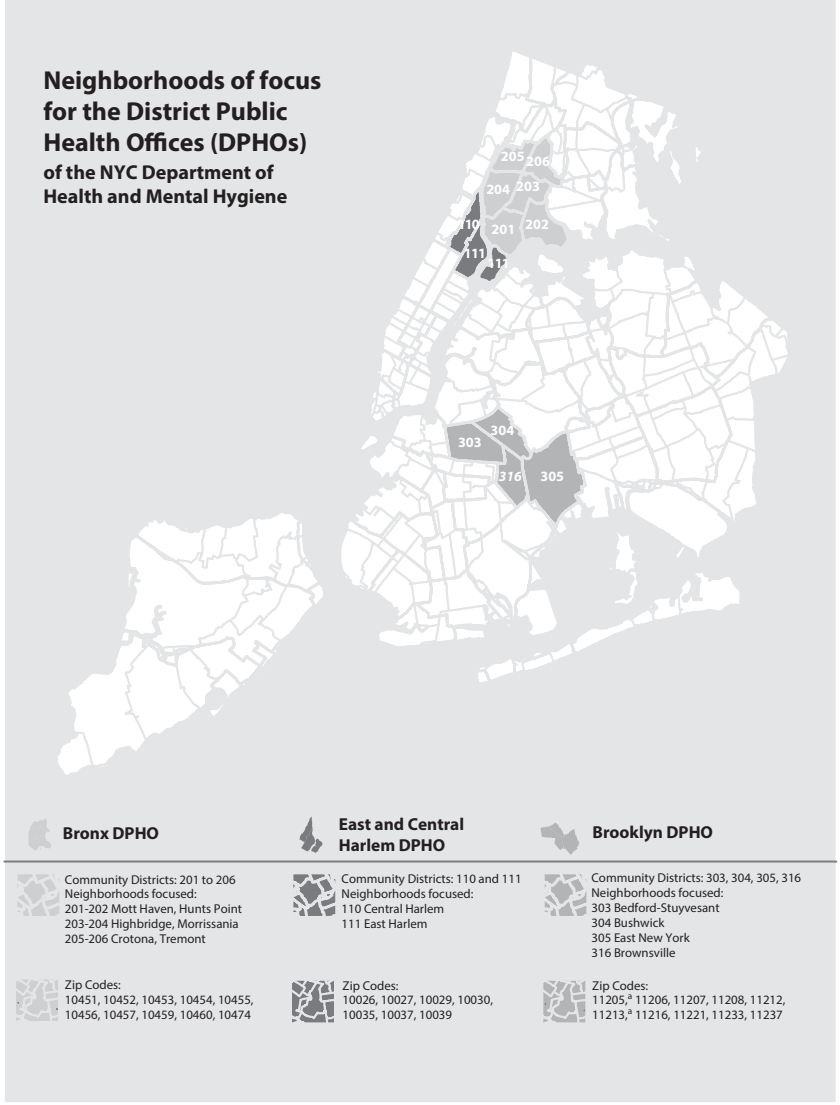
On the basis of these findings, federal, state, and local efforts to increase access to fresh produce have increased substantially over the past decade. In addition to federal grant funding via the Centers for Disease Control and Prevention's (CDC's) Communities Putting Prevention to Work program and other initiatives, the Healthy Food Financing Initiative was introduced at the federal level to provide funding for locally based initiatives focused on increasing access to fresh produce and other healthy foods for low-income families.[17,18] In the 2014 reauthorization of the Farm Bill, increased funding has been made available for the Healthy Food Financing Initiative, along with a number of other initiatives focused on improving access to fresh produce for low-income Americans, including the Farmers' Market and Local Food Promotion Program, Community Food Projects, Specialty Crop Block Grants, the Senior Farmers' Market Nutrition Program, and Beginning Farmers.[19]

The Healthy Food Financing Initiative support has focused on food deserts—areas that lack full-service grocery stores—and has funded farmers' market initiatives, urban farms, construction of new supermarkets and other retail outlets, and renovation of existing markets throughout the nation.[20] In addition, state agencies have partnered with their municipal counterparts, as well as community-based organizations (CBOs), faith-based organizations, and others, to improve access to fruits and vegetables for low-income adults. Incentive and voucher programs at farmers' markets have provided additional dollars to shoppers for the purchase of fresh produce (often a dollar-for-dollar match, or $2 for every $5 spent).[21,22] Furthermore, initiatives such as the Healthy Corner Stores network, a coalition of organizations that supports efforts to improve availability of sales of healthy, affordable foods through small-scale stores in underserved communities, have also improved access to fruit and vegetables at the neighborhood level.[23]

Despite these promising efforts, local programs are often limited in scale and scope, and implemented in isolation from other initiatives. To develop a comprehensive approach to improve access to fresh produce in a large metropolitan area, the New York City Department of Health and Mental Hygiene (DOHMH) used the social–ecological model as a framework to design and launch a series of complementary initiatives, with the goal of reducing disparities in access and achieving similarly high produce purchasing and consumption of fruits and vegetables across all population groups. With this framework in mind, citywide efforts have been complemented by programming for those at highest risk for diet-related

diseases, including type 2 diabetes and cardiovascular diseases, in high-poverty neighborhoods, including the South Bronx, East/Central Harlem in Manhattan, and North/Central Brooklyn, where the DOHMH's 3 District Public Health Offices are located (Figure 1).

Beginning in 2005, the New York City DOHMH developed collaborative partnerships with governmental agencies and CBOs to introduce a social–ecological approach to health, relying on the social–ecological model to guide program development intended to increase access to fruits and vegetables citywide. The social–ecological model, which recognizes that individuals are embedded within larger social systems, is used by the CDC and others to understand and address challenges to population health. Initiatives are introduced at multiple levels of human behavior—societal, community, institutional, interpersonal, and individual—to effect change.[24] In this article, we summarize the key components of the DOHMH's approach and the results achieved, which may serve as an example for other jurisdictions seeking to increase fruit and vegetable access to improve population health through a comprehensive approach.



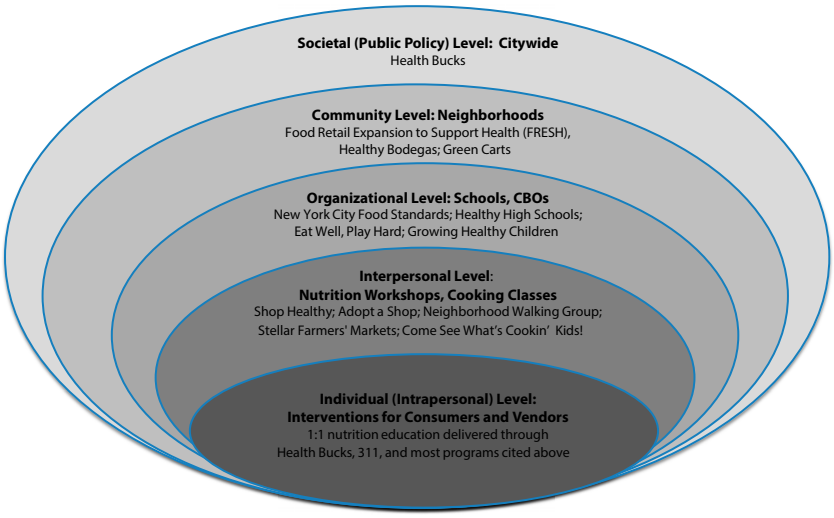
[a]Only a small area of the zip code lies within the focus community districts. Although included in the District Public Health Office focus area for outreach and programming, such zip codes are not generally included when calculating area-level rates of illness.

FIGURE 1—Neighborhoods of focus for the District Public Health Offices (DPHO) of New York City Department of Health and Mental Hygiene.

FRAMEWORK FOR PROGRAM DESIGN

The original articulation of the social–ecological model by Bronfenbrenner[25] was adapted by McLeroy et al.[26] a decade later for use in the public health sphere. The iteration of the model by McLeroy et al. identified specific strategies that could have an impact on health at each level of the model, which were defined as public policy, community, institutional, interpersonal, and intrapersonal levels. As research documenting successful applications of the model within public health emerged, the CDC joined the World Health Organization and the Department of Health and Human Services' *Healthy People 2010* in conceptualizing health as influenced by interlinked individual and environmental factors, and in advocating a social–ecological approach to health promotion and disease prevention.[27–29] Use of the model to guide programming and policy to increase fruit and vegetable consumption has been a particular area of research interest.[30]

In New York City, basing the DOHMH's work on the social–ecological model helped to link fruit and vegetable initiatives into a comprehensive approach while also elucidating areas that required additional programs, policies, or focus. The DOHMH used the CDC's iteration of the model as a framework and defined the societal level as encompassing citywide initiatives; the community level was defined as neighborhood-based programs; the organizational (or institutional) level referred to work within city agencies, schools, and child care centers; the interpersonal level corresponded to classes and activities conducted within larger programs and in collaboration with CBOs and other groups; and the individual level was defined as one-to-one efforts with consumers and vendors, including nutrition education and information (Figure 2). In some cases, different programs that focused on the same area of activity were combined across



Note. CBO = community-based organization.

FIGURE 2—The social–ecological model, as adapted by the New York City Department of Health and Mental Hygiene, applied to programs to increase fruit and vegetable access, availability, and consumption among low-income New Yorkers.

levels of the social–ecological model, to ensure that programs covered multiple angles of the same issue.[26,27]

Program descriptions are presented in the next paragraphs, by level of the social–ecological model.

Citywide Initiative: Health Bucks

To increase the affordability of fresh produce for all low-income New York City residents, the DOHMH introduced Health Bucks as a farmers' market–based initiative to distribute $2 coupons to low-income consumers.

Beginning in 2005, the DOHMH has allocated Health Bucks coupons in 2 ways: first, by partnering with CBOs that distribute the coupons to their constituents paired with nutrition education, and, beginning in 2007, by directly issuing $2 coupons for every $5 spent with Supplemental Nutrition Assistance Program (SNAP) monies via electronic benefit transfer (EBT), increasing SNAP recipients' buying power by 40%.[31]

Neighborhood-Specific Initiatives

Food Retail Expansion to Support Health program. Because many neighborhoods across the city are underserved by grocery stores, the DOHMH worked with other city agencies to establish the Food Retail Expansion to Support Health (FRESH) program. FRESH provides zoning and financial incentives to promote the establishment and retention of neighborhood grocery stores in underserved communities throughout the 5 boroughs. Stores that benefit from this program must provide at least 30% of retail space for perishable goods and at least 500 square feet of retail space for fresh produce.

Healthy Bodegas. Launched in 2005, Healthy Bodegas designated DOHMH program staff to work with shopkeepers and consumers in high-need neighborhoods to increase the stock and promotion of, and demand for, healthy foods, including fruits and vegetables. Bodegas, or small corner stores, are ubiquitous in low-income communities; increasing the availability of healthy foods in these outlets is essential to altering the neighborhood food environment. Among the changes promoted by Healthy Bodegas were stocking several varieties of fresh produce, including at least 1 dark green leafy vegetable; stocking canned fruits and vegetables with no added salt or sugar; and displaying shelf talkers (small promotional signs) next to healthier products to promote them.[32]

Green Carts. The Green Carts initiative was launched in 2008 to increase the availability of fresh produce in focus neighborhoods throughout the city. The New York City Council and Mayor Bloomberg signed legislation establishing a new class of permits for mobile vendors to sell only fresh, whole fruits and vegetables, releasing 1000 such permits for operation in neighborhoods where at least 14% of residents had stated that they had not consumed any fruits or vegetables on the previous day.

Organization-Specific Initiatives

City agencies: New York City Food Standards. Established in 2008, the New York City Food Standards (the Standards) are comprehensive nutrition standards for all foods purchased and served by city agencies and their programs.[33,34] The Standards addressed fruit and vegetable consumption by requiring 2 servings of fruits and vegetables in lunches and dinners served by city agencies and their programs, and 5 servings per day for programs serving breakfast, lunch, and dinner. Nutrient standards, such as those related to fiber, also encourage fruit and vegetable offerings. In addition, the Standards require that any canned fruits served be canned only in their own juice and that lower- and no-salt-added canned and frozen vegetables be used.

The Standards apply to more than 260 million meals and snacks that city agencies serve each year and, as a result, have an impact on diverse populations through schools, after-school programs, day-care centers, senior centers, homeless shelters, correctional facilities, and public hospitals. The DOHMH extended its work to private hospitals through the voluntary Healthy Hospital Food Initiative, which sets standards for cafeteria food, patient meals, and vending machines. Among the cafeteria standards are requirements to offer a minimum of 4 varieties of fresh fruits daily; provide at least 1 steamed, baked, or grilled vegetable option daily that contains 200 milligrams of sodium or less; and require leafy green salads with at least 1 vinegar-based dressing available.

Schools: improving school food and Healthy High Schools. To make fresh fruit and vegetables more accessible to the 1.3-million schoolchildren in New York City public schools, the DOHMH worked with the New York City Department of Education to hire 2 professional chefs to help school food service staff prepare

fruit and vegetable offerings that would entice students, including installation of an attractive salad bar at nearly every school. This effort was supported in part by the CDC's Communities Putting Prevention to Work grants. For adolescents, the Healthy High Schools initiative worked with public high schools to promote healthy and nonfood fundraisers instead of the usual candy and bake sales. Moreover, through a collaboration with GrowNYC, a local nonprofit venture that aims to improve neighborhood environments, Healthy High Schools brought locally grown produce to participating schools to be packaged and sold for fundraisers. The DOHMH invited the principals of every public high school in the city to participate in webinars, sharing the topics of the webinars in advance, and offered technical assistance to create healthy fundraisers.

Child-care centers: Eat Well, Play Hard and Growing Healthy Children. In the Eat Well, Play Hard program, implemented in collaboration with the New York State Department of Health, registered dietitians led fun, hands-on nutrition and cooking classes for 3- and 4-year-olds and for parents and caregivers, and provided nutrition workshops for child-care center staff.[35] Also offered within child-care centers, the Growing Healthy Children program provided a self-directed curriculum and toolkit for teachers of young children to provide lessons and activities for caregivers and children, such as fruit and vegetable taste tests for children, parents, and staff. In partnership with GrowNYC, the DOHMH is also piloting a farm to early child-care center program, in which weekly fresh produce boxes are sold to parents who are interested in purchasing them with EBT and Health Bucks–discounted rates.

Interpersonal Initiatives

Interventions at the interpersonal level were designed to increase interest in fresh fruits and vegetables among New Yorkers, and especially among low-income adults. Ultimately, this interest would increase demand for and consumption of fresh produce—which, in turn, would sustain the changes introduced within the retail sector.

Shop Healthy. As part of the ongoing Shop Healthy program—a comprehensive effort that works with retailers, suppliers, and communities to effect change in the retail environment—DOHMH staff met with CBOs, faith-based organizations, health institutions, and schools to understand the issues that are most important to them, and rally organizations and residents to be agents of change in their neighborhoods. For example, Shop Healthy partnered with Krasdale Corporation, which owns 150 mid- to large-sized supermarkets in the New York City area (e.g., C-Town, Bravo), to develop five 10-second radio ads to run on their in-store radio station to support healthy choices; Krasdale plans to air these ads indefinitely.

Shop Healthy also supported CBOs to work with retailers and encourage them to post signs with the locations of Green Carts vendors and farmers' markets where fruits and vegetables were available in the neighborhood. These signs were branded with the Shop Healthy logo and served as a means for retailers to demonstrate their commitment to healthy food access in the neighborhood and help residents feel that healthy food is available, right in their own community.[36] Each of the neighborhood organizations also worked to ensure that their constituents know the locations of Green Cart vendors, farmers' markets, and participating bodegas in the neighborhood, thus connecting these various DOHMH programs and reinforcing their efforts to achieve the overarching goal of increasing fruit and vegetable consumption at the population level. A Shop Healthy implementation guide is available through the DOHMH's Web site.[37]

Adopt-a-Shop. Linking to Shop Healthy and to its precursor, Healthy Bodegas, the DOHMH developed an Adopt-a-Shop toolkit to help individual consumers encourage change in the bodegas and supermarkets in their local neighborhoods. Toolkits included strategies and activities that both individuals and organizations could use to work with shop owners and managers. Staff of DOHMH were trained to implement Adopt-a-Shop workshops in Shop Healthy neighborhoods, often held at the offices of CBOs interested in improving food retail. Monthly workshops were also presented to the public, at which any New York City residents who wanted to learn how to change the food retail environment were welcome. Staff also distributed Adopt-a-Shop toolkits to CBOs and others; these toolkits are available through the DOHMH's Web site.[38]

Neighborhood walking groups. The DOHMH led walking tours in District Public Health Office neighborhoods to familiarize residents with retail outlets and farmers' markets where healthy foods, including fruits and vegetables, could be purchased. By engaging with residents and encouraging them to socialize and share ideas about healthier food choices, the DOHMH built momentum and enthusiasm for initiatives such as Green Carts and Healthy Bodegas that were being implemented at the citywide and neighborhood levels.

Stellar Farmers' Market. Through the Stellar Farmers' Market program, launched in collaboration with the New York State Department of Health, the New York City DOHMH nutritionists used the US Department of Agriculture's "Just Say Yes to Fruits and Vegetables" curriculum to provide free, comprehensive nutrition education workshops and cooking demonstrations for nearly 50 000 SNAP-eligible participants at select farmers' markets throughout the city each year. Workshop topics included healthy eating, food resource management, food safety, and tips on saving money when food shopping.[39] Recipes are distributed at the workshops and are also available on the DOHMH's Web site.[40] To maximize the benefit of the program, participants are also encouraged to use Health Bucks coupons to purchase the fruits and vegetables used in the cooking demonstrations, thereby increasing the affordability along with the appeal of unfamiliar seasonal produce.

Come See What's Cookin' Kids! For children aged 6 years and younger, Come See What's Cookin' Kids! was launched in 2013 to engage children, particularly those at nearby Special Supplemental Nutrition Program for Women, Infants, and Children centers, in interactive activities at the farmers' markets. Topics included places where fruits and vegetables grow, smart snacking, tasting new foods, and eating a variety of colorful fruits and vegetables; the program reached 9000 children in its first season.

Individual-Level Initiatives

Although the DOHMH does not offer one-on-one nutrition counseling, nutrition information and education are offered as a component of many different programs. For example, recipes are distributed through the Stellar

Farmers' Market and Come See What's Cookin' Kids! initiatives. Shop Healthy provides direct-to-consumer and direct-to-vendor information about healthy eating. School-based programs similarly provide nutrition education and information to children and adolescents in English and Spanish.

In addition, the DOHMH releases monthly Health Bulletins to inform the public about timely public health issues, including nutrition topics. These bulletins are distributed electronically via the DOHMH Web site.[41] The city's information line, 311, also dispenses information about DOHMH programs related to fruit and vegetable access.

CITYWIDE PROGRAM DEVELOPMENT AND EVALUATION

The 2004 New York City Community Health Survey (CHS) documented that 90% of New Yorkers ate fewer than the recommended number of fruit and vegetable servings per day and that 14% had eaten no servings of fruits or vegetables on the previous day.[42] The CHS is a random-digit-dial, cross-sectional health survey conducted annually since 2002 by the DOHMH, weighted to be representative of the New York City noninstitutionalized adult population. The lowest levels of produce consumption were found among Blacks and Hispanics, (2.0 and 1.8 servings per day, respectively, compared with 2.7 servings per day in Whites), those with low education levels (1.7 servings per day in those with less than high-school education compared with 2.7 servings per day among college graduates), and those living in high-poverty conditions (2.0 servings per day in those < 200% of the federal poverty level compared with 2.7 servings per day in those 400% of the federal poverty level; S. Yi, New York City DOHMH, oral communication, April 1, 2014).

In low-income, minority neighborhoods, an absence of supermarkets or farmers' markets offering high-quality fruits and vegetables was also documented. Neighborhood food access surveys conducted by DOHMH in 2004–2005 showed that bodegas were far more common than supermarkets in low-income neighborhoods, and that these retailers rarely stocked produce, either fresh or canned without added salt or sugar.[14] These data formed the foundation for papers detailing differences between the food sold in bodegas in high-income neighborhoods in Manhattan and Brooklyn, compared with lower-income neighborhoods located nearby.

For evaluation citywide, CHS data on self-reported fruit and vegetable intake was tracked over time, and compared by income, education, borough, and race/ethnicity to better understand trends in the context of multiple, interlinked programs being implemented in specific neighborhoods. Overall, the percentage of New York City adults who reported consuming no fruits and vegetables in the previous day decreased slightly over a 10-year period (2002: 14.3% [95% confidence interval = 13.4%, 15.2%]; 2012: 12.5% [95% confidence interval = 11.4%, 13.6%], P-trend < .001; M. Firestone, New York City DOHMH, oral communicaton, April 1, 2014).[42]

INITIATIVE-SPECIFIC PROGRAM DEVELOPMENT AND EVALUATION

In addition to the citywide data resources, the DOHMH used additional data for program development. To evaluate the success of programs on increasing access to fruits and vegetables in New York City, the DOHMH employed diverse strategies, including quantitative and qualitative surveys as well as mixed-methods evaluations. Process evaluations have also been used to track program implementation. Evaluation methods and findings are presented in the next paragraphs related to the following programs: Health Bucks, Healthy Bodegas, Green Carts, and Stellar Farmers' Markets. Initiatives that were not formally evaluated include the New York City Food Standards, Eat Well Play Hard, FRESH, Healthy High Schools, Neighborhood Walking Groups, Shop Healthy, Come See What's Cookin' Kids!, and Adopt-a-Shop. A summary of all programs and key achievements, including process evaluation results, are included in Table 1.

Health Bucks

Several evaluations of Health Bucks have been completed to date. The DOHMH worked with Greenmarket, the largest outdoor urban farmers' market network in the country, to evaluate the impact of Health Bucks on EBT spending at participating markets. We analyzed 4 years of EBT sales data (2006–2009), and results showed that farmers' markets that offered Health Bucks coupons to SNAP recipients averaged higher daily EBT sales than markets without the incentives ($383.07 vs $273.97; $P < .001$).[31] This difference in spending remained even after adjustment for neighborhood poverty level. Health Bucks, paired with a New York City Council initiative to add EBT machines in most markets to facilitate SNAP purchases, has increased the number of farmers' markets and farmers coming to the city, particularly in low-income neighborhoods. Currently, there are 141 farmers' markets in all 5 boroughs, 59% of which are in high-poverty communities, where few previously existed.

An external program evaluation conducted by Abt Associates further found that, since the introduction of the EBT distribution mechanism, use of EBT to distribute Health Bucks benefits has risen steadily, with just over 50% distributed as EBT in 2008, compared with more than 70% in 2010. When evaluators incorporated components assessing both process and outcomes, they found that Health Bucks was perceived as a positive program model by respondents. Importantly, in District Public Health Office areas, 68% of farmers and vendors surveyed noted that availability of Health Bucks benefits influenced their decision to participate in farmers' markets in those neighborhoods, and 95% of market managers identified Health Bucks as a reason more repeat customers visit their market managers. Consumers reported that Health Bucks had a significant impact on eating and purchasing behavior, and demonstrated a high level of knowledge and awareness related to health and nutrition.[43]

Healthy Bodegas

The DOHMH used food environment surveys, Dun and Bradstreet data on food retail businesses, and published research to identify neighborhoods with few healthy food retailers, along with CHS data and DOHMH food environment surveys documenting areas of low produce consumption and availability, to identify specific high-poverty areas as critical neighborhoods for increasing the availability, purchase, and consumption of healthy foods in the Healthy Bodegas program.[44,45] In a 2009

TABLE 1—Key Health Department Initiatives to Increase Fruit and Vegetable Consumption—New York City, 2005 to Present

Level and Initiative	Year(s)	Description	Key Results and Achievements
Citywide: Health Bucks	2005–present	Increased affordability and accessibility of fruits and vegetables at farmers' markets citywide via electronic benefit transfer (EBT), for Supplemental Nutrition Assistance Program beneficiaries (SNAP), and through community-based organizations (CBOs)	Evaluation results demonstrated that farmers' markets offering Health Bucks to SNAP recipients averaged higher daily EBT sales than markets without the incentives ($P < .001$)
Neighborhood			
Food Retail Expansion to Support Health (FRESH)	2009–present	Provided zoning and financial incentives to promote the establishment and retention of neighborhood grocery stores in underserved communities across New York City's 5 boroughs	Supported the introduction of 11 new supermarkets and the renovation of 7 older supermarkets
Healthy Bodegas	2005–2011	Worked with shop owners to improve fruit and vegetable quality and availability in bodegas	Evaluation findings showed that, on average, participating shop owners made 4 health-promoting changes to their business, including increasing fruit and vegetable offerings
Green Carts	2008–present	Introduced new fruit and vegetable carts to areas with low fruit and vegetable intake	Introduced nearly 500 Green Carts, 100 of which featured EBT Fostered microenterprise and created jobs The increased number of Green Carts in individual neighborhoods has been linked to increased availability of fruits and vegetables in existing food retailers in those neighborhoods
Organization			
New York City Food Standards	2008	Established nutrition standards for all foods purchased and served by city agencies	Increased the number of required servings of fruits and vegetables at meals served by city agencies
Healthy High Schools	2010–2012	Worked with high schools to promote healthy and nonfood fundraisers instead of food fundraisers high in fat and sugar (e.g., candy and bake sales)	Delivered technical assistance to 50 New York City high schools Provided $1000 minigrants to 18 high schools to implement semester-long efforts to improve the school food environment Through a collaboration with GrowNYC, a local nonprofit, brought locally grown produce for use in high school fundraisers
Eat Well, Play Hard	2008–present	Developed a toolkit and curriculum and conducted training for teachers of young children in child care centers to promote healthy eating and physical activity	Distributed 145 toolkits Department of Health and Mental Hygiene dietitians conducted 33 trainings in 189 child care centers for a total of 887 staff
Growing Healthy Children	2009–present	Developed an activity-based toolkit and curriculum as a self-directed train-the-trainer program for teachers of young children to deliver lessons to caregivers and children in centers where Eat Well, Play Hard is implemented	680 staff trained in 188 child care centers that are enrolled in Eat Well, Play Hard
Interpersonal			
Shop Healthy	2013–present	Supported local organizations in District Public Health Office neighborhoods that want to improve availability of fruits and vegetables	Worked with 86 CBOs to implement Shop Healthy initiatives
Adopt a Shop!	2013–present	Developed toolkit for consumers to work with neighborhood bodegas and supermarkets to improve healthy food availability	Distributed more than 330 toolkits
Neighborhood walking groups	2012–present	Conducted group walking tours to familiarize residents with locations of farmers' markets and Green Carts in their neighborhood	In 2012, conducted 56 walking tours to 36 markets for a total of 514 participants In 2013, conducted 57 walking tours to 37 markets for a total of 552 participants
Stellar Farmers' Markets	2009–present	Offered cooking classes using seasonal fruits and vegetables at farmers' markets in high-need neighborhoods to influence preferences, encourage culture change, and develop cooking skills	Classes conducted at 18 markets in 4 boroughs (Brooklyn, Bronx, Manhattan, and Queens) Evaluation findings demonstrated that shoppers who participated in 2 or more classes consumed almost one half cup more of fruits and vegetables daily compared with shoppers who participated in 0 or 1 class ($P < .001$).

Continued

TABLE 1—*Continued*

Come See What's Cookin' Kids!	2013–present	Offered workshops and cooking classes for children at farmers' markets in high-need neighborhoods to raise interest in seasonal produce	Reached 9000 children in its first season
Individual: education and Information	2005–present	One-to-one nutrition education delivered through programs cited previously and on the New York City Department of Health and Mental Hygiene Web site (http://www.nyc.gov/doh)	Health Bulletins Curricula Recipes Newsletters Evaluation reports, such as Epi Data Briefs and Data Tables

program evaluation, the DOHMH employed in-store observations, store owner surveys, and consumer surveys to examine 60 bodegas. Baseline data were collected in January 2009, and postintervention data 6 months later. Results showed that, on average, shop owners made 4 health-promoting changes to their business, including increasing their fruit and vegetable offerings, with some making as many as 7 improvements.[32]

Green Carts

Nearly 500 Green Carts were introduced in high-need neighborhoods of Manhattan, Queens, Brooklyn, and the Bronx, 100 of which have EBT terminals to facilitate access by SNAP recipients. To assess the impact of Green Carts, the DOHMH evaluated changes in produce availability, quality, and variety in a sample of retail outlets (supermarkets, fruit and vegetable stores, small grocery stores, bodegas, and mobile carts) in selected Green Cart and non–Green Cart neighborhoods, collecting data over 3 summers: before implementation in 2008, and twice after implementation, in 2009 and 2011.[46] Findings showed that the proportion of food retailers selling both fruits and vegetables increased in Green Carts precincts, but not in comparison precincts, following the introduction of Green Carts. These findings persisted even when produce availability directly attributable to Green Carts sales was removed from the analysis, suggesting that higher fruit and vegetable availability was being driven by bodegas. Green Carts may have driven consumer demand for fruits and vegetables, encouraging other retailers to stock fresh produce.[47] Not only did Green Carts introduce fresh produce into areas where little was previously available, but they also fostered economic development, new jobs, and microenterprise at the citywide level.

Stellar Farmers' Markets

In 2012, the DOHMH conducted a mixed-methods evaluation of the Stellar Farmers' Markets program, using a quasi-experimental design to measure program impact on participants' attitudes, self-efficacy, and behaviors with respect to fruit and vegetable preparation and consumption. Three groups were surveyed: (1) a control group of market shoppers who had never attended a Stellar Farmers' Markets class; (2) a "1 class" group, comprising participants who attended their first class right before they took the survey; and (3) a group of participants who had attended 2 or more classes.

The DOHMH also conducted focus groups with participants to corroborate the quantitative findings, explore which elements of the program most contributed to its effectiveness, and identify recommendations for improvement. An independent research firm conducted the focus groups, recruiting participants by phone from a list of 600 names obtained at recent Stellar Farmers' Markets workshops. All participants were aged 18 years or older and had attended at least 2 Stellar Farmers' Markets workshops to ensure sufficient experience with Stellar Farmers' Markets to generate robust discussion. Twelve people were recruited per group; a total of 5 focus groups were conducted, 3 in English and 2 in Spanish.

Results showed that attending classes was associated with greater produce consumption, more positive attitudes toward consuming produce, and higher self-efficacy to prepare and consume produce. These associations fit a dose–response pattern, with positive outcomes increasing as class attendance increased, and remained significant after control for age, race/ethnicity, education, and gender. Of note, respondents who had attended 2 or more classes consumed almost one half cup more fruits and vegetables daily than the rest of the sample ($P<.001$).[48]

IMPLICATIONS

The New York City DOHMH's approach hypothesizes that complementary initiatives, implemented simultaneously, will create a citywide food environment that will fuel changes in social norms and cultural preferences, increase consumer demand, and, ultimately, support sustainable, increased access to affordable fruits and vegetables. Specifically, we hope to change community expectations of the local food environment, such that consumer demand will require retailers to maintain a higher ratio of healthy to unhealthy foods on their shelves, and on mobile vending carts, including a diverse and plentiful array of fresh produce. Expanding availability of the healthy foods consumers demand will increase spending in

these retail outlets, leading to greater profitability for vendors. Thus, although key achievements can already be identified for each program, we anticipate that the cumulative effect of these programs on improving access to fruits and vegetables over the long term will result in similarly high purchasing and consumption levels across all population groups, which will be reflected in CHS and other citywide data. Despite relatively small advantages to individuals in the short term, these strategies will lead to larger population-level benefits in the long term, by shifting the population distribution of risk factors to reduce incidence of disease.[49]

This social–ecological approach to increasing fruit and vegetable access is not unique to New York City; many jurisdictions across the country are working to increase healthy eating opportunities in local supermarkets, at farmers' markets, in small corner stores and bodegas, and in schools, and data have begun to reflect the positive impact of these efforts regionally as well as nationwide.[50] In recent years, a shift in thinking about chronic disease prevention has occurred, whereby greater emphasis is now placed on societal levels of influence—and less on the impact of individual-level factors—on health behaviors. Recent public opinion research reflects broader support for environmental interventions to reduce chronic disease, including increasing the affordability of fruits and vegetables.[51] As New York City is one of the largest and most diverse jurisdictions to embrace a comprehensive, long-term approach to this challenge based on the social–ecological model, tracking outcomes and incorporating lessons learned may inform effective and efficient program development elsewhere. As methods for evaluation of societal level initiatives evolve, we anticipate that researchers will be able to more effectively link fruit and vegetable accessibility to consumption, and to better track the impact of programming on produce consumption on a population level.

Innovation is often constrained by funding and political will, and new initiatives must demonstrate short-term gains to justify long-term investment. Surveys by DOHMH show increased fruit and vegetable availability, purchasing, and consumer knowledge across New York City and in low-income neighborhoods of focus. We attribute these findings to the cumulative effect of key achievements in interlinked programs.

For example, Stellar Farmers' Markets and Come See What's Cookin' Kids! offer workshops and cooking demonstrations for groups of local residents and their children on site at neighborhood farmers' markets, working to change social norms of what healthy food looks like and tastes like through familiarization with fresh seasonal produce, in the same locations where Health Bucks distributes $2 coupons to SNAP recipients via EBT, effectively lowering the price of the fruits and vegetables that the workshops spotlight. Furthermore, among bodegas and other retailers, an increased stock and variety of fruits and vegetables has been sustained for 2 years following interventions in specific communities where Green Carts also sell produce, indicating that New Yorkers in previously underserved neighborhoods are purchasing produce in sufficient quantities to support continued availability in their neighborhoods.[32]

Although behavior modification is difficult to achieve, and changing social norms takes time, we envision that sustained increase in fruit and vegetable access, and our work to make fresh produce more affordable and familiar, will create a city with higher fruit and vegetable consumption, particularly in high-poverty neighborhoods where produce consumption has been lowest. Ultimately, in the long term, we hope to achieve decreases in chronic disease morbidity and mortality through these types of large-scale, integrated, and innovative efforts. ■

About the Authors

At the time of study, all authors were with the Bureau of Chronic Disease Prevention and Tobacco Control, New York City Department of Health and Mental Hygiene, Queens, NY.

Correspondence should be sent to Rachel Sacks, MPH, Consultant, Bureau of Chronic Disease Prevention and Tobacco Control, New York City Department of Health and Mental Hygiene, Gotham Center, 42-09 28th St, 9th Floor, CN 46, Queens, NY 11101 (e-mail: rachel.sacks.mph@gmail.com). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Contributors

R. Sacks, S. S. Yi, and C. Nonas all contributed to the conceptualization of the article, and the drafting and editing of the original and final articles. In addition, R. Sacks was responsible for overseeing the writing, editing, and submission process; S. S. Yi led the conceptual development of the article; and C. Nonas served as nutrition program lead from 2005 to present, and as content reviewer for this article.

Human Participant Protection

Institutional review board approval was not sought for this article, as data used to develop the article were limited to program evaluation data and population-level data.

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