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Fruit and vegetable access programs and consumption in low-income communities

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ABSTRACT

States, cities, and communities are implementing a variety of programs to increase access to fruits and vegetables, but relatively little is known about their impact, especially among low-income populations. To determine factors associated with program utilization and fruit and vegetable consumption, we interviewed 217 participants in three types of programs – farmers market Supplemental Nutrition Assistance Program (SNAP) incentives, subsidized farm stands, and subsidized produce bag distribution – as well as a comparison group of 90 non-participants, all in King County, Washington. Demographics and utilization differed by program. Participation in the farmers market SNAP incentive program was positively associated with fruit and vegetable consumption.

KEYWORDS

Fruit and vegetable consumption; farmers market; Supplemental Nutrition Assistance Program (SNAP); low-income; community food access

Introduction

A healthy diet that includes a variety of fruits and vegetables can help prevent chronic disease and promote long-term health.¹ While few adults in general meet fruit and vegetable intake recommendations,² low-income adults are even less likely to benefit from health-promoting diets that include fruits and vegetables.^{3–7} They face challenges such as limited transportation and limited quality, variety, and availability of affordable fruits and vegetables.⁸ Because low-income adults have higher risk of diet-related chronic diseases,^{9,10} public health initiatives have been designed to enhance access as a way of increasing consumption of fruits and vegetables and building health equity.¹¹

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Overall, lower prices and increased availability have been found to increase fruit and vegetable consumption.¹² Specific strategies such as farmers market and mobile-market-based Supplemental Nutrition Assistance Program (SNAP) incentive programs appear to be beneficial for low-income shoppers.^{13–16} However, more research is needed on the effects of specific strategies and approaches.¹⁷

Relatively little is known about how people learn about or decide to participate in different food access programs and how often they are used.^{18,19} Conceptual models suggest that factors like location, variety or selection of produce, affordability, quality of foods, and socio-demographics are likely to influence participation in community-level food access programs.^{20,21}

Community partners have been working to increase affordability of and access to healthy foods in Seattle and South King County, Washington, for a number of years. From 2014 to 2017, Public Health Seattle and King County and its partners, Seattle Children’s Hospital and the Healthy King County Coalition, received a grant from the Centers for Disease Control and Prevention for a Partnerships to Improve Community Health (PICH) initiative. PICH provided funding and technical assistance to local government and community-based organizations engaged in policy, system, and environmental change to promote increased opportunities for healthy eating and physical activity.^{22,23} Many King County PICH efforts centered around increasing the availability and affordability of fruits and vegetables in South Seattle and South King County, areas with disproportionate numbers of low-income residents, greater racial and ethnic diversity, and few healthy retailers. PICH-funded food access work included support for expanding a nutrition incentive program at farmers markets for SNAP participants (“Fresh Bucks”), subsidized produce bags (“Good Food Bags”), and a subsidized mobile farm stand.

Given the opportunity provided by PICH in King County, with three distinct strategies aimed at meeting the same goal of increasing access to fruits and vegetables, this study was designed to investigate the relationships between individuals’ program participation and their fruit and vegetable consumption, to identify and compare factors that influence program participation, and to examine differences and similarities in participant demographics by program.

Methods

This cross-sectional study was based on phone interviews with 307 south King County residents.

Food access programs included in the study

Table 1 summarizes the three PICH-funded food access programs examined in this study, including program details and eligibility that have a bearing on participant demographics, and differences in design subsidization, which

could potentially influence study outcomes. For example, farm stands were located in mixed income neighborhoods, and farm stand participants did not have to meet any income guidelines, while SNAP incentive farmers market participants were all low income.

Study recruitment and enrollment

We recruited interview respondents from 18 PICH fruit and vegetable program sites (program participants) and 10 community sites where PICH programs were not being implemented (non-participants). Non-program recruitment sites were in the same neighborhoods as the PICH sites; they included health clinics, food banks, and a child care center. A sign-up sheet and recruitment flyer describing the study purpose and process were posted and circulated at each site. For most recruitment sites, research staff recruited in-person during the sites' open hours. Research staff shared the flyer with potential respondents, and interested individuals signed up with their names and phone numbers to be contacted via phone to complete the interview. In a handful of sites, program staff or volunteers distributed the flyers and offered the sign-up sheet. In total, over 160 hr were spent recruiting. We conducted all recruitment in both English and Spanish, the most commonly spoken languages among potentially eligible participants. [Figure 1](#) displays the recruitment process, including the number of recruitment sites by type and the number of individuals recruited and interviewed from each site.

Trained data collectors telephoned all potential interview respondents a maximum of six times, leaving no more than three voicemails. Upon reaching a potential respondent, data collectors informed them of the purpose of the study and any risks, confirmed that they were over the age of 18, and asked if they were willing to voluntarily participate. Data collectors then either conducted the phone interview during that call or made an appointment for a future time to conduct the interview.

Data collection

We developed, piloted, and then deployed a structured telephone interview organized into five primary areas of inquiry: program participation frequency, fruit and vegetable consumption, shopping/purchasing behaviors, perceived program benefits and impact, and demographic and household characteristics. Data collectors asked respondents how many times within the past month they participated in Fresh Bucks, mobile farm stands, and Good Food Bags. The "Block Fat/Sugar/Fruit/Vegetable Screener" Food Frequency Questionnaire (FFQ), with a 1-month reference period (Nutrition Quest, Berkeley), was administered to estimate fruit and vegetable consumption.²⁴ The FFQ was selected because it captures fruit and vegetable consumption, is available in

Table 1. Descriptions of food access program South Seattle and South King County, 2016.

Program description	Subsidization approach	Eligibility	Program details
Fresh Bucks			
SNAP matching program at farmers' markets to incentivize fruit and vegetable purchases (once per week per farmers' market location)	SNAP funds spent at the farmers market are matched, up to \$10, with currency that can be used to purchase fruits and vegetables	SNAP participants	Offered at nearly all farmers' markets throughout South Seattle and South King County. Shoppers use SNAP to purchase SNAP-eligible items and receive Fresh Bucks to purchase fruit, vegetables, herbs, mushrooms, and plant starts.
Mobile neighborhood farm stands			
Farm stands located in several lower income neighborhoods with limited grocery store access (once per week per farm stand location)	Produce sold at wholesale or discounted prices	Anyone	Offered in several neighborhoods in South Seattle. Farm stands are located in collaboration with coordinated housing developments, community centers or businesses, and occasionally offered with community events (e.g., live music, health or cultural events, workshops, food preparation or gardening demos). Farm stands offer a mix of fruit and vegetables.
Good Food Bags			
Grocery bags containing four items of discounted produce available for purchase and pick-up at locations people regularly access (e.g., churches, senior and child care centers, health clinics) (once per week per distribution site)	\$10 value of produce sold to participants for \$5	Varies, some sites restricted to individuals using the workplace/center, while other sites are open to anyone	Offered at locations in South Seattle and South King County. Each bag includes one type of fruit and three types of vegetables. Some sites sell bags pre-packed while others allow shoppers to mix and match the four selections. Some locations use a sign-up and pay in advance model for months at a time (similar to Community Supported Agriculture), while others allow for purchase at each individual visit.

English and Spanish, is amenable to phone administration, and is a reliable and valid dietary screening tool. The interview also included questions about the portion of all purchased produce that comes from the food access program participants used most often, the likelihood of using the program again, and

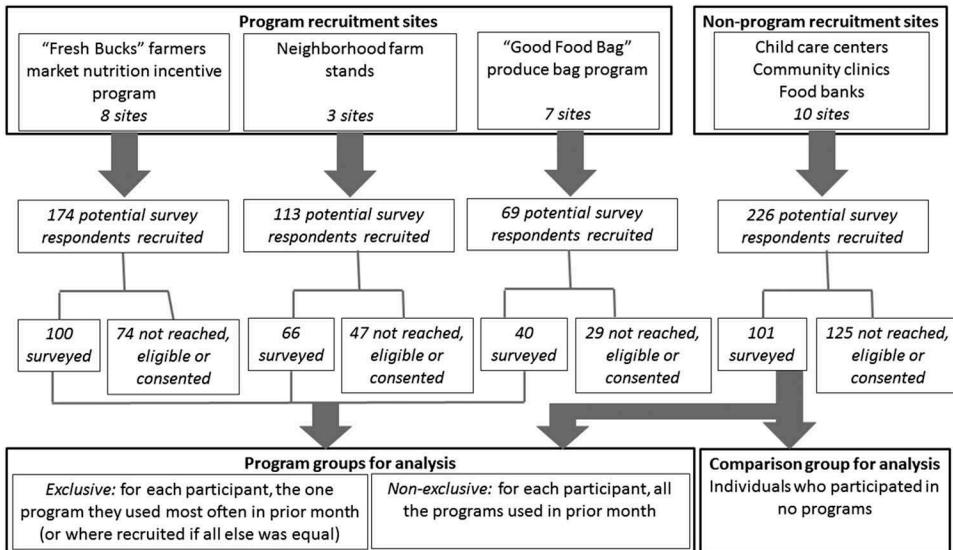


Figure 1. Recruitment of interview respondents from food access programs recruitment sites and non-food access community sites in South King County.

factors that influence food program participation: value and perceived benefits of the programs and perceived effects of the program on diet and finances. Individuals reported their gender, annual household income, educational level, age, employment status, race, ethnicity, household size, and food security status as determined by responses to a validated two-question measure.²⁵

Trained data collectors conducted the phone interviews in English and Spanish. Interviews averaged 25–30 min; participants were offered a \$15 grocery gift card on completion. The phone interviews occurred between June 24, 2016 and August 8, 2016. The University of Washington IRB approved study protocols (IRB #49843). Participants verbally consented to study participation.

Data analysis

Independent variables: program participation and participation frequency

The key independent variables in this study were “program participation” and “participation frequency.” All study participants reported the number of times they participated in each of the three programs over the prior month. Since some program participants used more than one program and some of our statistical tests (i.e., ANOVA and chi-square) required exclusive groups, we analyzed survey respondents in two different ways: (1) in “exclusive” or “primary” program groups (i.e., each participant was assigned to only one group) based on the program each participant used most frequently in the prior month, or the individual’s recruitment site if all else was equal, and (2) in “non-exclusive” program groups (i.e., participants could be assigned to multiple groups) based

on all the programs participants reported using in prior month. For example, if an individual was recruited at a Fresh Bucks site and participated in Fresh Bucks three times in the past month, they were classified as a Fresh Bucks participant for the analyses that used the “exclusive” participation variable. If this same individual also visited a farm stand once in the past month, for the non-exclusive variables we categorized them as both a Fresh Bucks and a farm stand participant, and used the reported program-specific participation frequency in the regression analyses that included all the programs. We categorized individuals who reported not using any of the three programs in the prior month as “non-participants.” These individuals had “zero” program participation frequency for all programs and comprised the comparison group. This approach allowed us to account for the influence of each program and any added affects from using more than one program. A small number of survey respondents answered questions about a “primary” program they had used in the past even though they had not participated in the program in the prior month or had only participated in similar non-PICH programs, so there are slight differences in the numbers of people in the comparison group between the “exclusive” and “non-exclusive” groups.

Primary dependent variables: fruit and vegetable consumption

The primary dependent variables for this study were daily fruit and vegetable consumption, calculated in cup equivalents from the FFQ.

Using the exclusive program groups, we compiled descriptive statistics for demographic and household characteristics, and reported the proportion of fruits and vegetables generally purchased from a specific food access program. We applied ANOVA or chi-square to test for differences across groups. To account for multiple tests, we performed a Bonferroni correction and used $p < .005$ to determine statistical significance.²⁶ We calculated frequencies by program type for responses to questions about program use and perceived impact on diet and finances.

In addition, we computed means for the non-exclusive program participation frequency and fruit and vegetable consumption and then derived multiple regression models to explore the potential associations among fruit and vegetable consumption, program participation, and other measures. Using an ordinary least squares regression, we regressed participants’ reported daily fruit and vegetable consumption on the following covariates: monthly program participation frequency, education level, age, and gender. We included these demographic covariates because studies have shown them to be effect modifiers with fruit and vegetable intake.^{27–29} Household income and race/ethnicity had high non-response rates and were not included in the models. We conducted separate ordinary least squares regression models for fruit and vegetable consumption for Fresh Bucks, farm stands, and Good Food Bags, and also for all programs combined. Individuals who had not participated in

any fruit and vegetable access programs served as the comparison group in each model.³⁰ Statistical significance was set at $p < .005$. Finally, we calculated fit statistics for each model. All statistical analyses were performed using Stata/SE 14.2 for Windows (StataCorp LLC, ©1985–2015).

Trained research staff reviewed all open-ended data about why participants use the programs and the impact programs had on diet and developed a codebook based on emergent themes. The codebook was used to double code all data.

Results

Sample size and characteristics

Three hundred and seven individuals completed the phone interviews, a 57% response rate based on 538 interested potential survey respondents. Of the 307 survey respondents, 215 reported participating in one or more programs in the prior month; 92 others reported participating in no programs over the past month. Thirty-four individuals participated in two programs (mostly farm stands and another program), and one person participated in all three programs. [Table 2](#) reports demographic and household characteristics by exclusive program group and the results of tests for differences between the groups.

Demographic and household characteristics varied significantly across program participant interview samples at the corrected $p < .005$ level, with the exception of race. Compared to other groups combined, Good Food Bag survey respondents were older on average ($p < .001$), and a larger proportion of farm stand survey respondents had income $> \$50,000$ ($p < .001$) and college degrees ($p = .0058$) compared to the Fresh Bucks and Good Food Bag participants. Compared to all participant groups combined, the comparison group was less likely to be college educated ($p < .001$), more likely to be non-English speaking ($p < .001$), and more likely to be food insecure ($p < .001$).

Program participation and fruit and vegetable consumption

[Table 2](#) displays results for program participation frequency and daily fruit and vegetable consumption by non-exclusive program groups. Fresh Bucks had the highest mean participation frequency at 2.7 visits per month; farm stands had the lowest at 2.2 visits per month. Fresh Bucks participants had the highest mean daily fruit consumption at 2.4 cups per day, and the comparison group had the lowest consumption at 1.5 cups per day. Daily vegetable consumption was similar across all groups at about 2.0 cups.

[Table 3](#) presents results regarding the associations between participants' program participation and fruit and vegetable consumption controlling for age, gender, and education. In program-specific models (Models 1–3), frequency

Table 2. Food access program survey respondents in South Seattle and South King County, 2016 ($N = 307$).

Demographics and household characteristics by exclusive program groups					
	Fresh Bucks $N = 111$	Farm stands $N = 65$	Good Food Bags $N = 41$	No Participation $N = 90$	p value
Age – Mean (sd)	45 (15)	45 (14)	55 (17)	43 (14)	$p < .001$ ‡
Sex – N (%)					$p < .001$
Male	19 (17%)	25 (38%)	3 (7%)	12 (13%)	
Female	92 (83%)	40 (62%)	38 (93%)	78 (87%)	
Education – N (%)					$p < .001$
High school diploma, GED or less	21 (19%)	3 (5%)	5 (12%)	45 (50%)	
Some college, vocational, trade, or Associates degree	47 (42%)	23 (35%)	21 (51%)	29 (32%)	
Bachelor's or post-graduate degree	43 (39%)	38 (58%)	15 (37%)	15 (17%)	
Missing	0 (0%)	1 (2%)	0 (0%)	1 (1%)	
Race – N (%)					$p = .124$
White	31 (28%)	16 (25%)	15 (37%)	28 (31%)	
Non-white	14 (13%)	2 (3%)	3 (7%)	27 (30%)	
Missing					
Ethnicity – N (%)					$p = .001$
Latino	15 (14%)	9 (14%)	3 (7%)	28 (31%)	
Non-Latino	96 (86%)	56 (86%)	38 (93%)	62 (69%)	
Household size – Mean (sd)	2.5 (1.8)	2.5 (1.3)	2.4 (1.5)	3.4 (1.7)	$p < .001$ ‡
Household income – N (%)					$p < .001$
Less than \$25,000	74 (67%)	5 (8%)	9 (22%)	44 (49%)	
\$25,000–\$49,999	21 (19%)	17 (26%)	14 (34%)	17 (19%)	
More than \$50,000	2 (2%)	41 (63%)	9 (22%)	12 (13%)	
Missing	14 (13%)	2 (3%)	9 (22%)	17 (18%)	
Food Security – N (%)					$p < .001$
Insecure	65 (59%)	12 (18%)	10 (24%)	69 (77%)	
Secure	45 (41%)	53 (82%)	31 (76%)	21 (23%)	
Missing	1 (1%)	0 (0%)	0 (0%)	0 (0%)	
Language spoken at home – N (%)					$p < .001$
English	97 (87%)	52 (80%)	36 (88%)	55 (61%)	
Other than English	13 (12%)	12 (18%)	5 (12%)	35 (39%)	
Missing	1 (1%)	1 (2%)	0 (0%)	0 (0%)	
Program participation frequency by non-exclusive program groups					
	Fresh Bucks $N = 113$	Farm stands $N = 95$	Good Food Bags $N = 42$	No participation $N = 92$	p value
Number of times used the program "over the past month" – Mean (sd)	2.7 (1.7)	2.2 (1.2)	2.4 (1.2)	0	$p = .046$ ‡
Daily fruit and vegetable consumption in cup equivalents by non-exclusive program groups					
	Fresh Bucks $N = 113$	Farm stands $N = 95$	Good Food Bags $N = 42$	No participation $N = 92$	p value
Daily fruit consumption – Mean (sd)	2.4 (1.9)	2.1 (1.1)	1.9 (1.1)	1.5 (1.0)	$p < .001$ ‡
Daily vegetable consumption – Mean (sd)	2.0 (1.2)	2.0 (1.0)	1.9 (1.0)	1.9 (1.1)	$p = .878$ ‡

p values are from chi-square tests for differences unless otherwise noted; missing entries are removed for each statistical test.

‡ ANOVA test

Table 3. Ordinary least squares regression of participation frequency (use in prior month) and demographic characteristics on daily fruit and vegetable consumption in South Seattle and South King County, 2016.

	Model 1: Fresh Bucks	Model 2: farm stands	Model 3: Good Food Bags	Model 4: all programs
Covariate				
Participation frequency in the last month	0.32***	0.16	0.27*	0.28***
Fresh Bucks				0.12
Farm stands				0.18
Good Food Bags				
Education (ref: < 12th grade)	0.41	0.79	0.71	0.62
High school diploma or GED	0.45	0.72	0.37	0.64
Vocational, trade school or Associate's degree	0.42	1.01*	0.98*	0.73*
Bachelor's degree, graduate, or professional degree				
Age (years)	-0.02*	-0.03***	-0.02*	-0.02*
Sex (ref = female)	0.78*	0.39	0.78	0.34
Male				
Model fit:	0.12	0.11	0.09	0.08
Adjusted R-squared	793	698	488	1167
(higher is better)	816	720	508	1200
AIC (lower is better)				
BIC (lower is better)				

* $p < .05$, ** $p < .01$, *** $p < .001$

‡ Subsample of survey respondents including only those who responded with frequency > 0 in a single program and those who reported no participation in any program in the last month

of participation in Fresh Bucks was associated with fruit and vegetable consumption; there was insufficient evidence to suggest a similar association with the frequency of participation in Good Food Bags or farm stands. Model 1 suggests that for every one-time increase in participation in Fresh Bucks, respondents reported an average 0.31 cup equivalent higher daily fruit and vegetable consumption ($p < .001$).

Model 4 includes program participation frequency for each of the three programs. A one-time increase in participation in Fresh Bucks within a month was associated with a 0.28 cup equivalent higher ($p < .001$) daily fruit and vegetable consumption, controlling for the other covariates and participation in the other programs.

Shopping and purchasing behaviors

Over 90% of program participants reported that they were likely to use their primary program again. About 60% of survey respondents from Fresh Bucks and Good Food Bags reported receiving half or more of all their produce from the respective programs, while only 32% of farm stand respondents reported this (exclusive program groups, $p < .001$).

Factors that influence program participation; perceived benefits

Why participants use programs

Reasons for program participation are displayed in Figure 2. Farm stand and Good Food Bags participants most commonly cited quality and freshness of the available produce, while Fresh Bucks participants most frequently cited affordability as their top reason for using the program. Unlike Fresh Bucks and farm stand participants, Good Food Bag participants reported that they were most likely to continue using the program because they had signed up for future weeks and paid up front, a feature unique to some of the Good Food Bag program sites.

Perceived impact of programs on participants' diet and finances reported by primary program

The three most common ways Fresh Bucks participants felt they ate differently were that they ate more fruit (50%), more vegetables (50%), and more healthfully in general (37%). Farm stand participants felt they ate more healthfully (32%), and ate more organic produce (31%) and vegetables

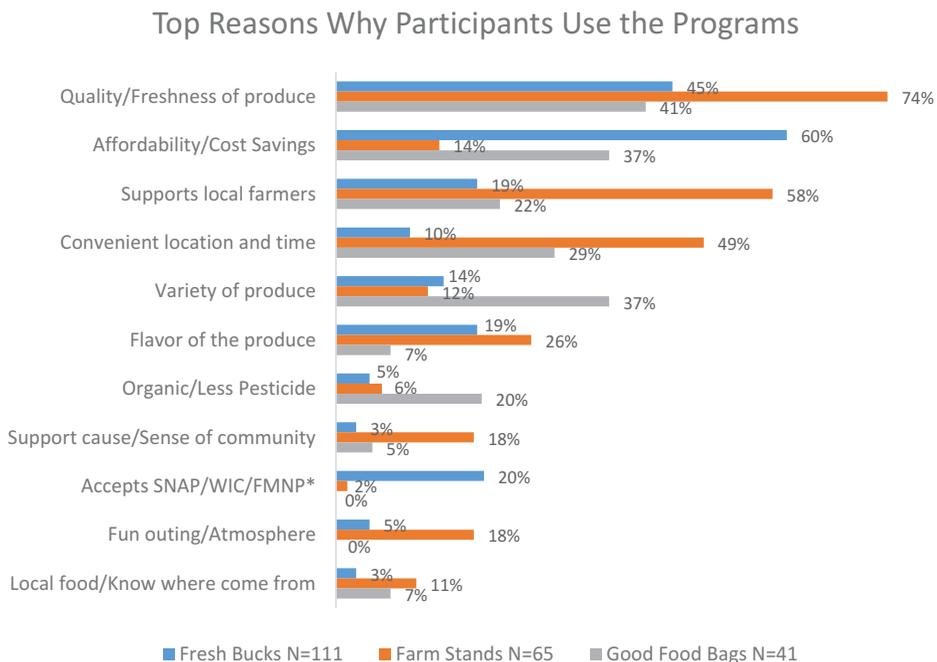


Figure 2. Reasons for using programs reported by 307 participants from Fresh Bucks, farm stands, and Good Food Bags in South Seattle and South King County.

Note: This question was asked only for program participants about their primary program and is reported by exclusive program groups. Respondents were able to report more than one reason why they used the program. Reasons reported by fewer than 10% of program participants are not shown.*Supplemental Nutrition Assistance Program/Special Supplemental Nutrition Program for Women Infants and Children/Farmers Market Nutrition Program

(28%) when they went to the farm stand. Good Food Bag participants reported that they tried new foods (41%), ate more vegetables (27%), and prepared new meals (24%). Thirteen percent of Fresh Bucks, 23% of farm stands, and 15% of Good Food Bag participants said they felt there was no difference in their diet as a result of participating in the program.

When asked if they felt their primary program helped them save money, large portions of Fresh Bucks and Good Food Bag participants responded that the programs helped save them a lot or some money (70% and 73%, respectively). For farm stands, a third (32%) said the program helped them save a lot or some money.

Discussion

This study examined three existing program types in one geographic area, all designed to improve access to fruits and vegetables in communities with limited access to affordable fresh fruits and vegetables. All three programs were well received by community participants, and the programs provided a substantial portion of the produce that the participants consumed. Frequency of participation in all three programs was positively associated with fruit and vegetable consumption – ranging from one-sixth to one-third of a cup of fruit and vegetables for each additional use of a program over the course of a month. When controlling for participation in multiple programs, this relationship remained statistically significant only for the Fresh Bucks farmers market SNAP incentive program.

This robust finding for Fresh Bucks is consistent with prior evidence that low-income shoppers' use of farmers markets is associated with greater fruit and vegetable consumption, and that incentive programs can positively influence diet.^{13,16,31,32} In this study, 60% of Fresh Bucks participants reported that they purchased half or more of their produce through the Fresh Bucks program. Fresh Bucks offers a larger amount and wider variety of produce options than farm stands or Good Food Bags; the Fresh Bucks program encourages participants to purchase \$20 worth of produce per visit (for the cost of \$10) and takes place at farmers markets with numerous vendors selling a range of produce types and varieties.³³ Although not examined in this study, Fresh Bucks participants may buy more produce, and potentially more produce that they already like and/or know how to cook, than participants of other programs, which could contribute to greater fruit and vegetable consumption.³⁴ Fresh Bucks participants also reported the lowest income and highest food insecurity of the three program groups. This makes sense given that Fresh Bucks is only available to SNAP participants who must meet low-income thresholds for eligibility. More than the other participant groups, Fresh Bucks participants mentioned affordability as a key reason for accessing the program, indicating that this program may uniquely address financial barriers for shoppers interested in purchasing healthier foods.

The Good Food Bag program also demonstrated a positive association between produce consumption and participation, but in the adjusted regression model the significance level of this association at $p < .05$ did not meet the $p < .005$ Bonferroni corrected significance level. Like Fresh Bucks, 50% of participants reported that half or more of their produce came from the program. Of the three program types, there is the least amount of prior evidence for dietary improvements associated with programs like Good Food Bags. Some studies have shown that regular participation in similar programs, such as subsidized community supported agriculture subscriptions, is associated with greater fruit and vegetable consumption.^{35,36} Many participants remarked on the quality, affordability, and convenience of the program as key benefits. Participants also commented on liking produce variety despite Good Food Bags only offering four types of produce in each bag; this may be a result of participants receiving produce they would not typically purchase themselves. “Trying new foods” was the most commonly mentioned dietary change reported by Good Food Bag participants. Participants in this group were also older on average than other survey respondents in our sample; this reflects the fact that Good Food Bags were offered at two senior centers in King County in our sample. Good Food Bag programs might be a suitable strategy for reaching targeted populations where they live, work, or recreate.¹⁸

Farm stand programs were not significantly associated with greater fruit and vegetable consumption in this study, despite associations in the expected (positive) direction. It is important to note that participants reported getting a smaller proportion of their produce from farm stands compared to the other programs. Furthermore, average participation frequency was lowest for farm stand shoppers, and their reasons for participating varied more than those of other program participants. Compared to Fresh Bucks and Good Food Bag participants, a higher percentage of farm stand participants highlighted the “fun community outing” and “sense of community” as benefits of farm stand participation. This may indicate that some participants considered farm stands valuable but less influential as a primary source of produce. This view aligns with the mission of this particular PICH-funded farm stand program, which is to use farm stands as a mechanism for community building in addition to improved access to healthy food. Other studies have found a significant association between neighborhood farm stand use and fruit and vegetable consumption.^{37,38} In the current study, the demographic differences in farm stand participants reflect the farm stands’ locations in mixed-income communities, and the fact that farm stands were not restricted to low-income participants may have influenced this association.

The participants of each program reflected the target audience, and the community or institution in which the program took place. The mix of strategies supported through the King County PICH initiative reached a diverse array of

communities, and this study highlights the potential for using different approaches for specific populations. A sizeable proportion of participants from all three types of programs reported that the quality and freshness of the produce was one of their top reasons for using the program. This indicates that produce quality is a shared value across communities and that there are several approaches that can help make high quality, fresh produce more accessible. This study also reinforces the idea behind conceptual models that have been developed to describe components of “food access” that go beyond mere physical access to food in communities.^{20,21}

Study limitations include the convenience sample which precluded randomly assigned interventions and the ability to determine causality. It may be that individuals who enjoy eating fruits and vegetables, or who face fewer barriers, seek out food access programs or that they are more likely to agree to be in a study. Many factors contribute to fruit and vegetable consumption. The sample drawn for the comparison group differed from the program participant groups; given the differences between participants of particular programs, no one comparison group could feasibly match all three program groups. Although the comparison group was recruited from the same geographic communities as the program sites and statistical models adjusted for demographic differences, unobserved heterogeneity between individuals or groups limits conclusions as not all differences could be known or accounted for in our analyses. Specifically, lack of sufficient data on race was a limitation as race has been found to be an effect modifier in previous studies of healthy food incentive programs.^{16,19,31} Likewise, the lower fruit and vegetable consumption of the comparison group may have been associated with factors such as education and food insecurity. Other limitations included the relatively small sample size for each program type and the reliance on self-reported dietary recall.

This study did include the use of a comparison group, an in-depth telephone interview approach that allowed for discussion of multiple topics, use of a validated food frequency screener to assess fruit and vegetable consumption, and the inclusion of multiple food access strategies. The in-depth telephone interview in particular allowed us to spend time with each program participant, gathering rich data on their experiences with each program. By interviewing non-program participants, we were able to gather a snapshot of potential program participants who, for a variety of reasons, had not yet come into contact with the programs. For planning purposes, comparison group members could be seen as potential participants for the three food access programs that were studied.

Findings from this study not only highlight promising community-based program strategies such as farmers market nutrition incentive programs for increasing fruit and vegetable consumption among low-income populations, but can inform the design and implementation of public health and

community-level food access programming. Differences in programs' reach and impact, like those highlighted in this study, indicate that some strategies may be best suited for specific populations. At the same time, given the different groups that comprise communities, a portfolio of approaches may optimize population impact. Additional comparative and real-world studies of this nature are needed to grow the base of evidence communities can use to make decisions about which strategies are likely to improve dietary outcomes and make the most sense for their unique context and demographics.

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