

**Research and Professional Briefs**

# Increasing Access and Affordability of Produce Improves Perceived Consumption of Vegetables in Low-Income Seniors

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**ABSTRACT**

High cost and limited access to food have been associated with lower intake of fruits and vegetables in limited-income individuals. The Veggie Mobile is a van that carries fresh produce and travels in low-income neighborhoods, selling fruits and vegetables at a fraction of regular supermarket prices. The purpose of this study was to determine whether participation in the Veggie Mobile increases fruit and vegetable intake in a group of seniors. The intervention, buying fruits and vegetables from the Veggie Mobile, was implemented between April and October 2008 in two senior housing sites that had not previously received Veggie Mobile services. Participants were asked about fruit and vegetable intake using a modified six-item questionnaire based on the Behavioral Risk Factor Surveillance System at preintervention and again at 3 to 5 months. The post-survey also included questions about perceived benefits and barriers to using the Veggie Mobile. The two cross-sections of seniors were matched using date of birth. Wilcoxon signed rank test and paired samples *t* tests examined change in pre- and post-intervention variables. Seventy-nine older adults completed the baseline survey and 63 completed the post-survey. Of these, 43 participants completed both surveys (70% white [*n*=30], mean age 69 ± 9 years). Mean intake of fruits and vegetables after using the Veggie Mobile increased by 0.37 servings/day. Vegetable intake alone increased from 1.98 ± 1.71 servings/day to 2.58 ± 1.4 servings/day (*P*=0.027), half of which was potatoes. Change in fruit intake was not significant (*P*=0.358). At post-intervention, seniors visited the supermarket less often (*P*=0.001) and spent an average of \$14.92 less during their last visit. The majority of participants who completed the post-survey (62 of 63) indicated being satisfied with the pro-

gram. The Veggie Mobile provides an example of a simple community intervention that has potential to lead to positive behavior change among low-income seniors.

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A large body of research links diets rich in fruits and vegetables (F/V) with lower risks of many chronic diseases (1-4). Despite this evidence, intake levels remain below national recommendations (5-10). Several factors influence dietary intake and food-purchasing decisions, including nutrition, cost, quality, and availability of food (11-17). Cost and availability are especially salient factors for individuals with limited incomes (13,16,18). Poorer neighborhoods have been found to have fewer grocery stores and less F/V markets than wealthier neighborhoods (19-21). Furthermore, supermarkets, especially those in more affluent neighborhoods, often provide better availability of produce, greater selection, and lower prices (22-27). In fact, living within close proximity to a chain supermarket has been associated with increased F/V consumption (5,19,21,28).

In an effort to address barriers and make fresh F/V more affordable and accessible to lower-income residents, the Capital District Community Gardens located in Troy, NY launched the Veggie Mobile in April 2007 (Figure). The Veggie Mobile is a van that carries fresh produce and travels to low-income neighborhoods in New York State's Capital Region, selling F/V at wholesale cost, on average 48% lower than local supermarket prices. Essentially a produce aisle on wheels, the refrigerated box truck is equipped with shelves and offers between 50 and 75 varieties of seasonal F/V. On a weekly basis, the Veggie Mobile is scheduled to make 1-hour stops at senior centers, public housing projects, and other densely populated locations.

The Veggie Mobile program has an annual operating budget of \$110,000 and requires two individuals to operate the van and handle and sell the produce. In 2010, the van made 22 weekly stops, served approximately 40,000 individuals and infused 115,000 pounds of fresh produce into the urban food deserts it served. The Veggie Mobile is not a self-sustaining program, given that the produce is sold wholesale and does not render a profit. The cost of transportation, van maintenance, salaries for the individuals who operate the van, and the one-time cost of the van itself are covered with grant funding and community donations. The aim of the present study was to preliminarily evaluate the impact of the Veggie Mobile on the shopping and eating habits of a group of community-

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**Figure.** The Veggie Mobile at a stop in a low-income neighborhood in the Capital Region of New York State.

dwelling seniors. It was hypothesized that participants who utilized the Veggie Mobile service would report increased intakes of F/V and decreased visits to the shopping market, often viewed as a burden by seniors who face mobility and transportation challenges (29,30). Benefits and barriers to shopping at the Veggie Mobile were also assessed.

## METHODS

### Study Participants and Design

The study reflects a cross-sectional evaluation of F/V consumption and shopping habits before and after the Veggie Mobile intervention in a group of seniors between the months of April and October 2008. Participation was limited to Veggie Mobile shoppers aged 55 years or older who were residents of the selected senior housing sites. One low-income senior housing site was selected in each of the cities of Troy and Albany, two urban areas in New York's Capital Region. The two senior sites were chosen because they did not have previous experience with Veggie Mobile services and were comprised of diverse racial/ethnic groups. The Veggie Mobile was scheduled for weekly, 1-hour stops at each site to sell F/V to residents. On repeated visits between April and May, as residents were waiting to purchase produce, they were approached and asked to complete the survey. Consenting shoppers 55 years or older were interviewed. Approximately 3 months later, researchers revisited the sites weekly and administered the post-survey. A cohort of seniors who completed the questionnaire at both time points was identified using date of birth. The Sage Colleges' Institutional Review Board for protection of human subjects approved the study. Permission was obtained from building management at the senior housing sites to conduct all data collection.

### Survey Development

Before developing the survey, two focus groups were conducted in two senior housing sites that were already

receiving Veggie Mobile services. The focus groups obtained feedback on Veggie Mobile shoppers' perceived benefits and barriers to utilizing the service. Focus group questions examined what shoppers liked most about the program, benefits of participating, perceived economic savings, impact of the program on F/V consumption, and suggestions for improvement. Focus groups were audiotaped and transcribed verbatim. Findings from the focus groups were used to inform the development of the survey.

### Survey Instrument

In addition to demographic and personal questions, participants indicated how often they visited the supermarket (twice a week or more, once a week, two to three times a month, once a month or less) and estimated the amount of money they spent during their last visit to the supermarket. F/V intake was assessed using a modified brief food questionnaire based on the Behavioral Risk Factor Surveillance System (BRFSS) six-item F/V questionnaire (31). Participants reported how often they consumed lettuce salad, potatoes, vegetables, 100% fruit juice, and fruit during the previous 24 hours. The BRFSS F/V questionnaire has been evaluated against other dietary assessment tools and was found to have moderate validity, where mean F/V intake was generally similar to estimates obtained from diet recalls (31). In a three-way comparison between the BRFSS F/V module, food frequency questionnaire data, and diet records, correlations between BRFSS and estimates from the food frequency questionnaire were 0.63 and 0.56 between BRFSS and diet records (32). Additional questions incorporated into the post-survey included the frequency of purchasing produce at the Veggie Mobile (weekly, two to three times a month, once a month or less), the amount of money spent shopping at the Veggie Mobile, as well as satisfaction with its services.

### Statistical Analyses

F/V intake was determined by computing the sum of reported F/V consumed within the previous 24 hours. Total vegetable consumption was calculated by summing all three vegetable intake variables (lettuce, potatoes, and other vegetables), and total fruit consumption was calculated by adding the intake of fruit and fruit juice together. Wilcoxon signed rank test and paired samples *t* tests were performed to examine the change in frequency of visits to the supermarket, money spent at the supermarket, and change in F/V intake after shopping at the Veggie Mobile. Statistical significance was set at  $P < 0.05$  and confidence intervals were reported where possible. Data were analyzed using SPSS for Windows (version 16.0, 2007, SPSS Inc, Chicago, IL).

## RESULTS AND DISCUSSION

At baseline, 79 participants completed the survey and 63 completed the post-intervention survey. Of these, 43 seniors completed both (70% white [ $n=30$ ], mean age  $69 \pm 9$  years). Many did not complete high school ( $n=18$ ) and 27 received food stamps (also known as Supplemental Nutrition Assistance Program). Baseline participants were

**Table 1.** Select demographic and personal characteristics of low-income seniors who completed the baseline questionnaire (n=79), comparing participants who continued shopping at the Veggie Mobile and completed the post-survey to those who did not complete the post-survey (ie, did not shop at the Veggie Mobile during the 3 months of post-data collection)

Characteristics	All Baseline Respondents (n=79)	Baseline Only Shoppers (n=36)		Return Shoppers (n=43)	
	n	n	% <sup>a</sup>	n	% <sup>a</sup>
<b>Sex</b>					
Male	14	8	57.1	6	42.9
Female	65	28	43.1	37	56.9
<b>Marital status</b>					
Married	4	2	50	2	50
Living alone	42	20	47.6	22	52.4
Widowed	33	14	42.4	19	57.6
<b>Education</b>					
Less than high school	35	17	48.6	18	51.4
High school	26	11	42.3	15	57.7
College/some college	18	8	44.4	10	55.6
<b>Race/ethnicity<sup>b*</sup></b>					
Black	31	20	64.5	11	35.5
White	46	16	33.3	32	66.7
<b>Yearly income</b>					
<\$10,000	40	18	45.0	22	55.0
≥\$10,000	39	18	46.2	21	53.8
<b>Food stamps<sup>c</sup></b>					
Receiving food stamps	34	18	52.9	16	47.1
Not receiving food stamps	45	18	40.0	27	60.0
		←————— <i>mean ± standard deviation</i> —————→			
<b>Age (y)</b>	68.2±9.0		67.4±9.2		68.9±8.9
<b>Visits to the supermarket (trips/mo)</b>	5.8±4.6		5.7±4.9		5.9±4.4
<b>Money spent during last visit to the supermarket (\$)</b>	73.1±47.7		69.6±45.3		77.2±50.9
<b>Total vegetable intake (servings/d)</b>	2.0±1.6		2.1±1.5		2.0±1.7
<b>Total fruit intake (servings/d)</b>	2.1±1.4		2.4±1.3		1.9±1.5

<sup>a</sup>The percentage across the listed characteristics.

<sup>b</sup>Three participants were Latino and were not included in this analysis.

<sup>c</sup>Also known as the Supplemental Nutrition Assistance Program.

\*Significant at  $P < 0.05$ .

divided into two groups: the cohort of return shoppers who completed both the pre- and post-surveys (n=43) and baseline-only shoppers who did not use the Veggie Mobile service during the 3 months of post-data collection (n=36). With the exception of race, no significant differences were observed in sociodemographic characteristics and initial reported F/V intake between return shoppers and baseline-only shoppers (Table 1).

#### Change in Frequency of Visits to the Supermarket

At baseline, many older adults reported frequently visiting the supermarket; 26 of 79 (32.9%) indicated shopping more than twice per week, 21 (26.6%) shopped once per week, 17 (21.5%) reported two to three visits per month, and 15 (19.0%) shopped once per month or less. After using Veggie Mobile services, participants averaged less frequent trips to the supermarket ( $P=0.001$ ). At post-intervention, only 6 of 63 (9.5%) frequented the supermarket twice per week or more, and more than one third

(23 of 63 [36.5%]) made one visit per month or less. The decline in frequency of shopping at the supermarket is a notable benefit to shopping at the Veggie Mobile because many older adults face mobility and transportation challenges that can be alleviated by delivering produce directly to their place of residence (29,30).

#### Change in Money Spent at the Supermarket

The potential reduction in money spent food shopping may be another benefit of the Veggie Mobile. Reported average dollars spent at the last trip to the supermarket decreased from  $\$73.05 \pm \$47.73$  preintervention to  $\$58.13 \pm \$42.35$  post-intervention; however, this change was not significant ( $P=0.065$ ). Additional analysis indicated money spent at the supermarket decreased overall, but not for everyone. Change in money spent at the supermarket did not reach significance ( $P=0.065$ ), possibly because of the small sample size. This finding should be confirmed in a larger sample of shoppers.

**Table 2.** Reported intake of fruits and vegetables consumed at baseline and after using Veggie Mobile services in a cohort of low-income seniors (n=43)

Variable	Mean	Standard deviation	Mean difference <sup>a</sup>	95% Confidence Interval of the Difference		P value
				Lower	Upper	
<b>Lettuce salad</b>						
Pre	0.51	0.80				
Post	0.58	0.79	0.07	-0.21	0.35	0.618
<b>Potatoes</b>						
Pre	0.49	0.59				
Post	0.77	0.75	0.28	0.06	0.49	0.013*
<b>Other vegetables</b>						
Pre	0.98	.96				
Post	1.23	0.75	0.26	-0.03	0.54	0.078
<b>Fruit</b>						
Pre	1.20	1.09				
Post	1.05	1.11	-0.15	-0.49	0.19	0.375
<b>Fruit juice</b>						
Pre	0.67	0.86				
Post	0.59	0.72	-0.08	-0.38	0.21	0.582
<b>Total fruit and vegetable intake</b>						
Pre	3.17	2.45				
Post	3.63	2.38	0.45	-0.23	1.14	0.188
<b>Total vegetable intake</b>						
Pre	1.98	1.71				
Post	2.58	1.64	0.60	0.07	1.14	0.027*
<b>Total vegetable intake excluding potatoes</b>						
Pre	1.49	1.52				
Post	1.81	1.26	0.33	-0.77	0.12	0.15
<b>Total fruit intake</b>						
Pre	1.87	1.52				
Post	1.64	1.54	-0.23	-0.74	0.21	0.358

<sup>a</sup>A positive number indicates increased intake from baseline to post-intervention.

\*Significant at  $P < 0.05$ .

A substantial number of older adults (24 of 63) shopped at the Veggie Mobile every week, about one fourth (14 of 63) used the service two to three times per month, and 22 shopped at the Veggie Mobile once per month or less. On average, participants indicated spending  $\$6.98 \pm \$5.02$  while purchasing produce at the Veggie Mobile. Seniors who responded to the post-survey were divided into two groups: those who shopped at the Veggie Mobile weekly vs those who used the program less often. Independent samples *t* test revealed that seniors who used the program weekly indicated spending on average \$29 less during their last visit at the supermarket than seniors who used the program less often ( $t = 1.9, P = 0.06$ ). Because this study was not designed to capture the amount participants spent on F/V at the supermarket, it is feasible that the money participants saved at the supermarket may have been equivalent to the amount spent at the Veggie Mobile. Future evaluations should directly measure the relationship between money spent on F/V at the supermarket and at the Veggie Mobile. Preliminary results, however, indicate a trend of possible savings when using Veggie Mobile services.

#### Change in F/V Intake

In this study of low-income seniors who used the Veggie Mobile service, the prevalence of older adults who consumed the recommended daily servings of F/V was comparable to national estimates from BRFSS (33). At baseline, 33% of respondents in the present study consumed vegetables three or more times per day, compared to 34% of older adults in BRFSS. Similarly, the proportion of older adults in this sample who consumed fruits two or more times per day at baseline was 53%, compared to 46% nationally (33). The proportion of participants reaching the vegetable recommendation of consuming at least three servings/day increased from 33% (14 of 43) at baseline to 51% (22 of 43) subsequent to shopping at the Veggie Mobile ( $P = 0.03$ ). The proportion of participants who achieved the fruit recommendation of consuming at least two servings/day increased from 53% (23 of 43) at baseline to 63% (27 of 43) post-intervention, but did not reach significance ( $P = 0.326$ ). After shopping at the Veggie Mobile, average intake of F/V increased by 0.37 servings/day (Table 2). Excluding fruit juice, which is not sold on the Veggie Mobile, baseline F/V intake averaged

3.17±2.45 servings/day and increased to 3.63±2.38 servings/day post-intervention, a difference of 0.46 servings/day. These differences were not statistically significant ( $P=0.188$ ).

When intake of F/V was examined separately, total vegetable intake significantly increased: there was a significant increase in potato consumption and other vegetable intake (excluding potatoes and lettuce) approached significance (see Table 2). The effect size of 0.3 servings/day for total vegetable intake (0.6 servings/day including potatoes) is comparable to many other interventions aimed at increasing F/V intake in diverse settings and using a variety of strategies (34-38). These studies have generally shown increases in F/V consumption ranging from 0.2 to 1.0 servings/day. Many of these earlier interventions were complicated, expensive, and involved considerable staff to succeed. The Veggie Mobile, on the other hand, is relatively simple. The intervention requires only two individuals to operate the van and sell the produce. One single van is able to visit a dozen sites weekly, impacting the lives of numerous shoppers. Determining the cost-to-benefit of programs such as the Veggie Mobile is complicated. The expectation is that by making produce more available and more affordable in food deserts, consumption will increase, resulting in decreased chronic disease prevalence and lower health care costs long term.

Fruit intake remained unchanged. A possible explanation for the lack of change in fruit intake is that a large proportion of participants were already consuming a substantial amount of fruit. At baseline, the average daily fruit intake of 1.98 servings/day already met the recommendation of two servings per day. A larger-scale intervention may be needed to show significant changes in fruit intake or to confirm results observed in this evaluation. Fruit intake findings were consistent with earlier reports that emerged from the focus groups. When asked whether the Veggie Mobile increased their intake of produce, none of the focus group participants reported an increase in their intake of fruit, and the majority indicated an increase in their intake of vegetables. In addition, many participants reported trying new vegetables, such as asparagus, artichokes, and red peppers, as a result of the program.

The majority of studies that aimed to increase F/V consumption in older adults have been disease-specific and focused on the delivery method, intensity, and length of the intervention (39-42), with availability of produce included as a contextual variable. Few studies have examined the relationship between community access to produce and levels of F/V consumption. Our study findings are supported by Caldwell and colleagues (43), who confirmed that availability and variety of produce were positively correlated with F/V consumption across the age span. Researchers should consider environmental factors, such as access to fresh produce, as important variables that have the potential to substantially modify the effects of community interventions.

### Satisfaction with Veggie Mobile Services

Participants' satisfaction with services offered by the Veggie Mobile was high; 62 of 63 (98.4%) indicated being satisfied or extremely satisfied with the program. When

asked to compare the Veggie Mobile to the supermarket, the majority indicated the Veggie Mobile offered lower prices (54 of 63 [85.7%]) and better/much better quality (54 of 63 [85.7%]) and variety (46 of 63 [73.0%]) of produce. When asked what they liked most about shopping at the Veggie Mobile, 49 (77.8%) indicated convenience and 44 (69.8%) indicated low prices. Many participants (25 or 39.7%) enjoyed the socialization that ensues while using the program. The vast majority of participants (62 of 63 [98.4%]) had no complaints about the program and left the question "What did you dislike (NOT Like) about the Veggie Mobile?" blank. Many said they would be distressed if the service was discontinued.

There are several limitations to the study. First, the study sample was small and nonrandom, consisting of volunteer shoppers. Therefore, the results may not be generalizable to other low-income senior populations. Second, the BRFSS F/V module was chosen specifically because it was a validated and brief questionnaire that minimized the burden on senior respondents; however, it is general and does not provide details of specific F/V consumed. Third, all data were self-reported and prone to recall error and social desirability bias. Fourth, the survey was not comprehensive. For example, other factors could have contributed to the decrease in the trips made to the supermarket that were not captured by the pre- and post-surveys. Finally, satisfaction with the Veggie Mobile may be inflated. Quite possibly, shoppers who were dissatisfied with the program, found prices too high, or purchasing inconvenient would not have continued to use the Veggie Mobile and would not have served as a pool for the post-survey.

### CONCLUSIONS

The present study demonstrated a modest increase in reported vegetable intake associated with using the Veggie Mobile program. Although the reduction in disease risk at the individual level may not be clinically significant, the impact on the population may have an important effect on reducing chronic disease rates (44). After shopping at the Veggie Mobile, this population of low-income seniors decreased the frequency of trips to the supermarket and increased daily intakes of vegetables. This study highlights the feasibility of increasing vegetable consumption in low-income seniors by making produce more available and affordable. Dietetics practitioners and public health nutritionists should continue to be creative in devising simple, community-based interventions to increase availability of produce in food deserts and help improve the diet quality of individuals.

### STATEMENT OF POTENTIAL CONFLICT OF INTEREST:

As an independent researcher and outside evaluator, Rayane AbuSabha was asked to plan and carry out the evaluation of the Veggie Mobile. All decisions with regard to the research were made by Rayane AbuSabha, who is the outside evaluator. Dipti Namjoshi was a graduate student who helped with data collection and analysis. Amy Klein oversees the operations of the Veggie Mobile. She helped facilitate elements of the project such as contacting building supervisors; however, she made no decision in terms of the research, data collection, and interpretation.

**FUNDING/SUPPORT:** The project was commissioned by Albany Guardian Society, a charitable organization that serves seniors in New York's Capital Region. Albany Guardian Society provided Capital District Community Gardens with the funds for the two additional stops at senior housing sites where the study was being conducted. Albany Guardian Society subcontracted with the principal investigator and first author to independently evaluate the effectiveness of Veggie Mobile services using the two new senior sites.

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