The Cost and Availability of Healthier Foods for the Pascua Yaqui Pueblo and the Old Nogales Highway Colonia: Community Baselines and Benefits of Mobile Markets

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Executive Summary

The Community Food Bank in Tucson, Arizona operates its own grocery store, the Value Foods Store (VFS) that sells food (and other) items at a substantial discount over regular grocery stores. The Food Bank also operates mobile markets in Pima County, Arizona that provide items from the VFS to low income areas with less access to grocery stores. This study uses market basket analysis to assess the impacts of mobile markets on the availability and affordability of food on the outskirts of Tucson, Arizona. The two communities examined in this study were the Old Nogales Highway Colonia and the New Pascua Yaqui Pueblo, 13 and 15 miles south of downtown Tucson.

The U.S. Department of Agriculture's Thrifty Food Plan (TFP) is a market basket of items designed to meet basic nutritional requirements at minimal cost. In the study area, the average cost of purchasing the TFP was lower than the national average. However, at the closest store to the Pascua Yaqui Pueblo, the TFP cost was 8 percent higher than the national average.

The cost of purchasing the TFP (based on 1999 market basket revisions) was compared with a "healthier" basket, patterned after a University of California, Davis study (Jetter and Cassady, 2005, 2006). The healthier basket has significantly more dietary fiber and less fat than the TFP. The healthier basket cost on average 12 percent more than the TFP. Based on nonparametric tests, the difference in the costs of the two baskets was statistically significant at the 0.1% level even with a small sample size.

Whole wheat bread and grain items and low fat cheeses were items most likely to be missing in surveyed stores. Jetter and Cassady (2005; 2006) also found that whole wheat bread and grain items were most likely to be unavailable in their survey of California stores.

By substituting mobile market purchases for regular supermarket purchases, a family of four could reduce the cost of purchasing the TFP by 11 percent and the cost of the healthier basket by 8 percent. Again, using nonparametric tests to account for small sample size, the cost reductions were statistically significant at the 0.1%-level.

Many items sold at the mobile markets were not part of either the TFP or the healthier basket. Looking at actual purchases rather than hypothetical market baskets, the price discounts are larger. If all the items sold at two mobile markets at the Pascua Yaqui Pueblo in May 2006 were purchased at local grocery stores, they would have cost 47 to 85 percent more. On average, the community saved 61 cents for every dollar spent at the mobile markets.

The absolute dollar gains to mobile market participation are limited by low total sales volumes, however. Total sales per mobile market visit are typically less than $160. So, even though percentage savings are large, the absolute dollar savings are limited. In May 2006, sales at Pascua Yaqui Pueblo averaged $125 per mobile market visit, with total cost savings to the community ranging from $54-$99 per visit. Direct wage costs of mobile markets were roughly $135 per visit. Other expenses (materials, employee benefits, gasoline) would add to costs per visit. These are primarily costs per visit rather than costs per item sold, so the cost effectiveness of the program can be greatly improved by increasing per visit sales volumes.

Introduction

Mobile markets, poverty, and distance to grocery stores

The Community Food Bank in Tucson, Arizona operates its own grocery store, the Value Foods Store (VFS) to serve people who may not qualify for their other food assistance programs. The VFS, open to the general public, sells fresh produce, meats, canned items, pasta, frozen vegetables, entrée items, dairy products, and other food items, as well as personal care and household care items (such as toothpaste, shampoo, conditioner, toilet tissue, baby diapers, paper towels, facial tissue, garbage bags, laundry bleach and soap). Because the Food Bank is a non-profit organization, unlike other grocery stores in Pima County, Arizona, they do not charge the standard 7-percent sales tax on these non-food items. VFS products are purchased from brokers throughout the United States using funds from store sales. It does not sell dented, damaged or salvaged food items. According to the Community Food Bank, prices are 30-70 percent less than local Tucson grocery stores.

The Food Bank also operates mobile markets in Pima County, Arizona. The mobile markets provide items from the VFS to low income areas with less access to grocery stores. Here is how mobile markets work. A Food Bank employee and volunteers load up a large truck with food (and some personal care and household) items and set up a small market at regular sites, with a tent and tables, and refrigerated items in the truck. The markets are open to the general public and sell products at VFS prices, which are substantially lower than prices at nearby grocery stores.

Our study focuses on two mobile market sites on the southern outskirts of Tucson. The mobile markets go to each of these two sites on alternating Tuesdays. For example, they may go to one site on the first and third Tuesday and the other on the second and fourth Tuesday of the month. One mobile market is at the Liogue Senior Center on the Pascua Yaqui Tribe in what is

known as the New Pascua Yaqui Pueblo. New Pascua Yaqui is located in southwestern Arizona, about 15 miles southwest of downtown Tucson on 1,152 acres of trust land. Many Yaqui Tribal members also live off of the reservation in communities throughout Arizona. These members are concentrated in Yoem Pueblo in Marana, Barrio Libre in South Tucson, and Old Pascua in Tucson.

The other mobile market is set up on the grounds of the Summit View Elementary School. The Summit View site is in the middle of the Old Nogales Highway Colonia. Colonias are federally-designated communities or neighborhoods located within 150 miles of the U.S.-Mexico border that lack basic infrastructure such as adequate water systems, sewer systems, drainage, paved roads, or permanent housing. Most colonias lack formal local government and government services. In the 1990s, Congress enacted legislation requiring U.S. Border States to set aside 10 percent of their Housing and Urban Development (HUD) Community Development Block Grant (CDBG) funds for colonias.

Both mobile market sites are centrally located within their respective census tracts. Poverty rates in the two census tracts that include the two mobile markets are significantly higher than rates in Pima County as a whole (Table 1). At the Summit View site they are nearly double the county average and at the Pascua Yaqui site, they are nearly quadruple. While poverty rates in families with the householder 65 and older at Summit View are relatively low and close to the county average, they are high (36.1 percent) at the Pascua Yaqui site. Poverty rates increase for families with any children and increase more for families with children less than 5 years of age.

The food bank's choice of mobile market sites is stated as "rural areas where people have limited access to transportation, low cost meals, dairy, dry goods and fresh produce." (http://communityfoodbank.com/community-food-security-center/value-foods-store-mobile-market/)

The closest full-service grocery store from Summit View is 5 miles away, while the next closest is 5.6 miles away. At Pascua Yaqui, the nearest full-service grocery store is 2.7 miles away. This store, however, has substantially higher market basket prices than other local stores. The next closest is 4.25 miles away. By way of comparison, Hatfield and Gunnell (2005) estimated that 90 percent of California's population lived within 2 miles of the nearest grocery store, while 95 percent of California's urban population lived within 2 miles of a grocery store. In contrast, Blanchard and Lyson (2006) defined food deserts as areas located farther than 10 miles from a large supermarket.

Table 1. Poverty rates in mobile market areas and Pima County

	Pascua Yaqui Census Tract 51	Summit View Census Tract 41.06	Pima County
Percent of families below poverty level			
All families	40.3	19.9	10.5
With related children under 18 years	43.9	28.4	16.4
With related children under 5 years	48.3	33.3	20.6
With householder 65 and older	36.1	4.9	4.7

Aims and scope of study

This study uses market basket analysis to assess the impacts of mobile markets on the availability and affordability of food on the outskirts of Tucson, Arizona. It begins with calculation of a community baseline, estimating the cost of purchasing USDA's Thrifty Food Plan (TFP) at stores frequented by residents of the Pascua Yaqui Pueblo and the Old Nogales Highway Colonia. Next, it estimates the costs of purchasing an alternative "healthier" market basket. This healthier market basket is based on one constructed by Jetter and Cassady (2005; 2006) in a study of food costs in Sacramento and Los Angeles, California. They substituted healthier variants of dairy, meet, canned fruit, breads, and grain products into the standard TFP to estimate the additional cost of purchasing a healthier market basket.

We next estimated the impact of mobile market participation on the costs of the two market baskets. This was done by substituting lower mobile market prices for local grocery story prices into each of the three market baskets and calculating the cost difference. To our knowledge, this is the first use of market basket analysis to assess the impacts of a nutrition program.

A market basket cost is no more than a price index. It measures the cost of a suite of hypothetical purchases, not the cost of consumers' actual purchases. How much mobile markets reduce actual costs depend on how closely the market baskets match actual expenditures. According to the Bureau of Labor Statistics' *Consumer Expenditures 2005* annual expenditures on food at home by households with four persons was equivalent to $93.19 per week. This is an average figure that does not account for the fact that lower income households spend less on food at home. For 1995, the TFP for a family of four with two children (of 2 and 3-5 years of age) was 100.80 (8% more than $93.19). For a family of four with two older children (of 6-8 and 9-11 years of age) the TFP was $100.80 (26% more than $93.19).

In addition, mobile market customers were surveyed to collect basic demographic information, information about their food shopping patterns, and information about how the mobile markets affected these food shopping patterns. In 2006, we conducted a pilot survey of mobile market customers and presented preliminary results of the market basket analyses to staff at the Tucson Community Food Bank as well as nutrition educators with Pima County Cooperative Extension and with the University of Arizona, College of Public Health.

The pilot survey results and responses nutrition educators and food bank staff raised a number of questions that were addressed in a 2007 follow-up survey. First, do trips to mobile markets save customers longer trips to grocery stores or are trips to mobile markets made *in*

addition to regular food shopping trips. If mobile markets save trips, customers would also be spending less on gasoline to drive to food stores.

Second, do mobile market customers make use of store discount cards? Our market basket studies of food item costs assumed that they did. The market basket study used the store discount card price as the lowest available price for given items. If mobile market customers do not use grocery store discount cards, however, it would mean that the market basket study would underestimate prices that people would actually pay for given items. A related question was whether or not mobile market customers clipped store coupons. We did not account for coupon savings in constructing market basket costs. So, to the extent that mobile market customers use coupons at regular grocery stores, we are overestimating prices they would actually pay at grocery stores.

Third, how heavily do mobile market customers rely on convenience stores to purchase basic food items such as milk, cereal, or orange juice? Prices at convenience stores are usually higher than at large supermarkets. So, relying on local supermarket costs may understate the costs of actual purchases of basic food items.

The main research questions addressed in the study are as follows.

- Using the Thrifty Food Plan as a metric, what is the cost and availability of basic food items around the study areas?
- What is the additional cost of purchasing the healthier market basket?
- How much could mobile market participation reduce the cost of purchasing the two market baskets?
- How do mobile market customers feel that the markets have changed their food shopping behavior?

Specific Research Questions

How does the cost of the TFP in the study area compare with the rest of the United States?

The U.S. Department of Agriculture's Thrifty Food Plan (TFP) is a market basket of items designed to meet basic nutritional requirements at minimal cost. The TFP lists items needed to provide one week (or two weeks) worth of meals and snacks for a family of four that fulfill basic nutritional requirements. Until recently, the TFP was based on the 1989 Recommended Dietary Allowances, the *1995 Dietary Guidelines for Americans*, the National Research Council's *Diet and Health* report, and recommendations from the USDA Food Guide Pyramid (Andrews, et al., 2001). USDA has revised the TFP based on new research, data, and analysis (Carlson et al, 2007). Average TFP costs are used to calculate food stamp benefits.

An advantage of using the TFP as a metric of food availability and cost is that it serves as a national standard. USDA reports monthly, national average TFP costs, making it possible to determine whether the cost of the TFP in a local area is above or below that national average. Also, because the TFP has a set number and quantity of items, it makes market basket studies more comparable across study areas. One disadvantage of the TFP is that it may not reflect actual purchases made by households. It is thus a price index, not a measure of consumer expenditures.

What is the extra cost of purchasing a healthier market basket?

The nutritional quality of basic food baskets like the TFP can be enhanced by substituting healthier items. Some examples would be substituting whole grain bread products for ones using white enriched flour, substituting canned fruits packed in juice for fruits packed in heavy syrup, or choosing lower-fat selections of meat or fish.

Whether healthier diets are indeed more expensive remains an open empirical question. Results from a number of European studies are mixed. Cade et al. (1999) compared data the U.K Women's Cohort Study. They found that women who most closely followed World Health Organization (WHO) dietary recommendations had higher dietary costs. Greater expenditures on fruits and vegetables were the main source of the cost difference. In a study of Danish children, Stender et al. (1993) found that a healthier diet increased dietary cost. They estimated that reducing energy from dietary fat from 35 percent to 25 percent energy from fat increased food costs 10-20 percent. In a study of French adults, Drewnowski et al. (2004) found that substituting more fruit and vegetables into diets were associated with higher food costs. In contrast, using a linear programming model to minimize food costs in Italy, Conforti and D'Amicis (2000) found that a healthier diet did not increase dietary costs.

Drewnowski and Barratt-Fornell reported in 2004, "Missing entirely from the literature on diets and health has been any mention of food prices and diet costs . . .there are virtually no U.S. studies on what it costs to eat a healthy diet (pp. 162). While a bit of an overstatement, the evidence from the United States on the costs of healthier diets is also limited and mixed.

Some interventions studies suggest that healthier diets are not more costly. Mitchell et al. (2000) found that dietary costs for young children on a low-fat diet were not greater. In an evaluation of a family-based obesity treatment program in New York State, Raynor et al. found, "Adopting a lower-energy, nutrition-dense diet did not increase dietary costs over time. Consequently, cost should not be a barrier in the adoption of a healthful diet. (p. 645)." In another U.S. study, Burney and Haughton examined the impacts of participation in the Expanded Food and Nutrition Education Program (EFNEP). They found that program participants were

able to reduce their family food expenditures $10-$20 per year while consuming more fruit, vegetables, bread, carbohydrate, iron, vitamin C, and fiber.

Yet, other studies suggest that healthier diets are more expensive. Putnam et al. (2002) reported that, based on 1999 supermarket scanner data, prices of breads and other baked goods were one-third higher for whole grain versions of the same item. Jetter and Cassady (2005; 2006) conducted market basket studies of stores in Sacramento and Los Angeles comparing the TFP with a healthier market basket. This healthier market basket had four times the dietary fiber and one fifth the fat of the TFP. They stated, "No research to date has examined the cost of healthier alternatives to the TFP (pp.39)." They estimated the cost of the healthier market basket ranged from 15-22 percent higher than the TFP, with an average price premium of 18 percent. Neault et al. (2005) conducted a similar exercise, substituting healthier items into the TFP and calculating market basket costs in Boston. They found that the healthier basket cost 23 percent more than the TFP.

The studies cited here vary in terms of whether they are looking at diets of children or adults, whether they are improvements over moderately healthy diets or more pronounced interventions to treat obesity, and whether they are comparing actual expenditures to market baskets (which are price indexes).

Are healthier items available at stores near the study area?

Jetter and Cassady (2005) found that when healthier items were unavailable, they were "usually in an independent store in a very low- or low-income neighborhood. (p. 2)" There has been a burgeoning social science literature and debate about the existence and policy implications of "food deserts" – low income areas where people do not have access to healthy food items (or to stores carrying those items). While an older literature examined whether the poor pay more for

food (see Kaufman et al. for a comprehensive survey), this newer literature focuses not only on prices, but also the availability of healthier items (Cummins et al., 2005; Furey et al., 2001; Guy and Gemma, 2004; Whelan, 2002; Wrigley, 2002a, 2002b; Wrigley et al. 2002, 2003). This study will examine whether there is a general lack of availability of more nutritious or healthy items available at local stores.

How much could Mobile Markets reduce the cost purchasing the TFP or the healthier basket? This question will be addressed directly by calculating the costs of purchasing the TFP and the healthier basket at local grocery stores in the study area, then calculating how much these purchase costs could be reduced by buying items at the mobile markets. The mobile markets do not carry all items in the three market baskets. For example, they do not sell fresh milk. This calculation looks at the potential cost savings of supplementing regular grocery store purchases with purchases from the mobile markets.

The Study Areas

The area of the New Pascua Yaqui Pueblo corresponds most closely to Census Tract 59 for Pima County, Arizona in the 2000 Decennial Census. The area of the Old Nogales Highway (ONH) Colonia corresponds to Census Tract 41.06.

Table 2 compares nativity, citizenship and languages spoken with averages for Pima County as a whole. Spanish is the most common language spoken at home in the Pascua Yaqui Pueblo, while nearly 44 percent of the population of the ONH Colonia speaks Spanish at home. In Pima County as a whole, nearly 23 percent of the population speaks Spanish at home. In the colonia, nearly 10 percent of the people are not citizens, slightly higher than the county average. Nearly all of the population in the pueblo was born in the United States.

Table 2. Nativity, citizenship, and language spoken at home

	Old Nogales Highway Colonia	Pascua Yaqui Pueblo	Pima County
	%	%	%
Born in United States	84.3	97.1	88.1
Foreign born, naturalized citizen	5.9	1.4	4.7
Foreign born, not a citizen	9.8	1.4	7.2
Speak only English	53.4	31.0	72.5
Spanish	43.8	64.0	22.8
Native North American languages	1.1	4.0	0.8

Source: 2000 Decennial Census

Median incomes in both study areas are substantially lower than for the county as a whole (Table 3). Median family income in the pueblo is less than half that of the county, while in the colonia it is 26 percent less than the county's. The difference in per capita income is more pronounced, with annual per capita income less than $6,000 in the pueblo. Median earnings for full-time workers are also lower than the county median. In the colonia, median earnings are greater for female than male workers. This differs from the pueblo and the county as a whole.

Table 3. Median income

	Old Nogales Highway Colonia	Pascua Yaqui Pueblo	Pima County
Median family income	$32,900	$21,293	$44,446
Per capita income	$10,033	$5,921	$19,785
Median earnings, Male full-time, year-round workers	$18,544	$21,439	$32,156
Median Earnings, Female full-time, year-round workers	$21,204	$18,715	$24,959

Source: 2000 Decennial Census

Table 4 considers housing characteristics as well as access to and use of vehicles. Over two thirds of the housing structures in the colonia are mobile homes. While lack of complete kitchen

facilities does not appear significant, there is a more significant share of the housing units without phone service, 6.5 percent in the colonia and 10.1 percent in the pueblo.

Given that the closest full-service grocery store is more than a five mile round trip from the pueblo and ten miles from the colonia and given that bus services is quite limited in the area, access to a vehicle is critical for food shopping. In the pueblo, about one in six housing units in the pueblo do not have an available vehicle and 44 percent have only one available vehicle. In the colonia only 4 percent of housing units are without a vehicle, while 32 percent have one available vehicle. More than 80 percent of workers drive to work from the pueblo, while over 94 percent drive to work from the colonia. For households with one vehicle this limits the availability of vehicles to go food shopping. Table 4 also shows a greater reliance on car pooling in the study areas than in the county as a whole.

Table 4. Housing and transportation

	Old Nogales Highway Colonia	Pascua Yaqui Pueblo	Pima County
	%	%	%
Mobile homes as a percent of all housing units	67.8	0.3	12.8
% of housing units lacking complete kitchen facilities	0	0.7	0.7
% of housing units with no telephone service	6.5	10.1	2.7
Vehicles available, none	4.1	16.8	9
Vehicles available, one	32	44	40.1
Percent of workers who commute by car, truck or van	94.5	80.6	88.5
Drove alone	71.8	61.4	73.8
Carpooled	22.6	19.2	14.7

Methods

Basic approach

First, in-person interviews of mobile market patrons at the Pascua Yaqui and Summit View sites were conducted. Basic information was collected for patron attitudes about the mobile market

and about their regular food shopping patterns. Interviews were carried out in either English or Spanish. From these interviews, we obtained a list of the grocery stores where mobile market patrons regularly shopped. Not surprisingly these matched the closest full-service grocery to their neighborhoods.

Next, these stores were surveyed to calculate the cost of purchasing the Thrifty Food Plan (TFP) and the healthier market basket (patterned after Jetter and Cassady). Stores and mobile markets were surveyed in the same week to account for seasonal volatility in food prices. The costs of the two base market baskets (TFP and healthier) were calculated first. Next, we substituted prices of items that were (a) available at the mobile market in that week and (b) at a lower price than at the chosen stores. This measures the maximum potential reduction in the cost of the market basket through substituting mobile market purchases for regular store purchases.

Store selection

Stores were chosen based on survey responses. The market basket surveys were confined to large supermarkets. Although many convenience stores are located closer to the neighborhoods surrounding the mobile market sites, respondents named large stores as the primary place they shopped. The closest store to the Pascua Yaqui mobile market was 2.7 miles away and the next closes, 4.25 miles away. The closest store to the Summit View mobile market was 5.01 miles away and the next closest, 5.61 miles away.

Market survey design and data collection

The TFP used for this study is based on the 1999 revisions of the market baskets and accompanying shopping lists of specific items in specific quantities (Andrews et al.; Cohen; Lino; Hogbin and Lino). We began collecting market basket cost data in January 2006. The USDA has subsequently revised the TFP (Carlson et al, 2007) and began reporting costs based

on the new version in March 2007. USDA has yet, however, to publish shopping lists based on the new TFP. For this reason and also to maintain consistency with our initial surveys and comparability with other studies, we have continued to use the shopping lists from the older version of the TFP.

Items used to calculate the TFP come from the version of the TFP are published in Appendix A of the *USDA Community Food Security Assessment Toolkit* (Cohen, 2002). This is a one-week version of the TFP for a family of four with two small children. This represents food consumed in the second week of a three-week meal plan (see Hogbin and Lino). This particular market basket was also used by Andrews et al. to study food costs and availability in Washington, DC.

The list of items is in Box 3-C, Appendix C: Food Store Survey Instrument and Materials of the report: http://www.ers.usda.gov/publications/efan02013/efan02013appc.pdf.

After conducting a pilot survey, we made two changes to the survey published in the *Toolkit*. First, we rearranged the survey template to group items based on how they are found in the store, rather than by food group (as in the *Toolkit*). For example, frozen fish and frozen vegetables were grouped together with items found in the freezer section of stores, rather than grouping frozen and fresh vegetables together and grouping frozen fish with fresh fish and meats. Second, imitation vanilla was substituted for real vanilla in the TFP and Healthier market baskets because real vanilla was significantly more expensive.

The healthier market basket, patterned after Jetter and Cassady's study (2005; 2006), was constructed by substituting healthier variants of items into the standard TFP. For example, whole grain bread is substituted for enriched white bread and (lower fat) skinless chicken is substituted for chicken with skin. Jetter and Cassady (2006) note, "By making the described substitutions,

the healthier market basket has four times the amount of fiber and one fifth the grams of total fat than the TFP market basket (p. 39)."

Table 5. Substitutions made to Thrifty Food Plan to construct Healthier basket

Thrifty Food Plan	*Healthier Substitute*
Enriched White Bread	100% Whole Grain Bread
Canned Peaches (heavy syrup)	Canned Peaches (light syrup or juice)
Canned Mandarin Oranges (light syrup)	Canned Mandarin Oranges (in juice)
Cottage Cheese	Cottage Cheese (low fat)
Chicken (with skin)	Chicken (skinless)
Vegetable oil	Canola oil
Corn flakes	Bran flakes
Whole egg noodles	Yokeless egg noodles
White flour	Whole wheat flour
Frozen French fries	Potatoes
Frozen fish (breaded)	Frozen fish (unbreaded)
Ground beef	Ground beef (<10% fat)
Tuna, chunk style (in water)	Tuna, albacore (in water)
Cheddar cheese	Cheddar cheese (low fat)
Mozzarella cheese	Mozzarella cheese (low fat)
Evaporated milk	Evaporated milk (low fat)
1% and whole milk	1% and nonfat milk
White rice	Brown rice
Mayonnaise	Mayonnaise (low or no fat)
Enriched spaghetti	Whole wheat spaghetti
Margarine	"Healthy" spread
Bagels	Whole wheat bagels
Hamburger buns	High fiber hamburger buns
Chicken broth	Chicken broth (low sodium)
Soy sauce	Soy sauce (reduced sodium)
Chocolate drink mix, powdered	Chocolate drink mix, powdered (reduced sugar)

Table 5 shows the items substituted to create our Healthier market basket. For whole wheat breads, care was taken to select breads that actually had higher fiber content than white bread. Stores carry a number of "brown" breads with little or no extra fiber than white bread.

We note here some differences between our market baskets and the ones used by Jetter and Cassady. First, we used a one-week market basket based on the second week of shopping from Hogbin and Lino, while Jetter and Cassidy used a two–week basket based on the first and second week of shopping from Hogbin and Lino. So, their market baskets include more items. Second, in our healthier basket, we included low sodium versions of soy sauce and chicken broth in our market basket as well as reduced sugar chocolate drink mix.

The lowest price available per unit for each item was recorded in the survey. When store membership discounts were available, these were included. Also in-store sales prices on the day of the survey were included. Discounts from coupons were not included. The quantity or sizes of items were chosen to match those of the TFP in the USDA *Toolkit.* Item sizes were matched to those in the base market baskets even if there were discounts for bulk purchases. If an item was missing in a store, following convention of previous market basket studies, average prices from other stores were used as substitutes (Andrews et al., Kaufman et al.). Also, it was recorded which items were unavailable in particular stores.

Prices from the mobile markets were taken in the same week as for grocery stores. Item prices were converted to the same units as the store market baskets. For example, if the TFP included a 15.25 ounce can of fruit, while the mobile market had the same item in a 16 ounce can. The base mobile market price was multiplied by 15.25/16. For the calculation of the impact of mobile market substitution on the cost of the three market baskets, surveys were conducted in late winter and late spring.

Our very small sample size precluded a number of possible statistical tests of the data. However, some of the differences in prices were large enough to be statistically significant using paired tests, even with few degrees of freedom.

Results

Characteristics of mobile market survey respondents

At the Pascua Yaqui market 71 percent of respondents were 55 years old or older (Table 6). This is not surprising considering the market operates just outside the tribal senior center. The mobile market at Summit View Elementary school targets families with younger children and 53 percent were younger than 45. Median household size at both sites was 4, with a median of 2 children. One quarter of respondents at Summit View used food assistance programs (such as food stamps or WIC) to purchase food, while one third of Pascua Yaqui respondents used food assistance programs.

Table 6. Age distribution of mobile market survey respondents

Age	Pascua Yaqui	Summit View	Total Sample
Number of Observations	32	21	53
< 25	0%	3%	2%
25-34	10%	19%	15%
35-44	14%	31%	25%
45-54	5%	16%	11%
55-64	38%	25%	30%
>64	33%	6%	17%

Only 28% of respondents (72 percent) worked for pay outside the home, while 34% reported themselves as housewives or homemakers, while 23 percent reported themselves retired. The markets operate on alternating Tuesdays from 9:00 a.m. to 1 p.m., which would be a constraint for potential patrons with full time jobs.

Table 7. Occupations of mobile market survey respondents		
Occupation	Number	Percent
Working for pay outside home	15	28
Housewife / Homemaker	18	34
Retired	12	23
Disabled	4	8
Unemployed	3	6
Other	1	2

Travel time to stores

Seventy four (74) percent of mobile market patrons surveyed said that their travel time to the mobile market was less than 10 minutes, while 13 percent of patrons said that they traveled less than 10 minutes to their local grocery store (Figure 1). Travel time to the mobile market was less than 20 minutes for 87 percent of mobile market respondents. In contrast, 28 percent said that average one-way travel time to grocery stores was 21-30 minutes and 11 percent said that average travel time was >30 minutes.

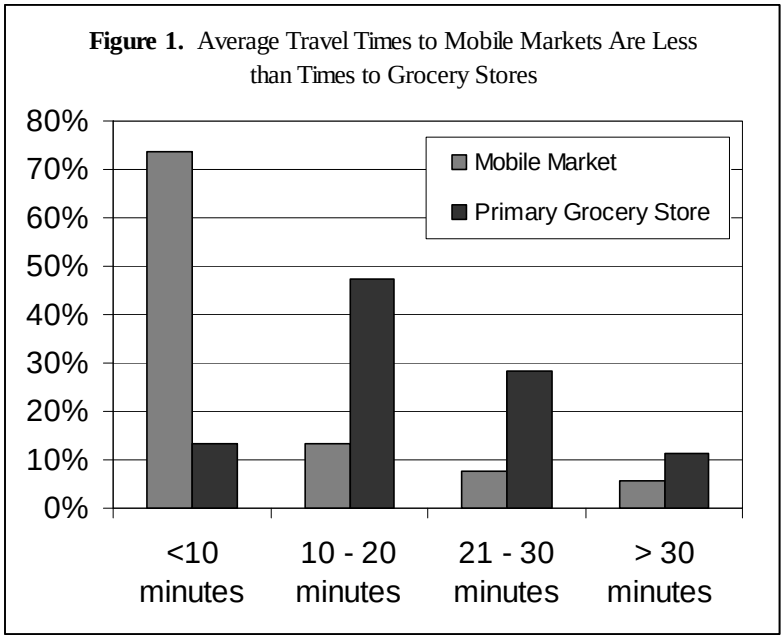

Figure 1. Average Travel Times to Mobile Markets Are Less than Times to Grocery Stores

Mobile market patrons were also asked whether – as a result of mobile market purchases – they (a) made fewer trips to the grocery store each month or (b) made the same number of grocery store trips, but came to the mobile market too. This question was asked to determine how much additional cost savings mobile markets could provide in the form of lower monthly costs of gasoline consumption for driving to grocery stores. Of 53 respondents, 48 answered this question. Of those answering, a third, (16 of 48) answered that mobile market participation reduced their number of monthly trips to the grocery store. Table 8 compares travel times to the mobile market and the primary grocery store of this subset of respondents.

Table 8. Comparative Travel Time to Mobile Markets and Grocery Stores of Respondents Who Said that They Travel to the Grocery Store Less Often as a Result of Mobile Market Participation

	Travel times to primary grocery store			
Travel times to Mobile Market	<10 minutes	10-20 minutes	21-30 minutes	> 30 minutes
<10 minutes		8	6	
10-20 minutes				
21-30 minutes			1	1

Table 8 suggests that some mobile market participants are able to substitute mobile market shopping for longer trips to the grocery store. For four mobile market patrons, these travel times are walking times, while the travel times to the grocery store are all driving times.

Mobile market expenditures

Survey respondents were asked about their average expenditures per mobile market visit. Averaging over all responses, this came to $8.14 per visit. This $8.14 figure is consistent with mobile market sales log data, which records total sales (including food stamp sales) and number of customers. It is also similar to pilot survey responses from 2006 that averaged $8.03 per visit.

According to *Consumer Expenditures, 2005* published by the Bureau of Labor Statistics, average annual expenditures on food at home consumer unit were $1,980 for the lowest quintile of income (poorest 20%). This amounts to $38.08 per week. For the second lowest quintile, average annual expenditures for food at home were $2,659, or $48.60 per week. So, expenditures of $8.14 per customer unit at the mobile market are equivalent to about 21 percent of weekly expenditures on food at home by the poorest quintile of the U.S. population and about 16 percent for the next poorest quintile. Mobile markets visit sites twice a month, so (adjusting for inflation) average mobile market expenditures are equivalent to about 10 percent of the national average of monthly expenditures on food at home by the poorest 20 percent of customer units.

Respondents were also asked if they agreed with the statement that as a result of mobile market participation they (a) ate more fruits and vegetables, (b) ate less fast food, or (c) spent less money on food (Table 9).

Table 9. Mobile Market Customer Perceived Impacts of Participation

	Perceived Impacts of Mobile Market Participation		
	Eat More Fruits and Vegetables	Eat Less Fast Food	Spend Less on Food
Strongly Agree	3%	5%	37%
Somewhat Agree	53%	28%	51%
Don't Know / Not Sure	28%	62%	12%
Somewhat Disagree	15%	3%	0%
Strongly Disagree	3%	3%	0%

Mobile market customers were more likely to strongly agree with the statement that the markets saved them money on food than to strongly agree that it changed their eating behavior (either eating more fruits and vegetables or eating less fast food). According to the Community Food Bank, their mobile market prices are 30-70 percent less than local Tucson grocery stores.

Surveys conducted in 2006 comparing items actually sold at the Pascua Yaqui mobile market with the prices at nearby stores bore out this claim.

Use of discount cards and coupons

Mobile market customers were asked whether they used supermarket discount cards and if not why not. Respondents were offered choices of

- Store doesn't offer discount cards
- Didn't know about them
- Knew about them, but not how to sign up
- Doesn't think savings are that great
- Doesn't want to give out information to stores
- Doesn't shop often enough
- Use card of friend or family member
- Other (please explain).

In 100 percent of the cases where respondents said they didn't use discount cards, the reason given was that the particular store did not offer the cards. These responses were cross-checked against stores they shopped at. In every case, it was a store that did not offer cards. No respondent checked any of the other options.

It appears that lack of use of discount cards is <u>not</u> a source of increased food costs in the study area. In contrast, nearly 38 percent (20 of 53) respondents said that they clipped coupons. For this group, posted grocery store prices do not reflect savings from coupons.

Convenience store shopping

Reliance on convenience stores is greatest for fresh milk, with 15 percent of respondents said that they purchased milk at least once a week at a convenience store. Another 11% said they

purchased bread at least once per week, and 6% said they purchased orange juice at least once per week at a convenience store. The mobile markets do not supply fresh milk, but they do provide frozen orange juice and bread, albeit twice a month.

How does the cost of purchasing the Thrifty Food Plan in the study area compare with the rest of the United States?

Six stores frequented by mobile market customers were surveyed in 2006 and again in 2007. In 2006, the cost of purchasing the TFP in the study area averaged 12 percent less than the national average. The national average was an average between January and May TFPs, corresponding to the months study area stores were surveyed. Beginning in March 2007 USDA began publishing TFP costs based on its revised series (Carlson, et al.) (Figure 2).

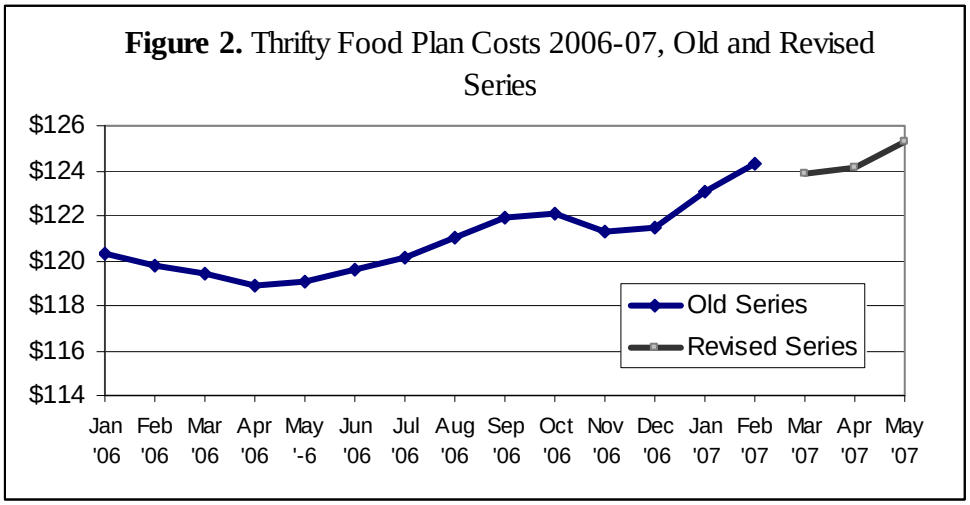

Figure 2. Thrifty Food Plan Costs 2006-07, Old and Revised Series

While the old and new series do not appear to diverge greatly, they are not exactly comparable. Comparisons of the TFP from the study area using the old series for April-May 2007 and the national TFP average over April-May 2007 using the new series must be treated with some caution. An April-May average was used because stores were surveyed in the last week of April and the first week of May. In both 2006 and 2007, however, the TFP in the study area appears to be lower on average than the national average (Table 10).

Table 10. Comparison of TFP Costs in the Study Area with the National Average

	2006	2007
Study Area	$105.25	$115.18
National Average	$ 119.70	$ 124.70

The store prices in the study area included discounts for in-store sales at the time of the survey and discounts from use of supermarket chain discount cards. Store prices do not include coupon discounts. Most store prices in the study area were lower than the national average. At the store closest to the Pascua Yaqui Pueblo, however the TFP cost was 8 percent higher than the national average in 2006 and 11 percent higher in 2007. Somewhat surprising (at least to us) was the large difference in prices between stores. In each year, prices at the highest price store were more than 33% higher than at the lowest price store.

What is the extra cost of purchasing a healthier market basket?

For all six stores in both years, the Healthier market basket was more expensive than the TFP (Table 11). Even with a small sample size, the difference was significant at the 0.1-percent level using a Wilcoxon sign rank test. Because of the small sample size, a non-parametric test is more appropriate than a paired t-test. The cost difference averaged over 2006 and 2007 was $13.37 for an average price premium of 12 percent.

Table 11. Average cost of Thrifty Food Plan and healthier market basket

	2006	2007	Both Years
TFP	$105.25	$115.18	$110.22
Healthier Basket	$115.58	$131.58	$123.58
Cost Difference	$10.33	$16.40	$13.37
Percent Difference	10%	14%	12%

This is lower than the 18 percent average premium reported Jetter and Cassady (2005; 2006) found for Sacramento and Los Angeles or the 23 percent premium Neault et al. (2005) for Boston. Again, there is a considerable cost difference across stores, with the healthier basket cost at the highest price store costing about 40 percent more than at the lowest price store.

Table 12. Items unavailable in stores at time of survey

Item	Total Number of Times Missing
Whole wheat bagels	6
Hamburger buns, high fiber	5
Whole wheat spaghetti	5
Mozzarella cheese, low fat	5
Cheddar cheese, low fat	4
Whole wheat flour	3
Ground turkey	3
Lean ground turkey	3
Ground beef < 10% fat	2
Vegetarian baked beans	2
Mandarin oranges in juice	2
Low sodium chicken broth	2
Yolk free noodles	2
Fish, unbreaded frozen filets	1
Peaches in juice	1
French bread	1

Are healthier items available at stores near the study area?

Table 12 lists items that were not available at one or more stores at the time of the surveys. Whole grain items and low fat cheese were more likely to be unavailable. Jetter and Cassady (2005; 2006) also found that whole grain items were more likely to be unavailable in their survey of California stores.

In most cases, basic versions of an item were available, while the healthier item was not. For example, bagels would be available, but not whole wheat bagels, spaghetti would be available, but not whole wheat spaghetti. One exception to this was ground turkey, where both regular and lean versions were unavailable in the same stores.

How much could Mobile Market purchases reduce the cost of the TFP or healthier basket?

Table 13 shows the reduction in the cost of purchasing the two market baskets by substituting mobile market purchases, wherever possible, for regular grocery store purchases. Not all items in the TFP or healthier basket are sold at the mobile markets and mobile market prices for every item are not always cheaper than local store prices, even though average mobile market prices are considerably lower than store prices. Mobile market prices were substituted into the other market baskets only when they were lower. This provides an upper-bound estimate of the potential for mobile market purchases to reduce the cost of purchasing a given market basket.

Table 13. Potential cost savings by substituting mobile market purchases in market baskets

	2006	2007	Both Years
Baseline cost savings			
Cost savings with mobile market substitution ($)			
TFP	$9.42	$14.48	$11.95
Healthier	$6.62	$12.50	$9.56
Cost savings with mobile market substitution (%)			
TFP	9.5%	12.3%	11.2%
Healthier	6.1%	9.4%	8.0%

Substituting mobile market purchases for regular grocery store purchases reduces the cost of buying the TFP by an average of $11.95 (11.2 percent) and reduces the cost of the healthier basket $9.56 (8 percent).

Why does mobile market substitution have less of an impact on the healthier market basket? The reason is that the mobile markets carry more items that are in the TFP than items that are in the other two baskets. For example, the TFP has canned fruit in heavy syrup, while the healthier basket has canned fruit in up or juice. If the mobile market only carried fruit in heavy syrup in the reference period, it would reduce the cost of the TFP, but not the healthier basket.

The difference between the base market basket costs and the costs with mobile market substitution were significantly different, even with a sample size of only 12 observations. Paired Wilcoxon sign rank tests were used to test the null hypothesis that mobile market substitution does not reduce the average cost of a market basket. This hypothesis was rejected at the 0.1-percent level for both market baskets.

Discussion

In the study area, items sold mobile markets offer significant discounts over regular grocery store prices. By participating in mobile markets, a family of four could reduce the cost of purchasing the Thrifty Food Plan an average of 11 percent. The cost of purchasing an alternative, healthier market basket could be reduced 8 percent. Many items sold at the mobile markets were not part of either the TFP or the healthier basket. Looking at actual purchases rather than hypothetical market baskets, the price discounts are larger. If all the items sold at two mobile markets at the Pascua Yaqui Pueblo in May 2006 were purchased at local grocery stores, they would have cost 47 to 85 percent more. On average, the community saved 61 cents for every dollar spent at the mobile markets.

The absolute dollar gains to mobile market participation are limited by low total sales volumes. Gross sales per mobile market visit are typically less than $160. So, even though percentage savings are large, the absolute dollar savings are limited. In May 2006, sales at Pascua Yaqui

averaged $125 per mobile market visit, with total cost savings to the community ranging from $54-$99 per visit. Direct wage costs of mobile markets were roughly $135 per visit. Other expenses (materials, employee benefits, gasoline) would add to costs per visit. These are primarily costs *per visit* rather than costs per item sold, so the cost effectiveness of the program can be greatly improved by increasing per visit sales volumes.

Conclusions

This article reports on a study that uses simple market basket analysis to examine several aspects of the local "food environment" in low income areas on the outskirts of Tucson, Arizona. First, we examined basic food costs and developed estimates of the availability of healthier food items. Next, we used market baskets to examine the scope for a new food program – mobile markets – to improve the availability and reduce the costs of food purchases. Although findings are preliminary, results suggest that cost-effectiveness of the program can be enhanced by providing more, healthier items (especially whole grain breads) and increasing sales volume per visit. In closing, we emphasize that this study is the first to our knowledge to demonstrate the potential for market basket studies to be used in food program evaluation. Further, analysis can be carried out using a simple spreadsheet program.

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