

The Relation of Farmers' Market Nutrition Program Coupon Use with  
Accessibility and WIC CVV Redemption Rates at Farmers' Markets

by

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## ABSTRACT

Fruit and vegetable intake is not uniform across levels of socioeconomic status (SES) and researchers have identified low SES as a risk factor for poor intake of fruits and vegetables. In an effort to eliminate public health disparities and increase fruit and vegetable intake, the Women, Infant, and Children (WIC) program implemented additional food assistance programs, with a specific emphasis on fresh fruits and vegetables. The Farmers' Market Nutrition Program (FMNP) provides pre-existing WIC clients with coupons to purchase fresh, locally grown produce at farmers' markets. In addition, Congress also approved the WIC Cash Value Voucher (CVV) program, which provides WIC participants with vouchers to purchase fresh fruits and vegetables at farmers' markets or grocery stores. The purpose of this thesis was to investigate the relation of FMNP coupon use with accessibility and WIC CVV redemption rates at farmers' markets. Furthermore, this thesis addressed whether WIC shoppers redeemed a higher percentage of their WIC CVV value at farmers' markets or grocery stores. WIC CVV and FMNP issuance and redemption data were analyzed to establish overall redemption rates and total percent of WIC CVV value redeemed. Accessibility was assessed using the Geographic Information System, which allowed me to calculate the distance that WIC participants would have to travel to redeem their FMNP coupons at FMNP-approved farmers' markets. The results showed that less than 1% of WIC shoppers redeem their WIC CVVs at farmers'

markets in Arizona. However, the redemption of WIC CVV was significantly higher during the months when shoppers had the option of using both WIC CVV and FMNP coupons at farmers' markets. Furthermore, the percent of total CVV value redeemed at farmers' markets was 99%, significantly higher than grocery stores (93.5%). Average FMNP coupon redemption rates for 2008-2010 was 43.3%, well below the national average of 59%. However, my spatial analysis revealed that there was no significant association between the distance traveled to farmers' markets and FMNP redemption rates. This indicates that the distance traveled to farmers' markets is not a major barrier to redemption of FMNP coupons in Arizona.

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## Chapter 1

### INTRODUCTION

#### *Background*

Cardiovascular disease and cancer constitute the major causes of death in the United States each year (CDC, 2007). To an extent, both are preventable diseases, and fruit and vegetable consumption has been associated with a decreased risk for these chronic diseases through a number of potential mechanisms (Hung et al., 2004; Joshipura, 1999). Increased intake of fruits and vegetables is related to improved glucose control (Ford et al., 2005; Montonen et al., 2005; Sargeant et al., 2001) and weight management (Rolls et al., 2004; Vioque et al., 2008). Fruits and vegetables are rich in essential micronutrients like vitamins A, C and E, which have anti-oxidant properties that can decrease oxidative stress and prevent DNA damage by quenching potent free radicals in the body (Briviba et al., 2007; Dereulle & Baron, 2008; Song et al., 2010). Dietary fiber, which is present in most fruits and vegetables, has also been linked to a decreased risk of coronary heart disease (Rimm et al., 1996; Wolk et al., 1999). The mechanism for this reduction in risk could be linked to the improvements in endothelial function following a high-fiber meal (Brock et al., 2006).

Fruit and vegetable intake is not uniform across levels of socioeconomic status (SES), however, and researchers have identified low SES as a risk factor for poor intake of these whole foods (Blisard et al., 2004; Kamphuis et al., 2006; Kennedy et al., 1999). In part, this inverse association led to the creation of

federal health initiatives to improve fruit and vegetable consumption, especially among low SES populations. For instance, as part of the Special Supplemental Program for Women, Infants and Children (WIC), Congress established the supplementary Farmers' Market Nutrition Program (FMNP) in an effort to provide fresh, locally grown fruits and vegetables to WIC recipients and, simultaneously, to increase awareness and use of farmers' markets (USDA FMNP, 2010). Through this program, WIC participants can purchase fruits and vegetables at farmers' markets using special FMNP coupons. In addition, the WIC program recently changed the composition of its food packages to include fresh fruits and vegetables (WIC Interim Rule, 2010). This entitled women who were eligible for WIC to purchase fruits and vegetables at grocery stores or state-authorized farmers' markets using WIC cash value vouchers (CVV). WIC users now have the option of spending WIC CVV or FMNP coupons to purchase fruits and vegetables at farmers' markets.

Current research indicates that supplemental WIC purchasing tools, such as CVV or coupons received through FMNP may be effective in increasing consumption of fruits and vegetables among WIC-eligible women (Anderson et al., 2001; Herman et al., 2008; Kropf et al., 2007; National Association FMNP, 2002). However, FMNP redemption rates remain low nationally; in 2006, only 59% of coupons were redeemed across participating states in the U.S. (Federal Register FMNP, 2008). To date, only a small number of studies have explored potential barriers to use of farmers' markets among WIC participants, including

issues related to price, accessibility and basic knowledge of the program (Colasanti et al. 2010; Grace et al. 2007; Racine et al, 2010).

### *Statement of the Problem*

Although redemption rates of CVV or FMNP coupons are not a direct indicator of WIC participants' consumption of fruits and vegetables, they provide information about the number of WIC families that might be benefiting from the program (Grace et al., 2007, Herman et al., 2008). As such, exploration of redemption rates can offer insight regarding the extent to which WIC participants access farmers' markets as a source of fruits and vegetables in the first place. Also, because no research has been published on use of CVV or FMNP benefits in Arizona in particular, more in-depth quantitative research is needed to assess use of these purchasing tools at farmers' markets as well as basic exploration of potential barriers to use in this locale.

### *Current Research Deficiencies*

Farmers' markets have the ability to improve access to, and utilization of, fresh fruits and vegetables by low-income individuals who are eligible for WIC (Holben, 2010). The current body of literature suggests that proximity to farmers' markets in particular influences the redemption rates of FMNP coupons (Brown, 2002; Grace et al., 2007; Herman et al., 2006; Holben, 2010; Racine et al., 2010). To the author's knowledge, no previous studies have investigated this issue in Arizona, nor has research been conducted to characterize the extent of usage of CVV in combination with FMNP coupons, as both may be used simultaneously at

farmers' markets. Although one previous study explored redemption rates and total usage of supplemental WIC coupons at farmers' markets compared to stores (Herman et al., 2006); this study issued both farmers' market specific and supermarket specific coupons. As such, consumer choice was restricted as each coupon type could only be redeemed at the respective locations.

### *Purpose*

The primary objective of this study will be to compare use of CVV at farmers' markets versus stores throughout the year, with and without the influence of FMNP coupons. This analysis will consider whether or not the introduction of FMNP coupons at certain times of the year influences WIC CVV redemption rates at farmers' markets in Arizona. A secondary objective will be to compare the total values of CVV redeemed at stores versus markets in Arizona. The third objective will be to quantitatively assess the relation between FMNP redemption rates and distance between the issuing clinic and nearest farmers' market.

### *Hypotheses*

The following hypotheses will be tested:

1. Introduction of FMNP coupons at WIC clinics will increase redemption of WIC CVV at farmers' markets.
2. Redemption of WIC CVV, as a percentage of the CVV's total value, will be significantly higher at farmers' markets than at grocery stores.
3. Distance to the nearest farmers' market from WIC clinics will be inversely related to redemption rates of WIC FMNP coupons issued at those clinics.

### *Definitions*

1. Chronic disease: A disease that is long-lasting or recurrent, usually applies to a condition that lasts longer than three months.
2. Socioeconomic status (SES): An individual's economic and social position relative to others based on income, education and occupation.
3. Farmers' market: A market which is usually in a fixed location that sells agricultural products like fresh fruits and vegetables.
4. Farmers' Market Nutrition Program (FMNP): A supplementary program of WIC that provides low income, at risk individuals with additional opportunities to access fruits and vegetables via FMNP coupons.
5. Special Supplemental Program for Women, Infants and Children (WIC): A supplemental nutrition program that provides supplemental foods, health care and nutrition education to low-income pregnant, breastfeeding and non-breastfeeding post-partum women, and to infants and children up to the age of 5 who are considered to be at nutritional risk.
6. Pre/post-test intervention questionnaire: An assessment method that uses a questionnaire before and after an intervention to measure the degree of change.
7. Proximity: The shortest driving distance between farmers' markets and WIC clinic locations when traveling along current Arizona road networks.
8. Maximum dollar redemption: The maximum dollar amount that is allowed to spent for a particular WIC cash value voucher
9. Post-partum: Birth through six months of age.

### *Delimitations*

The study included pregnant, breastfeeding and non-breastfeeding, post-partum women, as well as children up to the age of 5 who participate in Arizona WIC. Therefore the results may not be applicable to the rest of the U.S. WIC population and may not be applicable to the population as a whole. Navajo Nation and Inter Tribal Council WIC participants were excluded from analyses because these particular WIC agencies do not issue WIC CVV.

### *Limitations*

A correlational study design does not allow us to make causal inferences about the relationship between proximity and redemption rates. Also, redemption rates for Arizona WIC and FMNP purchasing tools were considered in aggregate and their usage cannot be traced back to individuals. As such, potential confounders such as age, sex, ethnicity, income, education levels, were not considered. The relationship between distance and redemption rates is based on the distance between participating WIC clinics and the nearest farmer's market, not on actual redemption rates at specific farmer's markets. Finally, other potential confounders including variable prices of fruits and vegetables, participant knowledge of farmers' markets, or extent of promotion of farmers' markets at WIC clinics also were not considered in the study design.

## Chapter 2

### REVIEW OF LITERATURE

#### *Fruits and Vegetables & Chronic Disease Risk*

Cardiovascular disease and cancer constitute the major causes of death in the United States each year (CDC, 2007). Fruit and vegetable consumption has been associated with decreased risk for these chronic diseases as well as with improved glucose control and weight management (Ford & Mokdad, 2005; Rolls et al., 2004; Vioque et al., 2008). Fruits and vegetables are rich in essential micronutrients like vitamin A, C and E, which have anti-oxidant properties that can decrease oxidative stress and prevent DNA damage by quenching potent free radicals in the body (Briviba et al., 2007; Dereulle & Baron, 2008; Song et al., 2010). Dietary fiber, which is present in most fruits and vegetables, has also been linked to a decreased risk of cardiovascular disease (Rimm et al., 1996; Wolk et al., 1999). The mechanism believed to be responsible for this reduction in risk could be linked to the improvements in endothelial function following a high-fiber meal (Brock et al., 2006). Also numerous research studies have linked deficiencies in certain micronutrients to birth defects in babies and increased chronic disease risk for malnourished infants later on in life (Super et al., 1991; Painter et al., 2006).

#### *Primordial Prevention*

Maternal nutrition plays a pivotal role in fetal growth and development (Wu et al., 2004). Malnutrition during pregnancy can cause a baby to be born with



low-birth weight or intrauterine growth retardation. Low-birth weight is classified as any baby born with a birth weight of less than 2,500 grams (5.5 lbs) (WHO, 2008). The odds of a child who is born with low-birth weight dieing of cardiovascular disease (CVD) during his/her life has been found to be 2-3 times higher than a baby that is born with normal birth weight (Eriksson et al., 2001). Low birth weight has been associated with the physiological precursors for CVD like elevated serum cholesterol (Barker et al., 1993), atherosclerosis (Martyn et al., 1998), fibrinogen and blood pressure (Rich-Edwards et al., 1997). Furthermore, observations from autopsies in the Bogalusa Heart Study and the Pathological Determinants of Atherosclerosis in youth study found a strong correlation between coronary atherosclerosis and cardiovascular risk factors in young people (Berenson et al., 1998). Researchers found fibrous-plaque lesions in the aorta and coronary arteries of children as young as two years old and were able to positively link levels of plaque with CVD risk factors like elevated cholesterol, blood pressure and triglycerides in young adults. Primordial prevention in the form of adequate nutrition during pregnancy and early infancy has the potential to potentially lower the incidence of chronic disease risk.

#### *The Farmers' Market Nutrition Program*

Researchers have identified low socioeconomic status (SES) as a major risk factor for poor intake of fruits and vegetables (Blisard et al., 2004; Kamphuis et al., 2006; Kant, 2004; Kennedy et al., 1999). This inverse relationship has created many federal, health initiatives to improve fruit and vegetable

consumption, especially among low SES populations. Congress consequently established the Farmers' Market Nutrition Program (FMNP) in an effort to provide fresh, locally grown fruits and vegetables to pre-existing Woman, Infant and Children (WIC) recipients, and simultaneously created awareness and use of farmers' markets (Herman et al., 2008). The WIC program is a special supplemental nutrition program that provides supplemental foods, health care and nutrition education to low-income pregnant, breastfeeding and non-breastfeeding post-partum women, and to infants and children up to the age of 5 who are considered to be at nutritional risk (USDA WIC, 2010). As an extension of the WIC program, FMNP attempts to provide these low-income, at-risk individuals with additional opportunities to access fresh fruits and vegetables.

FMNP is currently operating in 45 states and any women, infant or child that have been certified to receive WIC are eligible to participate (USDA FMNP, 2010). However, there is usually a limit to the amount of people that receive FMNP benefits. In 2009, only 2.2 million WIC participants received these FMNP benefits. A small minority when one considers that the WIC program served approximately 9 million individuals each month in 2009. The Food and Nutrition Services (FNS) provide cash grants to state agencies such as health departments or Indian Tribal Organizations, who then issue FMNP coupons to eligible WIC participants in addition to their regular WIC benefits. Each individual receives \$10 to \$30 per year in FMNP coupons to spend on fruits and vegetables at farmers' markets.

### *WIC Cash Value Voucher Program*

In December 2007, the WIC program changed its rules to include fresh fruits and vegetables in their food packages (WIC Interim Rule, 2008). The revisions aligned with the recommendations made by the Institute of Medicine (IOM) of the National Academies in its report, “WIC food packages: Time for a Change,” which called for more diverse fruits and vegetables and whole grains in the WIC food packages. On October 1<sup>st</sup>, 2009 the federal register implemented the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) that entitled women who were eligible for WIC to purchase fruits and vegetables at grocery stores or state-authorized farmers’ markets using WIC cash value vouchers (CVV). According to the Community Food Security Coalition, seven states (Arizona, California, New Jersey, New York, Ohio, Oklahoma and South Carolina) were piloting or implementing the WIC CVV use at farmers’ markets in 2009 (Food Security Coalition, 2010). A further 11 states (Connecticut, Georgia, Iowa, Maryland, Maine, Massachusetts, Montana, Oregon, Rhode Island, Texas and Washington, as well as the District of Columbia) were implementing or piloting the program the following year in 2010. The value of cash value vouchers for purchasing fruits and vegetables was also increased to \$10 from the previous \$8 on December 31, 2009. The inclusion of new foods in the WIC food list varies by state because state agencies are not required to include all of the foods that are WIC-eligible (WIC Food Package Regulations, 2010). Also, the state agencies must offer WIC-eligible fresh fruits and vegetables but have the option of

including canned and frozen fruits and vegetables, especially during times of the year when fresh fruits and vegetables may be limited or unavailable.

The new regulations allow WIC participants more access to fresh fruits and vegetables and supports local farmers and agriculture. The objective of this review is to assess the current literature in order to identify the effectiveness of WIC CVV and FMNP coupons in increasing fruit and vegetable consumption among the low-income population of women in the US. It will also allow us to identify certain areas of the research that may be deficient and help generate hypotheses to fuel further research.

#### *Sustainability & Food Quality at Farmers' Markets*

WIC CVV and FMNP do not only benefit low-income populations but also the local farmers at farmers' markets. A farmers' market is a retail outlet which is usually in a fixed location that sells agricultural products like fresh fruits and vegetables. Most of these farmers' markets are seasonal, open for 6 months of the year and only open for a few hours on certain days of the week. The benefit for farmers directly selling their produce at a farmers' market is that they avoid the middle-man and are able to get considerably more return on investment for their items. The USDA estimates that farmers usually receive 19 to 20 cents on the dollar spent at grocery stores versus full redemption at farmers' markets (Nestle, 2002). Just and Weninger (1997) found that WIC FMNP results in a net economic gain and a farmers gain of about 7-9% more than the actual coupon

redemption value (Just & Weninger, 1997). However, the benefits seem to extend beyond dollar amounts when one considers the impact the farmers' markets have on promoting sustainability and local agriculture in most states (Markowitz, 2010). Fresh produce at farmers' market also has the potential to be fresher, superior and more nutritious than those sold at grocery stores due to shorter transit (Bourn & Prescott, 2002).

### *EBT Implementation & Farmers' Market Use*

A significant limitation to both farmers and FMNP users in the previous 14 years was the implementation of the Electronic Benefits Transfer (EBT) food stamp program in 1996 (Fisher, 1999; Grace et al., 2007). EBT is an electronic system that allows a recipient to authorize transfer of their government benefits from a federal account to a retailer account to pay for products received with an EBT debit card (USDA SNAP, 2010). Previously, farmers could accept food stamps in their paper currency form and redeem these for reimbursement but advent of EBT negatively affected both redemption rates and farmer sales. Most farmers are in rural areas that do not have access to the infrastructure that is essential to use EBT. Between 1994 and 1998, redemption rates at farmers' markets for food stamps dropped significantly from \$6.4 million to \$3.6 million (Grace et al., 2007). In response to this sharp decline, the federal government appointed representatives for farmers' market organizations and cooperative extension programs throughout the country to implement initiatives and resurrect

the use of FMNP coupons at Farmers' Markets. In New York State redemption rates decreased significantly ( $p < 0.05$ ) by 2.36% annually between 1996 and 2000 mainly due to the switch over from paper coupons to the EBT system, before being reignited by a state-wide initiative to enhance the effectiveness of FMNP that included hiring cooperative extension staff, increasing collaboration at the state-level and disseminating nutrition education resources (Conrey et al., 2003). This led to an actual redemption rate that exceeded the expected rate by 2.2%. Through these state-wide initiatives and EBT installations, FMNP redemption rates have slowly been returning to normal, although it certainly varies by state.

Although a redemption rate of FMNP coupons is not a direct indicator of the program's effectiveness, it provides information about the number of WIC families benefiting (Conrey et al., 2003). With this being said though, these redemption rates are important because the WIC clients must receive fresh produce and local farmers their compensation. If one is using redemption rates as the most influential factor for assessing effectiveness then the national rate of redemption in 2006 of 59% seems mediocre at best (Federal Register FMNP, 2008). Perhaps an equally important measure of the program's effectiveness should be the increased consumption of fresh fruits and vegetables among FMNP participants.

### *FMNP & Fruit and Vegetable Intake*

Several research studies have assessed whether or not FMNP increased fruit and vegetable consumption by users and provided higher incomes for farmers (Grace et al., 2007; Herman et al., 2008; Kropf et al., 2007; Markowitz, 2010). Kropf et al. (2007) looked at the difference in household food security status, fruit and vegetable intake and behaviors between women in WIC versus FMNP in Athens County, Ohio. The researchers used a cross-sectional survey to assess the differences between the FMNP participants, who received \$18 per season in coupons, and the control group of WIC participants (Kropf et al., 2007). 829 WIC and 246 FMNP participants were selected for the study, the disparity in group size reflecting the fact that FMNP coupons are issued to a lot fewer people each year. The results showed that women in the FMNP group reported a higher but non-significant mean intake of vegetables ( $2.23 \pm 1.18$  servings) than the control group ( $1.91 \pm 0.98$  servings). This non-significant increase could be due to the fact that \$18 per season does not usually make a big dent in buying practices. The response rate for this study was only 22%, possibly due to illiteracy, language issues or apathy. Nevertheless, this significantly weakens the results found in this study.

The National Association of Farmers' Market Nutrition Programs (2002) investigated the efficacy of FMNP use among participants ( $n=24,800$ ) enrolled in 30 WIC program centers and participating farmers ( $n=2,561$ ) across the US. The

researchers used surveys to ask questions about fruit and vegetable intake at Farmers' Markets (National Association of FMNP, 2002). 73% of FMNP participants reported eating more fresh fruits and vegetables after the implementation of FMNP coupons compared to previously. Furthermore, 54% spent money at the markets in addition to coupon use. As for the farmers, 90% reported that accepting FMNP coupons at their markets increased their overall sales. The results in this study reflect that FMNP coupon use positively affects both the low-income consumer and the farmer (National Association of FMNP, 2002). However, the researchers do not share information about surveys or sampling procedures and validity of survey measures, so it is difficult to ascertain the statistical strength of these results.

Anderson et al. (2001) evaluated the effectiveness of three different initiatives to increase fruit and vegetable consumption in one county in Michigan. The researchers selected subjects from WIC and Common Action Agency programs and assigned them to one of four intervention groups: education only, education and FMNP coupons, FMNP coupons only or storage and nutritional information about fresh produce (Anderson et al., 2001). They also included a group that had no intervention as a control group. Coupons were a one time \$20 amount. The researchers used WIC redemption rates and pre/post-intervention questionnaires (modified version of Behavioral Risk Factor Surveillance System Survey) to measure outcomes. Response rates (81.7%) were higher than those witnessed in the Kropf et al. (2007) study (22%) with 455 out of 564 participants



completing the questionnaires. The results showed that both the education and coupon interventions significantly increased fruit and vegetable intake when compared to the control group. Education alone seemed to impact attitudes more positively, where as coupons only increased intake but did not affect attitudes as much. The most statistical significance for increasing intake was seen in the intervention that included both education and FMNP coupons simultaneously.

Anliker et al. (1992) were among the first to evaluate the success of WIC FMNP on fruit and vegetable consumption. The researchers followed women from six WIC FMNP providing clinics and three WIC clinics that did not provide FMNP coupons (Anliker et al., 1992). Pre-assessment interviews of the participants (n=489) were followed by follow-up surveys (n=216) after 2 months. Fresh, canned and frozen fruits and vegetables intake was measured using a short Food Frequency Questionnaire (FFQ), this measure differs to more recent research studies that chose to only assess the intake of fresh fruits and vegetables (Anderson et al., 2001; Herman et al., 2008; Kropf et al., 2007; National Association of FMNP, 2002). Results found that there was no significant difference between the FMNP and control groups in terms of intake. A reason for this could have been the low value (\$10) of coupons provided to the participants per season (Anliker et al., 1992). Perhaps this was not enough of an incentive for a trip to the local farmers' market. However, there could be a variety of variables that could have affected these results. The researchers did find that women who received the FMNP coupons consumed more dark-orange vegetables, fresh

tomatoes and peppers than the control group. This finding reinforces the increase in fresh fruits and vegetables with FMNP use and the overall comparison between intervention and control may have differed if frozen and canned fruits and vegetables were omitted. It is also important to note that the response rates (44.2%) limited this particular study.

Herman et al. (2008) evaluated the use of an economic subsidy for increasing fruit and vegetable intake in postpartum WIC participants in California. The 6-month intervention enrolled 602 WIC participants from 3 WIC sites in Los Angeles and provided these women with a \$10 coupon twice a month for two months, which they could redeem at farmers' markets or supermarkets (Herman et al., 2008). Three groups were established: Farmers' Market coupon group, Supermarket coupon group and control group. The control group was not presented with a fruit and vegetable subsidy but a set of coupons (\$13/month) was given to them for participating in the study. The intervention lasted 6 months and was then followed up by a 6 month monitoring phase where the participant's diets were analyzed to establish longevity and sustainability of any behavior change.

The researchers used single multiple-pass 24 hour dietary recalls to assess fruit and vegetable intake (Herman et al., 2008). Analysis of variance, Pearson product moment correlations and the t-test were used for bivariate analysis. In comparison to the control group, the farmers' market group significantly ( $p < 0.001$ ) increased their consumption of fruits and vegetables by 1.4 servings per

1000 kcal from baseline to the end of the intervention. Supermarket participants increased intake non-significantly by 0.8 servings per 1000 kcal. Linear regression analysis was used to analyze fruit and vegetable intake in the period post-intervention and found that increases in fruits and vegetables remained significant. ( $r^2=.13$ ,  $p<.001$ ). These results are promising but may not be applicable to women in other parts of the country that do not have farmers' markets available to them all-year round like the participants had in this study. Also, the monetary value of the coupons used in the study was higher than the standard FMNP coupon amounts used by other research studies so this could have indirectly influenced the outcome.

#### *Food Environment & Risk of Obesity*

The food environment that people live in is significantly associated with body size and body mass index (BMI) (Rundle et al., 2009; Zick et al., 2009). A higher local density of healthy food outlets, classified as supermarkets or fruit and vegetable markets, has been associated with a lower mean BMI and lower prevalence of obesity. This is in contrast to areas that have limited availability of healthy food outlets and are instead littered with fast-food outlets, convenience stores and gas stations. Of course an individual could still buy “unhealthy, calorie-dense” foods at a store that is classified as healthy but in terms of associations, there is an inverse relationship between number of healthy stores and BMI in particular areas (Rundle et al., 2009; Zick et al., 2009). With these accessibility

and availability issues usually occurring in lower-income areas of a city, it would be applicable to assess whether or not these factors are playing a role in supplemental WIC or FMNP coupon redemption.

### *Food Deserts*

Areas or neighborhoods that have poor access to healthy foods such as fruits and vegetables have been identified as “food deserts” (Weinberg, 2000). These areas tend to have fewer supermarkets and more fast-food or convenience stores. Large supermarket stores tend to offer more high-quality and healthful products at a lower price where as convenience stores tend to sell processed, high-calorie foods and little fresh produce, at higher prices (Larson et al., 2009; Zenk et al., 2006). Furthermore, demographic factors like race and income seem to be associated with levels of access to healthy foods. Low-income neighborhoods have fewer chain supermarkets than middle-income or affluent neighborhoods (Gordon et al., 2011; Larson et al., 2009; Powell et al., 2007). African-American and Hispanic neighborhoods have less access to healthy supermarkets when compared to White neighborhoods. These lower SES areas also tend to have higher prevalence of fast-food restaurants and calorie-dense foods (Larson et al., 2009; Powell et al., 2007). The introduction of farmers’ markets in these areas that are classified as food deserts can potentially reduce or eliminate them all together (Larsen & Gilliland, 2009).

Larsen and Gilliland (2009) looked at the impact that opening a farmers' market in London, Ontario would have on the price and availability of healthy foods in a food desert. The introduction of a farmers' market caused a 12% decrease in food prices over a 3 year period at grocery stores in the surrounding neighborhood (Larsen & Gilliland, 2009). Also, the variety and accessibility of fresh produce increased and overall household food costs decreased in this neighborhood, previously classified as a food desert. The findings of this study suggest that introducing farmers' markets to low SES neighborhoods, which previously had poor access to healthy foods, could potentially improve accessibility to lower-priced, fresh produce and consequently lower chronic disease risk. Further research studies using objective methods need to be conducted in the US to assess whether or not farmers' markets will have a similar impact. The objective method used by the majority of researchers to assess food store availability and accessibility, in terms of quantity and proximity is the Geographic Information System (GIS) (Gordon et al., 2011; Larsen & Gilliland, 2009; Larson et al., 2009; Rundle et al., 2009).

#### *Geographic Information System & Walkability Scales*

A geographic information system integrates data for capturing, managing, analyzing, and displaying all forms of geographically referenced information (GIS, 2010). This allows researchers to manipulate spatial data to develop indices that represent the local neighborhood. Physical addresses of subject households or

store locations are geocoded into latitude and longitude coordinates and then plotted on map to give spatial data that allows the researcher to obtain accurate proximity measures for resource accessibility. The geocoded coordinates can then be conceptualized as a series of layers of information (e.g. population density, road networks, land use, store locations, etc) with each observation in each layer tied to specific points on the earth's surface (Leslie et al., 2007). GIS then cuts vertically through the relevant information layers and analyses the relationships between phenomena co-located in the same area. For example, GIS could be used to calculate the walkability of a neighborhood by using different layers or factors that would affect walkability.

Walking is the form of physical activity that is currently the main focus of environmental and policy initiatives in public health (Agrawal et al., 2008). It also is the primary mode of transport for a lot of lower SES individuals, which makes it important to assess if we wish to operationalize the accessibility of healthy food outlets such as farmers' markets in specific neighborhoods. A walkable distance is usually defined by urban planners as a distance of 0.5 to 1 mile (Adams et al., 2009; Agrawal et al., 2008; Leslie et al., 2007; Rundle et al., 2009). The walkability of a community or neighborhood is determined by the characteristics of the built environment and land use. This determines how conducive residents in the area are to walking for leisure, exercise, to access services or to get to work (Leslie et al., 2007). Saelens et al. (2003) argue that that the choice to walk or use motorized transport ultimately comes down to two dimensions of the way land is

used, proximity and connectivity. Proximity is determined by two key land use variables; density and land use mix, which is the degree of heterogeneity with which functionally different uses are co-located in a space (Leslie et al., 2007). An environment that is more compact and intermixed will have shorter walking distances to potential destinations. Connectivity measures the directness of the pathways between two points and is based on the design of street networks. The number of freeways, walls or other physical objects facilitates the ease with which a direct path can be taken. The number of interconnecting streets usually determines the degree of connectivity; a regular grid pattern (New York City) is the best at facilitating walking for transport as the number of freeways is limited and there are almost an unlimited number of potential routes (Saelens et al., 2003).

Adams et al. (2009) used GIS to validate a subjective walkability-scale known as the Neighborhood Environment Walkability Scale (NEWS). This scale was developed to assess constructs from transportation and urban planning literatures and assesses several environmental characteristics related to physical activity but primarily for transportation purposes (Adams et al., 2009). NEWS surveys the self-reported: neighborhood density, land use mix-diversity, land-use mix-accessibility, street connectivity, crime rates, walking facilities and pedestrian safety of a particular area. Using GIS as an objective measure of the built environment, the researchers were able to obtain a significant concordance between GIS and the NEWS survey, with weak to moderate effect ( $r=0.09$  to

-0.36,  $p < .001$ ) (Adams et al., 2009). These findings indicate that the NEWS survey is a valid method for measuring the built environment when perhaps GIS is not available or only self-reported data is available.

Using GIS and walkability analysis to calculate the proximity of farmers' markets to WIC clinic locations can help us to establish whether or not accessibility plays a significant role as a barrier to WIC and FMNP coupon redemption.

#### *Barriers to Farmers' Market Use-Awareness & Price*

The current research indicates that although supplemental WIC coupons are effective in increasing consumption of fruits and vegetables, the redemption rates of these coupons are still poor (Conrey et al., 2003; Grace et al., 2007; Racine et al., 2010). Grace et al. (2007) investigated the barriers to using Urban Farmers' Markets for participants in the Food Stamp programs in Portland, Oregon. In 2004, Department of Health Services (DHS) in Oregon issued 5,317 food stamps and in the next 17 seasonal market days that followed only had 2,300 of food stamp dollars spent (Grace et al. 2007). The researchers set out to explore the barriers that were causing these low redemption rates at farmers' markets. 108 food stamp clients were interviewed using a survey tool that comprised of four topics: Farmers' Market Awareness and Experience, Mealtime routines, Grocery shopping habits and Advice for Farmers' Market organizers. The subjects were chosen based on proximity to farmers' markets, were mainly female (74%) and



two-thirds represented family households (Grace et al., 2007). No control group was used in the study. 67% of respondents described the food stamps as their primary or only grocery funds. A third of the participants interviewed said they had never been to a farmers' market before and 29% reported that they were not even aware that supplemental coupons (EBT) could be used at farmers' markets. Basic awareness about farmers' markets and the ability to use food stamps there seems to be a major barrier to redemption rates.

The second major barrier to farmers' market use among the participants was price (Grace et al., 2007). The subjects believed that farmers' markets were more expensive than grocery stores and did not offer any incentives in the form of discounts or special offers. The researchers stated that there was no comprehensive research comparing grocery store produce against farmers' market produce in terms of price or quality. A counter-argument to this would be to say that farmers are more willing to provide produce that will meet the food stamp's absolute redemption value, when compared to redemption in grocery stores that are limited by fixed prices. Future research should assess the differences in absolute dollar amounts of coupons redeemed at farmers' markets versus grocery stores, to establish whether or not farmers' markets have better absolute redemption rates. Another major barrier mentioned by the participants was limited hours and market locations. Most of the farmers' markets only operated one day per week and were only open for an average of 4-6 hours. The subjects said that grocery stores were closer than farmers' markets and more accessible via public

transport systems. More than half the group did not own a car so the availability of public transport and proximity to farmers' markets were major factors in their decision to redeem their coupons. The choice to select participants who lived close to farmers' markets probably reduced the confounding effects of proximity and access.

#### *Barriers to Farmers' Market Use-Variety & Convenience of Fresh Produce*

Other minor barriers to using farmers' markets reported by the participants were limited selection of foods, inconvenience of fresh produce, poor usability and lack of product promotion (Grace et al., 2007). Inconvenience of fresh produce was expanded upon to include the quick spoilage of fresh fruits and vegetables and long preparation time. The inclusion of canned, frozen fruits and vegetables in the WIC program is currently a major topic for increasing fruit and vegetable intake among WIC-eligible individuals. As of now, only fresh fruits and vegetables are offered via WIC cash value vouchers but state agencies have the option of offering canned or frozen fruits and vegetables if fresh produce is unavailable (WIC Interim Rule, 2008). In the Grace et al (2007) study, the participants were also questioned on which factors contributed most significantly to them trying farmers' markets during the study. Location was the biggest influence on the participants visiting a farmers' market. According to Brown's inventory of farmers' market research conducted from 1940-2000, the most important factor for the success of a farmers' market is location (Brown, 2002).

Another major factor which participants listed as important to farmers' market use in the Grace et al. (2007) study was the subsidy provided in the form of WIC Farmers' Market Nutrition program. Being eligible for the FMNP coupons was a major motivator for farmers' market use and when they had exhausted their economic subsidy, the participants did not remain regular market customers. An important confounder in the study is the fact that the Portland area has a high concentration of farmers' markets and agriculture in the state of Oregon is second only to the high-tech sector in terms of gross state product. This means that the results seen in the study may not be generalizable to the rest of the population. For example, specific states like Arizona do not have the same concentration of farmers' markets or agricultural land that Oregon has.

#### *Barriers to farmers' market use-Accessibility*

Racine et al. (2010) assessed Farmers' Market use by African-American women participating in the supplemental WIC program in Washington DC and Charlotte, North Carolina. The researchers recruited 108 WIC enrollees in Charlotte and 71 in Washington DC (Racine et al., 2010). Only women who were American-born and eligible for WIC were included in the study to control for variability in diet among study participants. The study design was quasi-experimental and the objective was to examine use of farmers' markets among pregnant African-American WIC participants in the Charlotte and Washington DC area. Charlotte was designated as the control group for the study. The

researchers explored the association between FMNP participation, previous redemption of FMNP and use of farmers' markets in both areas. Multivariate regression analysis was used to assess FMNP participation, previous redemption of FMNP coupons and dietary intake associated with farmers' market use.

All of their data for the study was acquired using a survey instrument that asked questions directly related to FMNP use and previous FMNP redemption (Racine et al., 2010). Dietary intake was assessed using the National Cancer Institute's 17-item Multifactor Screener. In addition to these questions, the researchers also included questions in their customized survey tool so that they could assess possible barriers to farmers' market use. Using these measuring tools, the researchers found that fruit and vegetable servings increased by 3 servings a day when using FMNP compared to prior research of African-American women's fruit and vegetable consumption in 2002, which also used the Multifactor screener to measure intake in their study (Racine et al., 2010). These results are probably over-estimated though since the interviewers assisted participants' complete their surveys, which usually increase fruit and vegetable intake reporting due to social approval bias.

Racine et al. (2010) also found a positive association between previous farmers' market use and increased redemption rates. Charlotte and Washington DC participants who had not previously used the FMNP coupons had non-significantly lower redemption rates of 32.4% and 40% respectively, when

compared to those who had previously used FMNP (61%) (Racine et al., 2010). This difference recognizes that lack of awareness about FMNP is a major barrier to redemption rates. Other commonly reported barriers in the surveys were lack of farmers' markets nearby and lack of transportation to farmers' markets. As much as 25% of the participants in Charlotte identified a lack of farmers' markets nearby as a barrier, where as only 4.9% of Washington DC participants reported this as a barrier. Transportation to farmers' markets was also identified as a barrier by both groups of participants but was not as big of a barrier as the location of the farmers' market. Not knowing where farmers' markets were and preference for grocery stores were other less significant barriers reported by the participants.

The barriers identified by the participants in the study are helpful in determining ways to increase national redemption rates of FMNP coupons (Racine et al., 2010). However, the study only included pregnant African-American women in the Charlotte and Washington DC area so the results are not generalizable to the rest of the WIC population in the US. Future studies to assess barriers to farmers' market use should include a more diverse population and use more objective measures than a survey tool that has not been validated.

#### *Factors that Promote Farmers' Market Patronage*

Colasanti et al. (2010) conducted several focus groups in Michigan to explore the behaviors and attitudes that motivate patronage at farmers' markets

across the state. All of the participants were primary shoppers of their respective households and collectively represented many of the demographics that are often underrepresented at farmers' markets-minority groups (Colasanti et al., 2010). A total of 63 people participated in 7 focus groups in both urban (n=3) and rural (n=4) locations across Michigan. African American, Arab American, White and Latino were evenly represented among the focus groups and the majority was of low to moderate income status. Semi-structured interviewing that consisted of open-ended questions yielded the following as primary factors for choosing to shop at a farmers' market: good value, quality products, variety of products available, convenient location, convenient hours, ability to do all shopping at one location, supporting local farms, information on how produce was grown.

Colasanti et al. (2010) then took the factors identified in the focus groups and conducted statewide telephone surveys to obtain quantitative results of which factors were most or least important in deciding on whether or not to choose farmers' markets. The referent population was non-institutionalized, English-speaking adults across Michigan who were 18 years or older (Colasanti et al., 2010). A total of 953 interviews were completed on a sample population that was weighted to be representative of Michigan residents. The importance of each factor listed as a reason to shop at farmers' markets was measured using a 4-point Likert-type scale. The factors with the highest mean importance were food quality (3.80), safety from food-borne illness (3.75), ability to support local farmers (3.71), good value (3.50) and location (3.44) (56). Taking the factors identified in

the focus groups and the survey responses into consideration, it is clear that participants across a variety of demographic groups valued and expected fresh, locally grown produce at farmer's markets.

This outcome is slightly different than other studies in that the participants viewed food quality, sustainability and supporting local enterprises as the biggest reason for visiting farmers' markets (Colasanti et al., 2010). Other similar research studies conducted in other states have found lack of awareness, proximity and price to be the main factors hindering use of farmers' markets by a similar demographic population (Grace et al., 2007; Racine et al., 2010).

#### *The Importance of Farmers' Market Location*

The current literature suggests that proximity to farmers' market locations influences the redemption rate of supplemental WIC coupons that are provided to buy fresh fruits and vegetables (Brown, 2002; Colasanti et al., 2010; Grace et al., 2007; Racine et al., 2010). Herman et al. (2006) used the same data set as was used in their 2008 study (Herman et al., 2008) of the effects of a targeted subsidy on the intake of fruits and vegetables in low-income women who participate in supplemental WIC, to investigate the effects that providing supplemental financial support for buying fruits and vegetables has on dietary intake (Herman et al., 2006). The researchers also assessed the redemption rates of supplemental coupons and ethnicity of the participants in the study. Of the 454 people who completed the study, 86% of the participants were Hispanic. This means that the

results of this study will not be very generalizable to the rest of the WIC population in the US. According to a 2002 study done by the USDA, only 39% of WIC participants are Hispanic (WIC Racial/Ethnic Data, 2002).

Redemption rates in the Herman et al. (2006) study were obtained from scanned data from the supermarket's headquarters. The farmers' market vouchers were turned into the city council by the farmers' market managers and mailed to the study's research staff, who recorded the data electronically. The results reflect redemption rates of 90.7% and 87.5% for farmers' markets and supermarkets respectively (Herman et al., 2006). These results are substantially higher than the national average of redemption rates for WIC and FMNP coupons. A possible reason for this is that the researchers in this study controlled for accessibility issues. WIC centers were selected for participation in the study based on proximity to a major supermarket store and a certified year-round farmers' market. The reason for this is that WIC centers are the location where WIC CVV, supplemental WIC and FMNP coupons are issued to participants in the program.

To be eligible the center had to be within walking distance (not more than ½ a mile) to a supermarket or a year-round farmers' market (Herman et al., 2006). Another limiting factor of the study would be that the amount of the subsidy (\$40/month) was greater than the amounts previously used in FMNP studies. It is also important to mention that California has an extremely favorable growing season, which allows it to have more farmers' markets and better access to fresh



produce year-round than other states in the US. This also may have contributed to the high redemption rates and overall success of the program in Los Angeles. The question is how generalizable are these results for the rest of the nation and the answer is probably not very generalizable based on ethnicity, accessibility and climate. The researchers reported no barriers to redemption of vouchers in the study, which is not surprising due to the fact that the researchers controlled for accessibility in the study.

### *Elimination of Food Deserts*

Farmers' markets have the ability to improve access to and utilization of fresh fruits and vegetables by the low-income populations living in food deserts that are eligible for WIC (Holben, 2010; Larsen & Gilliland, 2009). The problem is that few studies have investigated these particular constructs and location continues to be a barrier to farmers' market access (Colasanti et al., 2010; Grace et al., 2007; Herman et al., 2006). McCormack et al. (2010) reviewed the current literature on farmers' markets and community gardens. These researchers established that further qualitative and quantitative studies need to be done to assess the barriers that are responsible for poor redemption rates, and in particular accessibility in terms of proximity and availability of public transport to farmers' markets (McCormack et al., 2010). This would provide researchers with the necessary data to establish trends and implement interventions to improve the redemption rates of WIC CVV and FMNP coupons at farmers' markets.

## *Conclusion & Discussion*

In conclusion, a review of the current literature with regard to farmers' market use by WIC CVV and FMNP coupon participants revealed that there seems to be a tendency toward these programs increasing fruit and vegetable intake. However, it is difficult to make causal inferences on the effectiveness of these particular programs to increase fruit and vegetable consumption due to weak study designs. Few of the studies chose to use validated questionnaires, which severely limit the results that may have reflected dietary intake. Six out of the eight studies that we reviewed used pre/post-test intervention questionnaires as their study design (Anderson et al., 2001; Anliker et al., 1992; Grace et al., 2007; Herman et al., 2006; Herman et al., 2008; Racine et al., 2010), and only four of these six studies used a control group (Anderson et al., 2001; Anliker et al., 1992; Herman et al., 2006; Herman et al., 2008). The other two studies reviewed used cross-sectional surveys (Kropf et al., 2007; National Association FMNP, 2002) however one of these studies failed to include information about survey and sampling design in their methods section (National Association FMNP, 2002). Pre/post-test intervention and cross-sectional studies do not allow us to establish causality so although the literature tends to suggest that fruit and vegetable intake increases with WIC and FMNP coupon use, the study designs do not allow for us to make this inference. Future quantitative and qualitative studies should be; more controlled, more multi-racial and include questionnaires that have been validated if we wish to draw inferences about the impact of WIC and FMNP coupons on

fresh produce intake. Also, future studies must ensure that the economic subsidy provided in the form of coupons is similar in amount to those seen in the WIC CVV and Farmers' Market Nutrition Programs, larger coupon dollar amounts may have caused over-estimations in redemption and produce intake.

The biggest barriers to farmers' market use seem to be location and lack of public transportation (Brown, 2002; Grace et al., 2007; Herman et al., 2006; Racine et al., 2010). Studies that received data about barriers to farmers' market use were limited in study design though; all of the studies used the pre/post-test intervention questionnaire to identify barriers. This qualitative approach gives us an idea of which barriers need to be further quantitatively investigated to prove causation. Furthermore, the only study that did not find any barriers to redemption rates happened to be the only study that controlled for accessibility by only including WIC centers that were within walking distance to farmers' markets and supermarkets (Herman et al., 2006). This indicates a possible relationship between accessibility to farmers' markets and redemption rates of WIC CVV and FMNP coupons. The majority of research articles that we reviewed identified accessibility as a major barrier to farmers' market use and reiterated the need for future research to identify barriers to use and ways in which redemption rates of WIC CVV and FMNP coupons could be improved. Analyzing barriers to redemption rates of these coupons is definitely an area of deficiency in the current literature. Furthermore, the difference between absolute dollar redemption of WIC CVV coupons at farmers' markets versus grocery stores has not been studied.

### *Future Research*

In-depth, quantitative studies that assess the relationship between proximity to farmers' markets from WIC locations and redemption rates of WIC CVV and FMNP coupons are needed to give us causal inference about particular barriers that are limiting these federal programs. Also, it would be interesting to witness the effect that the changes in the WIC program, which allow participants to use WIC CVV at state-authorized farmers' markets, has on FMNP coupon redemption rates and whether or not absolute dollar redemption amounts differ between grocery stores and farmers' markets.

## Chapter 3

### METHODOLOGY

#### *Study Design, Participants and Data Collection Procedures*

WIC and FMNP redemption data were provided by the Arizona Department of Health Services (AZDHS). The research investigator met once a month with AZDHS employees to obtain the data electronically. These data included identification of the issuing clinic, redemption rates of WIC CVV and FMNP coupons by clinic, the amount used per voucher or coupon, date of use, and distance between clinics and nearest approved market, regardless of whether coupons were redeemed there. Secondary data included for analysis came from participants participating in both WIC and FMNP in Arizona between October 2009 and December 2010. WIC CVV data were gathered from the months of October 2009 through December 2010. CVV data from October 2009 through February 2010 were used to establish a baseline rate of use without the influence of FMNP coupons. FMNP coupon data were gathered for the months of March 2008 through October 2010, the period of time in which these coupons are issued to participants and may be used.

Arizona FMNP offers eligible participants a subsidy of \$30 per year in FMNP coupons to provide them with the opportunity to purchase fresh fruits and vegetables at farmers' markets. Pregnant or breastfeeding women currently receive \$10 and children up to the age of 5 receive \$6 per month in FMNP benefits in Arizona. WIC participants in Arizona are primarily Hispanic (67%)

(WIC Racial/Ethnic Data, 2002). Twenty-six percent are White, 4.5% Black and less than 3% are Asian, Native American or Pacific Islanders. Only data from participants in both WIC and FMNP were included in this study. Data from Navajo Nation and Inter-Tribal council WIC participants were excluded from analyses because these WIC agencies do not participate in the WIC CVV and FMNP programs.

### *Geographic Information System*

Distances from WIC clinics to the nearest WIC-approved farmers' markets were calculated using the Geographic Information System (GIS). A geographic information system integrates data for capturing, managing, analyzing, and displaying all forms of geographically referenced information (GIS, 2010). By using GIS, we were able to calculate the distance between WIC clinics and farmers' markets based on existing Arizona road networks. Only farmers' markets that accept WIC CVV/FMNP benefits were included in distance analyses. The specific addresses of WIC clinics and farmers' markets were obtained using the AZDHS WIC website. All addresses and location names were entered into Microsoft Office Excel, 2007 edition. Those data were transferred into Batchgeocode, Free online edition. Batchgeocode is a program that allows the geocoding of each physical address into map coordinates, which can then be used to plot locations on a map using latitude and longitude. The program also allows for manual adjustment of location data to minimize inaccuracies in mapping.

ArcGIS 9 ArcPad 7.0.1. was used to create a map of Arizona as well as WIC clinic and farmers' markets locations. Road networks and other mapping data were obtained from the Arizona State University Noble Science & Engineering Library (Tempe, AZ). The map of Arizona included city, county and state lines, as well as road networks (2007) for the entire state. Tagging farmers' markets with different colors and identities simplified map readability and allowed GIS to distinguish between farmers' markets and WIC clinic locations. The program was then used to calculate distances between WIC clinic locations and the nearest farmers' market to each clinic based on the Arizona road networks provided. All distances were calculated in meters. Distance data were imported into SPSS, version 19.0, for analysis.

#### *Statistical Analysis*

The Statistical Package for the Social Sciences (SPSS) version 19.0 (Chicago, IL) format was used to analyze data. A *t*-test was used to compare baseline CVV redemption rates and CVV redemption rates during the period when FMNP coupons were introduced. The data were adjusted or transformed if a normal standard distribution is not achieved. Should normality not be achieved, then a Non-Parametric, Mann-Whitney was used to assess if there is a significant difference between the two means. The *t*-test was also be used to establish whether or not there is a significant difference in the percentage value of CVV redeemed at WIC-approved stores compared to the percentage value redeemed at farmers' markets. Also, an ANOVA was used to establish whether or not there is

a significant difference in the mean redemption of FMNP coupon redemption in 2009 and 2010 (when WIC CVV was introduced and available respectively) to 2008 (before WIC CVV was available). If normality was not achieved, a Non-Parametric, Kruskal-Wallis was used to assess if there was a significant difference between the three means. A t-test was used to establish whether or not there was a significant change in mean redemption from year to year. If normality was not achieved, a Non-Parametric, Mann-Whitney was used to assess if there was a significant difference between the two means.

Finally, a Pearson correlation was run to determine if a significant relationship exists between distance to the nearest farmers' market from WIC clinics and redemption rates of WIC FMNP coupons. A rural versus urban comparison of redemption rates of WIC FMNP coupons and the distance traveled to the nearest farmers' market from WIC clinics was also carried out. Urban areas of Arizona were classified as any farmers' market or WIC clinic location located in Coconino, Maricopa or Pima county. Rural areas of Arizona were classified as any farmers' market or WIC clinic location not located in Coconino, Maricopa or Pima county. An  $\alpha$  value of  $<.05$  was used to determine statistical significance and a 95% confidence interval (CI) was used for all of the statistical tests performed.



Chapter 4

RESULTS

*WIC Cash Value Voucher Redemption Characteristics*

**Table 1.**

***Total WIC Cash Value Voucher issuance and redemption 2009-2010.***

WIC CVV Issued (n)	WIC CVV Redeemed (n)	Total CVV Redemption (%)	Sum of CVV redemption (\$)
2,575,382	2,152,924	83.6	11,820,456

Table 1 reflects the total number of WIC Cash Value Vouchers (CVVs) issued and redeemed in Arizona during 2009 and 2010, as well the Total CVV redemption rate and sum of CVV dollars redeemed during this period. Approximately 84% of WIC CVV were redeemed during this time period, with the majority (~99%) of WIC CVV being redeemed at grocery stores and a small minority being redeemed at farmers' markets (<1%). In fact, only 1,078 WIC CVVs (Table 2) were redeemed at Arizona farmers' markets during the 16-month period.. The number of WIC CVV vouchers redeemed at Arizona farmers' markets per month was higher during the intervention period (March-October 2010) than the baseline period (November 2009-February 2010) (Figure 1). WIC participants redeemed 177 vouchers (44.3/month) during baseline (WIC CVV only) and 657 vouchers (82.1/month) during the intervention period when WIC participants could use either WIC CVV or FMNP vouchers at farmers' markets.

**Table 2.**

***WIC Cash Value Voucher redemption by grocery stores and farmers' markets***

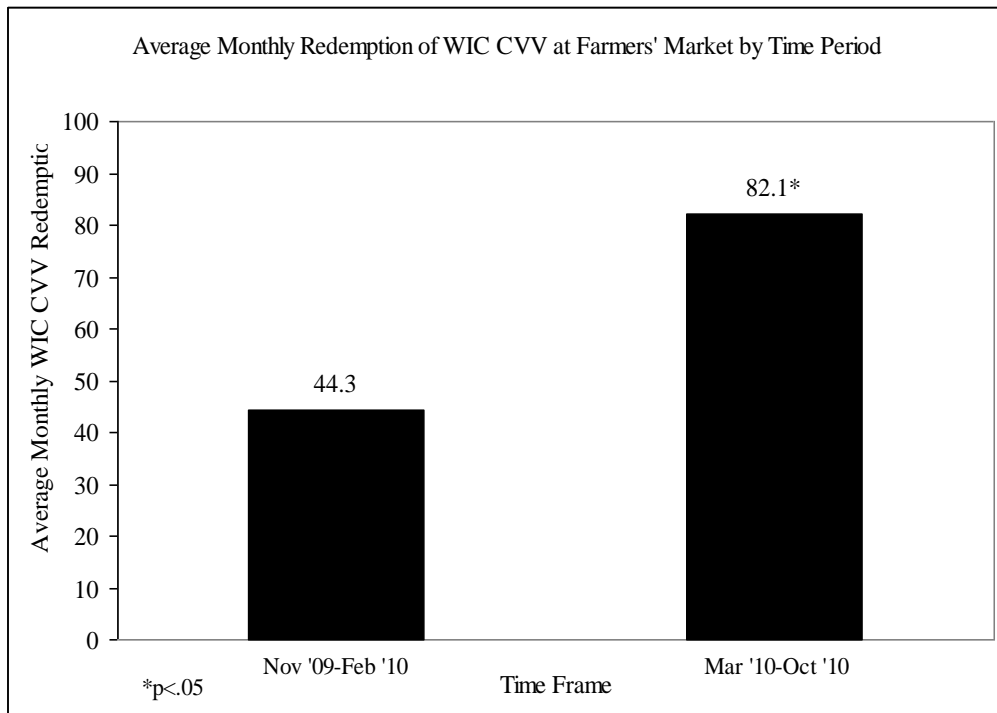
***2009-2010.***

WIC CVV Redeemed at Grocery Stores (n)	WIC CVV Redeemed at Farmers' Markets (n)	Percent Total Value Grocery Stores (%) <sup>a</sup>	Percent Total Value FM (%) <sup>b</sup>	Difference	p-value
2,151,835	1,078	93.5	99	5.5%	<.001

FM=Farmers' Market

<sup>a</sup>= The percent of total WIC CVV value redeemed at Grocery Stores

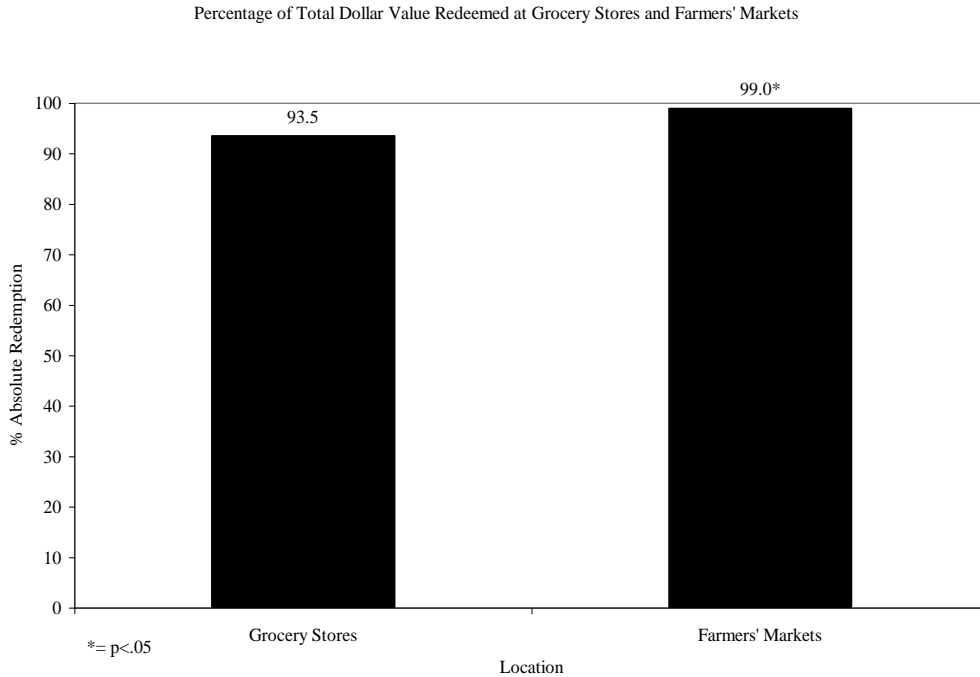
<sup>b</sup>= The percent of total WIC CVV value redeemed at Farmers' Markets



**Figure 1. Average monthly redemption of WIC Cash Value Voucher during baseline and intervention period.**

Figure 2 reflects that WIC CVV recipients redeemed a significantly higher percent of total CVV value at farmers' markets (99%) as opposed to grocery

stores (93.5%) ( $p < .05$ ). Individuals who used a \$10 WIC CVV voucher at farmers' markets were likely to redeem approximately \$9.90, whereas those who choose to redeem their vouchers at grocery stores redeemed \$9.35 (Figure 2).



**Figure 2. WIC Cash Value Voucher absolute redemption percentage at grocery stores and farmers' markets.**

*WIC Farmers' Market Nutrition Program Characteristics*

Table 3 reflects the total number of Farmers' Market Nutrition Program coupons that were issued and redeemed at farmers' markets across Arizona during a three-year period. Redemption rates for all three years can be seen in Figure 3. The overall redemption rate for FMNP coupons at Arizona farmers' markets over this three year period was 43.3%. A non-parametric Kruskal-Wallis test revealed a non-significant difference between mean redemption across the three time

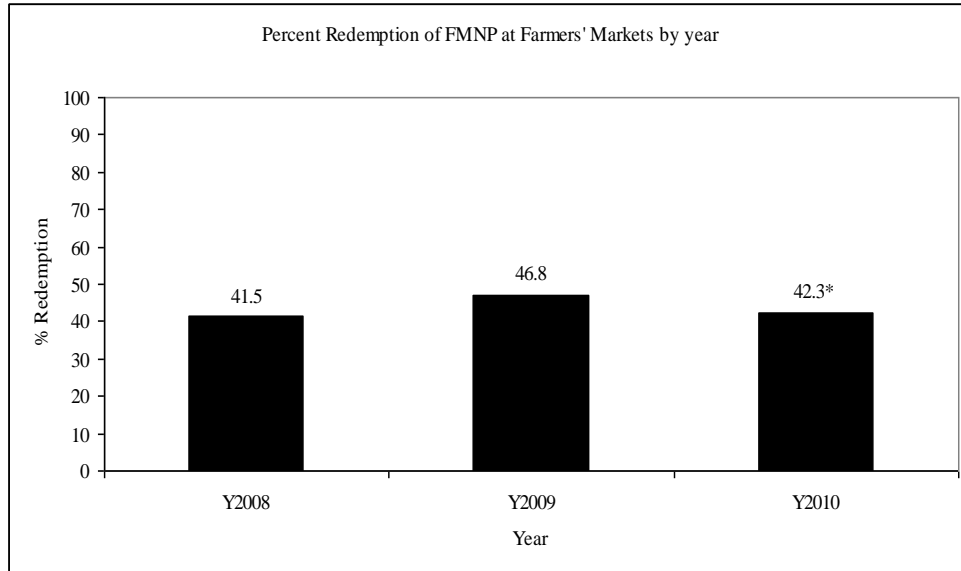
periods investigated. Further analysis using the Mann-Whitney test revealed that there was a non-significant 5.3% increase in the redemption rate of FMNP coupons at farmers' markets from 2008 to 2009. However, these increases in redemption were not maintained the following year and redemption rates showed a significant 4.5% decrease in 2010 ( $p < .05$ ) (Figure 3).

**Table 3.**

***Total Farmers' Market Nutrition Program coupon issuance and redemption 2008-2010.***

Year	FMNP Issued (n)	FMNP Redeemed (n)	FMNP redemption (%)	$\Delta$ (%) <sup>a</sup>	Sum of FMNP redeemed (\$)
2008	132,200	54893	41.5%		\$164,679
2009	87,770	41050	46.8%	5.3%	\$123,150
2010	63,440	26833	42.3%	-4.5%	\$80,469
Total	283,410	122,776	43.3%		\$368,298

<sup>a</sup> denotes percent change from the previous year.



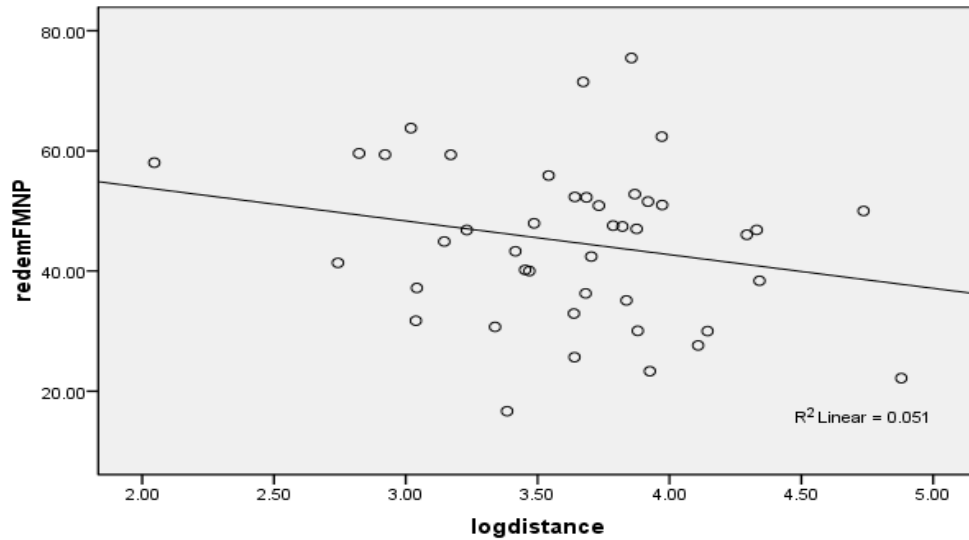
\*=significant change from the previous year

**Figure 3. Redemption rate of Farmers' Market Nutrition Program coupons 2008-2010.**

*Relationship between FMNP Redemption and Distance*

Pearson correlation analyses showed no significant association between the distance WIC participants had to travel to their nearest farmers' market and the redemption rate of FMNP coupons (Figure 4).

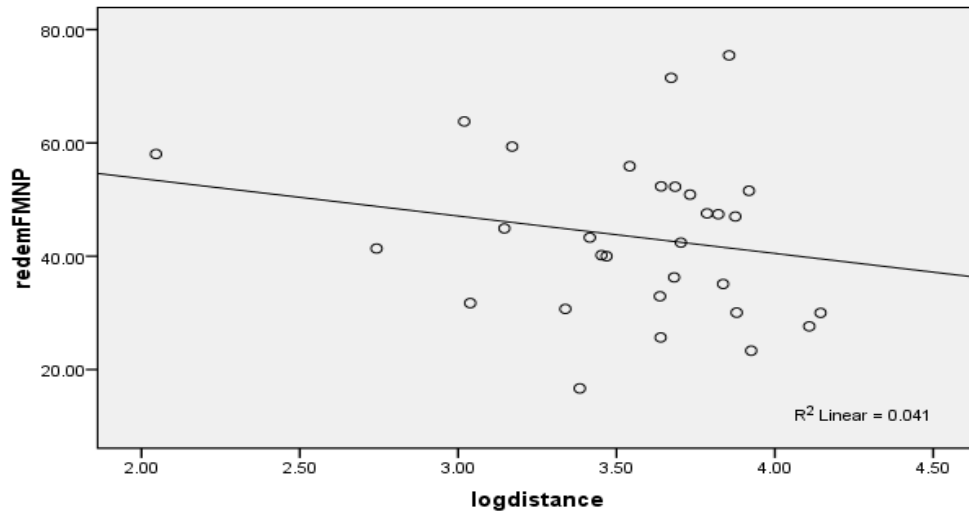
**Farmers' Market Nutrition Program Redemption Rate Versus Distance Traveled in all of Arizona**



**Figure 4. Relationship between redemption rates of Farmers' Market Nutrition Program coupons at WIC clinics and distance to nearest farmers' market location in Arizona.**

WIC clinics and farmers' market located in urban areas of Arizona, classified as any location in Coconino, Maricopa or Pima county, yielded a non-significant, inverse relationship (R value=-0.203) between FMNP redemption rates and distance traveled (Figure 5).

**Farmers' Market Nutrition Program Redemption Rate Versus Distance in Urban Areas of Arizona**

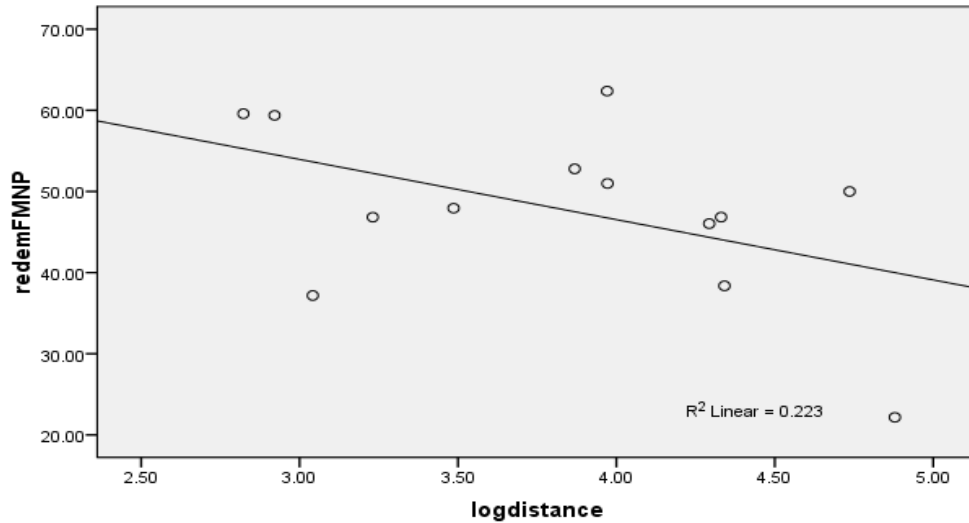


Urban areas of Arizona were classified as any Farmers' Market location that was located in Coconino, Maricopa or Pima county.

**Figure 5. Relationship between redemption rates of Farmers' Market Nutrition Program coupons at WIC clinics and distance to nearest farmers' market location in urban Arizona.**

WIC clinics and farmers' market locations in rural areas of Arizona, classified as any location not in Coconino, Maricopa or Pima county, yielded a non-significant, inverse relationship (R-value=-.473) between FMNP redemption and distance travelled (Figure 6). Statistical analysis yielded a weak, non-significant inverse relationship between distance and FMNP redemption rates at farmers' markets in both rural and urban Arizona (Table 4).

**Farmers' Market Nutrition Program Redemption Rate Versus Distance in Rural Areas of Arizona**



Rural areas of Arizona were classified as any farmers' market location not located in Coconino, Maricopa or Pima county.

**Figure 6. Relationship between redemption rates of Farmers' Market Nutrition Program coupons at WIC clinics and distance to nearest farmers' market location in rural Arizona.**

**Table 4.**

**Relationship between redemption rates of Farmers' Market Nutrition Program coupons at WIC clinics and distance traveled to nearest farmers' market location in rural, urban, or both areas of Arizona.**

Location	Farmers' Markets (n)	Redemption Rates (%)	Mean Distance Travelled (m)	R-value <sup>a</sup>	p-value
Arizona	44	44.9	8,455.20	-0.226	0.146
Rural	13	47.7	17,434.60	-0.473	0.103
Urban	31	43.7	4,689.60	-0.203	0.282

<sup>a</sup> R-values were obtained using a Pearson correlation



## Chapter 5

### DISCUSSION

Several studies have shown that the WIC CVV and FMNP programs may be effective at increasing the consumption of fresh fruits and vegetables among a high-risk, low SES population (Anderson et al., 2001; Herman et al., 2008; Kropf et al., 2007; National Association FMNP, 2002). However, results of the present analyses show that WIC CVV and FMNP redemption is still poor at farmers' markets in Arizona. Less than 1% of WIC CVV vouchers were redeemed at farmers markets during 2009-2010, and FMNP redemption rates were only 43.3%, well below the national FMNP redemption average of 59% (Federal Register FMNP, 2008). However, with this being said the addition of WIC CVVs in 2009 appeared to have a positive effect on FMNP redemption as the redemption rate improved by 5.3% in 2009. Conversely, it should be noted that redemption rates the following year returned to a level close to that of 2008. This suggests that perhaps the promotion of the WIC CVV program and the opportunity to spend both FMNP and WIC CVV dollars at farmers' markets may have contributed to the large increase in redemption rates seen in 2009 and then subsided the following year if interest in use of CVV at farmers' markets was not maintained. Furthermore, it appears that having the additional option of using either WIC CVV or FMNP at farmers' markets also plays a role in WIC CVV redemption levels. In this study, WIC CVV redeemed per month was significantly higher during the months when WIC participants had the option of spending

either WIC CVV or FMNP coupons at farmers' markets, as opposed to WIC CVV only during the months of November through February. One might point out that WIC CVV redemption is simply higher due to seasonality; FMNP is available primarily during the summer months. However, Arizona is actually different to most states in that the growing season is typically in the early spring and late fall. Furthermore, many farmers' markets are not open or have limited hours of operation during the summer months due to the intense heat. Therefore it plausible to suggest that higher WIC CVV redemption rates during the summer months at farmers' markets were more likely due to the addition of another subsidy (FMNP) and not purely the effects of seasonality.

The present data also reflect that WIC shoppers who chose to redeem their WIC CVV at farmers' markets received a significantly higher percentage of their total WIC CVV voucher value than those who redeemed their WIC CVV at grocery stores. Farmers at markets are more likely to throw in an extra apple or banana to meet the total CVV value, whereas grocery stores do not have the ability to do this at the register and will not let customers pay the difference. A lot of WIC participants perceive farmers' market produce as being more expensive (Briggs et al., 2010; Grace et al., 2007). This perception is creating a major barrier to the use of these entities by this particular demographic group. One particular research study actually found that local produce sold at a farmers' market is cheaper than produce sold at the grocery stores (Pirog & McCann, 2009). However, this study took place in Iowa during the peak of the growing season, so

the outcome might not be reflective of farmers' market prices in other states. Whether or not farmers' market produce is cheaper or more expensive than grocery store produce seems dependent on the location and season. However, the present data suggest a higher total redemption of WIC CVV value at farmers' markets than grocery stores, and this might offset any possible difference in total price between the two locations.

Although many WIC participants in Arizona appear to be benefiting from increased access to fresh fruits and vegetables via these subsidies, the data suggests that more than half of WIC FMNP participants still do not redeem these benefits. There may be several factors responsible for poor WIC and FMNP redemption at farmers' markets in Arizona. Accessibility, seasonality, awareness and the price of produce have all been shown to play a role in farmers' market use by WIC participants (Brown, 2002; Grace et al., 2007; Herman et al., 2006; Racine et al., 2010). Proximity to neighborhood farmers' markets from WIC clinic locations where they are issued may play an integral role in the likelihood of WIC shoppers redeeming their vouchers.

In this study, the distance that WIC CVV and FMNP recipients had to travel to the nearest farmers market to redeem their FMNP coupons was not significantly associated with redemption rates. Analyses focused specifically on either rural or urban farmers' markets similarly yielded non-significant results. There may be several plausible explanations for why there was no significant association between distance and redemption rates. First, the average proximity

between issuing WIC clinics and the nearest farmers' market that accepts FMNP coupons is approximately 8.5 km (5.3 miles), which is well out of walking distance and makes the walkability of Arizona neighborhoods irrelevant when considering proximity as a factor because it is unlikely that individuals will be walking those sorts of distances to redeem coupons. Second, the number of farmers' markets that accept WIC CVV and FMNP coupons is still limited in Arizona. When calculating the distance to the nearest farmers' market from each WIC clinic, only farmers' markets that accepted WIC CVV and FMNP were included. This disqualified potential farmers' markets that may have been within walking distance from WIC clinics; these markets might have been more likely to have higher redemption rates due to better proximity. The main reason for a limited number of farmers' markets accepting WIC CVV and FMNP in Arizona is largely due to insufficient infrastructure. A lot of small-market farmers do not have the additional money to invest in EBT terminals that would allow them to accept SNAP benefits and as a result decide not to participate in any food assistance programs. However, one unaccounted for factor may play the biggest role of all in the poor WIC CVV and FMNP redemption rates at farmers' markets.

A general lack of awareness about farmers' markets and the ability to use their WIC CVV vouchers at farmers' markets may be a significant limiting factor in Arizona. When WIC participants were surveyed at WIC clinics across Maricopa County, Arizona, only 64% had ever heard of a farmers' market and only 34.2% reported every being to a farmers' market in Arizona (AZDHS,

2011). These data suggest that a basic lack of awareness about farmers' markets may be a major factor in determining the number of WIC participants who frequent farmers' markets. In an effort to promote farmers' markets and improve awareness among WIC participants, the AZDHS created a 5-minute DVD about farmers' markets that will be played periodically in the waiting rooms of Arizona WIC clinics. In addition, clinics are also stepping up their promotion of farmers' markets by providing flyers to WIC participants and hanging posters on the walls of their waiting rooms. Promotional campaigns should also include data that supports the benefits of using WIC CVV at farmers' markets, as opposed to grocery stores.

Future research studies should examine the effectiveness of current promotional campaigns that attempt to increase awareness about the use of WIC CVV and FMNP at farmers' markets. Furthermore, researchers should design and implement innovative methods of increasing basic awareness about these food assistance programs and encourage WIC participants to use their subsidies at farmers' markets. In addition, designing studies that are well-controlled and address whether or not WIC CVV and FMNP significantly increase fruit and vegetable intake will add credibility to these food assistance programs. Lastly, researchers should look at whether or not increasing the number of farmers' markets that accept WIC CVV and FMNP has a significant effect on redemption.

## Chapter 6

### CONCLUSION

In summary, this study included analyses of redemption rates of WIC CVV and FMNP coupons at Arizona farmers' markets and grocery stores in 2008-2010 to establish whether or not there were any noticeable trends in redemption. Results showed that less than 1% of all WIC CVV vouchers issued to WIC participants in 2009 and 2010 were used at farmers' markets. However, the redemption of WIC CVV was significantly higher at farmers' markets during the months when both WIC CVV and FMNP coupons were available for use by WIC participants. Furthermore, those who redeemed their WIC CVVs at farmers' markets received a significantly higher percentage of their total CVV value than those who chose to redeem their WIC CVVs at grocery stores. With regard to FMNP coupons, redemption rates still continue to be well below the national average. Accessibility has been highlighted by many researchers as a major barrier to the redemption of both WIC and FMNP coupons across the nation. However, the present analyses demonstrated no significant relationship between the distance traveled by WIC participants to their nearest FMNP-approved farmers' market and redemption rates of FMNP coupons in Arizona.

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APPENDIX A

MAP OF AZ WIC CLINICS AND FARMERS' MARKETS

AZ Farmers' Market and WIC Clinic Locations

