DEMOGRAPHIC, HOUSEHOLD AND PERSONAL CORRELATES OF FRUIT AND VEGETABLE INTAKE FOR LOW-INCOME, MINORITY ADOLESCENTS IN AUSTIN, TX

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DEDICATION

To my mother, Carolyn

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ABSTRACT

OBJECTIVES

Fruit and vegetable intake (FVI) is below recommended levels among adolescents in the U.S., especially among low-income populations and minorities at higher risk for diet-related disease. The main objective of this study was to explore household, demographic and personal factors related to FVI in a sample of low-income minority adolescents from five schools in Austin, Texas. Secondary objectives were to look for factors related to household access & availability (AA) and to address the implications of a food-gardening related intervention in this sample.

METHODS

Cross-sectional baseline data taken in January 2009 for the *Sprouting Healthy Kids* intervention evaluation was analyzed. The sample included 194 primarily low-income, Hispanic parent and student pairs. Parent and student questionnaires were compared to identify independent demographic (DFs), household (HFs) and personal factors (PFs) of FVI in students. Social Cognitive Theory and the Social Ecological Model formed the basis of the theoretical framework for this study. Predictive Analytic SoftWare Statistics (SPSS) Version 18 was used to perform bivariate analysis and multiple linear regression.

RESULTS

Mean FVI for both the student and parent sample was below recommendations. A large percent of the variance in student FVI was explained by the HFs. The model that explained the greatest variance in FVI (AR^2=.33, p<.001) included a combination of DFs, HFs and PFs. Among factors in all models, *household AA* and *parent FVI* had the strongest association with student FVI. These relationships remained strong when adjusted for PFs. None of the PFs measured had a significant association with student FVI once adjusted for HFs & DFs. Students who had more *experience growing food*, *liked cooking FV*, and whose *family ate homegrown FV* more often had a higher FVI, but this may be confounded by other factors. Several HFs, including *adult support* and *experience growing FV* had a moderate, unadjusted correlation with Household AA in this sample.

CONCLUSION

Findings from this study support other studies which have found household AA and parent FVI to be highly associated with young persons' FVI. Since no causal relationships can be determined with this study design, future research that includes qualitative focus groups and longitudinal methods is warranted. Current interventions targeted towards parents and FV AA in the household should be evaluated for effectiveness and increased. Food gardening may indeed be an effective method to increase FVI in students and parents in this sample, however more research is needed to determine whether this method is well-received by the target population (low-income Hispanics).

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Abbreviations

AA – Access & Availability

CDC—Centers for Disease Control

FV – Fruits and Vegetables

FVI—Fruit and Vegetable Intake

SCT—Social Cognitive Theory

SEL—Social Ecological Theory

SLT—Social Learning Theory

SFC—Sustainable Food Center

SHC—Sprouting Healthy Communities

SHK—Sprouting Healthy Kids

SNAP—Supplemental Nutrition Assistance Program

WIC—Supplemental Nutrition Assistance Program for *Women, Infants and Children*

Preface

For a young person, eating behavior is the result of an array of ingredients that create the unique environment in which they are living and growing. In Oslo, Norway, a piece of fruit may be cheaper than a bag of chips; in the rural countryside in Nepal, a young person may only have the choice of eating the one plate of rice and dal they are offered; while in Austin, Texas, an easy family dinner for an exhausted mom may be on the dollar menu at the fast food restaurant down the street.

We are aware now, more than ever before, that the food we consume on a daily basis matters. For a young person, not acquiring the proper amount of nutrients can lead to poor performance in school, suboptimal physical growth and more frequent illness. Yet, the adolescent period is marked by a decline in healthy eating patterns. One eating behavior that is particularly important is the consumption of fruits and vegetables. Fruits and vegetables grow in a wide variety of flavors in every land across the globe, and provide us with nearly all the vitamins, minerals and phytochemicals we need for good health. We are told to consume a variety of at least 5 fruits and vegetables a day for the prevention of disease. Adolescents who do not meet these guidelines are at greater risk for poor health outcomes.

In order to help adolescents meet these guidelines, it is necessary to understand the specific factors which are most associated with the consumption of fruits and vegetables. Because eating behavior is highly contextual, it is also important that it be examined with a contextual lens; especially within subgroups of populations that are at a greater risk for dietary-related disease.

However, diet is not one-dimensional. Factors that influence fruit and vegetable intake exist within multiple domains, such as the household and school. *Social-Ecological Theory* (SEL) proposes that these domains are interconnected and that successful behavioral change cannot come when one is conducive to change but the other is not. For adolescents

the home environment is one domain that has not been thoroughly researched and for which there are many knowledge gaps.

A multi-component intervention to increase healthy eating behavior in middle school students has been in effect since January of 2009 in a primarily low-income urban area in Austin, Texas. This study attempts to identify household, personal and demographic factors that were associated with fruit and vegetable intake in the students at the start of the intervention by examining data reported by both parents and students.

This study is important in light of the high levels of childhood obesity and chronic disease currently burdening the U.S., particularly within low-income, minority groups. Billions of dollars are being spent on treatment of diet-related disease each year. Furthermore, millions of people are without health insurance to cover these costs. Therefore appropriate contextual interventions to increase healthy eating and prevent disease are vitally important at this time.

This thesis begins with an introduction, which describes: 1) the global and national challenges with low FVI, 2) a bit about adolescents and FVI, 3) factors related to FVI of adolescents, 4) popular theory related to FVI, 5) a brief profile of Austin and *Sprouting Healthy Kids*, and ends with 6) the theoretical framework and research objectives addressed in the study. Chapter 2 explains the methodological aspects of the study. Chapter 3 describes the results from the data analysis. The final chapters, 4 and 5, will discuss the main findings and present conclusions and recommendations for interested stakeholders. Bon appetite!

1. Introduction

1.1. Background

1.1.1. Global Outlook

Fruit and vegetable consumption (FVI) is an important factor in the preservation of health and the prevention of disease. A variety of fruits and vegetables provides most of the essential nutrients our body needs for growth and repair, such as potassium, dietary fiber, vitamin C and folate (1). Despite this well known fact, a very small percentage of the world population meets the recommended intake guidelines. The World Health Organization (WHO) estimates that if all individuals were to consume 400 grams of fruit and vegetables daily, worldwide coronary disease levels would be lowered by 31%, stroke levels lowered by 19%, and cancer incidence would decrease by 12-20% (2,3). In total, 2.7 million deaths would be prevented every year with adequate FVI worldwide (2).

Low FVI is a problem that burdens countries at all levels of development, however the factors related to low FVI may differ by geographic region and subpopulations. WHO defines low FVI as eating less than 400 grams or 5 servings daily. A review from the Netherlands examined the global variability of fruit and vegetable consumption across 52 low and middle income countries and found that in most countries the adult population surveyed had about 80% low FVI (4). The review also found that urban living, age, sex and income were the most common factors associated with low FVI. A similar consumption level in adults residing in more developed countries like the U.S. and Australia has also been found (5).

1.1.2. Diseases related to low fruit and vegetable intake

Currently, almost half of the top ten leading causes of death in the U.S. are associated with low FVI, including type II diabetes, cardiovascular disease, stroke and some cancers (6). Heart disease is at the top of the list, followed by stroke (2^{nd}), cancer (3^{rd}) and diabetes (6^{th})

(7). The rate of diabetes incidence is growing every year and the Centers for Disease Control in the U.S. reported that in 2007 about 7.8% of the U.S. population, or 23.6 million people, were affected with the disease (8). Diabetes places a large burden on the healthcare system in the U.S., with about 174 billion spent annually on the total health care and related costs for the treatment of the disease. The expense is also great for the diabetic individual who has to spend on average 2.3 times more on medical costs than a person without diabetes (8).

There are two main types of diabetes. Type I diabetes usually affects children and young adults and is thought to be inherited (9). The second type of diabetes, Type II, accounts for 90-95% of the total number of cases of diabetes and is more closely related to diet than Type I. Onset of Type II diabetes usually occurs in adulthood, although poor eating habits in youth can put them at greater risk for developing diabetes later in life. As risk factors for diabetes rise in the young population, such as obesity and impaired fasting glucose, the incidence of diabetes Type II is also increasing. Minority youth are especially at risk for developing the disease (8). Among all non Hispanic White people, 6.6% have diabetes, compared to 7.5% of Asian Americans, 10.4% Hispanics, and 11.8% of African Americans. It is predicted that 2 in 3 children who are Hispanic or African American will develop diabetes in their lifetime, compared to 1 in 3 children in the entire population (9).

Diseases associated with dietary imbalance are interrelated. For example, cardiovascular disease is the leading cause of death for people with diabetes, occurring 2 to 4 times more frequently in adults with diabetes compared to adults without the disease. Heart disease and stroke cause death in about 68% of people with diabetes (8).

A major risk factor in the development of diabetes and cardiovascular disease is being overweight. Although no causal relationship has been determined, overweight status is associated with lower preference for and intake of FV (10). Right now, over a third of the population aged 2-19 years are considered overweight in the U.S. by BMI standards. Statistics also show that overweight and obesity also varies by ethnicity; almost 68% of Hispanic people and 69% of Black people were considered overweight or obese in 2007 (11).

1.1.3. Disparities in health care provision & access

Even in one of the most "developed" countries in the world disparities exist among those who receive healthcare and among the health status of individuals. The U.S. Census Bureau reported that 15.4% of the population was uninsured in 2008 (12). There were wide differences in coverage between different ethnic groups. Nearly three times as many Hispanics of all origins in the U.S. were uninsured (30.7%) compared to non Hispanic whites (10.8%). Of all ethnic groups, Hispanics were the most uninsured in 2008, with African Americans as the second least insured group. When comparing income groups, 24.5% of people that made less than $25,000 were uninsured versus the 8.2% that made more than $75,000. The census also reports that children in poverty and older children and youth are less likely to be uninsured.

The economic situation at the present time exacerbates the problem of the underserved accessing healthcare. The Census Bureau reports that 13.2% of all people in the U.S. were living "below poverty" in 2008 (12). This ranged from 8.6% of all White people to a high of 24.6% and 23.2% of all Blacks and Hispanics living below poverty, respectively. Children, a vulnerable subgroup, are at even higher risk for living below poverty in the U.S. Combining race and age statistics, the census reported that one third of Hispanic individuals younger than 18 years fell below the poverty threshold compared to 15.3% of White people in the same age group.

With these marked differences in healthcare and income in the United States, it is not surprising then that lower SES and ethnic minority children are in a higher risk category for poor health outcomes. Research shows that children from low-income families in the U.S. are more likely to suffer from colds and headaches (13), are at higher risk for obesity (14), and consume less fruits and vegetables (15). Hispanic and African Americans are associated with lower levels of fresh fruit and vegetable consumption and higher rates of diet-related chronic disease (5,6). Low-income, minority adolescents are of particular concern.

1.1.4. Adolescents & diet

Adolescence can be a determining stage in the long term health of an individual. This stage is defined by the American Heritage Medical Dictionary as "the period of physical and psychological development from the onset of puberty to complete growth and maturity,"

which begins with the appearance of secondary sex characteristics and lasts up until the age of 20 (17). WHO defines adolescents as people who are 10-19 years of age (18).

Eating properly is essential during this life stage as rapid growth demands more nutrients to sustain it. For a healthy adolescent, fruits and vegetables can be an excellent source of most of the nutrients they need, including potassium, dietary fiber, vitamin A, vitamin C, folate, and vitamin E. They help protect against infection and cell oxidation of fatty acids, assist in proper bowel function and growth and repair of body tissue, help heal wounds, provide a feeling of satiety, and keep the skin and gums healthy (1). The recommended intake of fruits and vegetables depends on physical activity and sex as well as age, however for the average young adolescent (age 9-13 years), 1.5-2.5 cups (3 servings) of fruit and 2-4 cups (4 servings) of vegetables per adolescent daily is suggested (19).

Unfortunately, the average adolescent in the U.S. has a poor diet with low FVI. Studies in the U.S. have identified a trend towards more unhealthy eating patterns from elementary school years (approx. age 5-10) to middle school years (approx. age 11-14) (20). On one hand, research shows a linear decrease in the consumption of fresh fruit and vegetables, fruit juice and milk during this time (21). While on the other hand, soda consumption and fast food has a positive linear relationship with age as kids mature into adolescence. The 2007 Youth Risk Behavior Surveillance Survey reported that only 0.4% of boys and 1.1% of girls (14-18 years) ate 5 or more FV per day (22). A more recent report from The Centers for Disease Control in 2009 also stated less than 1% of all adolescents are meeting USDA guidelines for fruit and vegetable consumption, eating on average, 0.51 cups of fruit and 0.72 cups of vegetables (excluding French fries) daily (5).

A lack of adequate nutrition, including poor consumption of fruits and vegetables, will automatically put an adolescent at greater risk for short and long-term health problems. These include eating disorders, obesity, cardiovascular problems, diabetes, asthma, and joint problems (23,24). Atherosclerosis, associated with poor dietary habits, is a major known cause of heart disease which can begin to develop in childhood and adolescence (25). The prevalence of type II diabetes has increased in children and adolescents in conjunction with an alarming increase in overweight and obesity in this age group over the last few decades. There are three times as many overweight adolescents today, aged 12-19

years old, as there was 20 years ago. Around 70% of adolescents who are overweight are predicted to be overweight adults in the U.S. (11). These health problems can have a devastating social and financial impact on the adolescent during their lifespan.

1.2. Literature Review

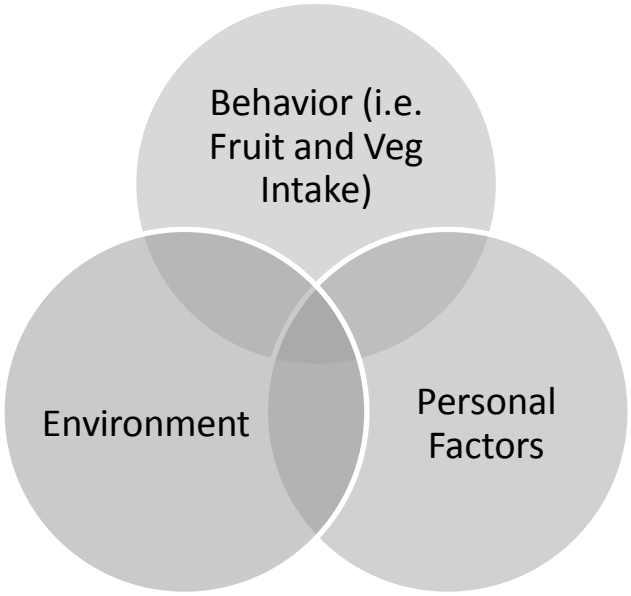
1.2.1. Theory behind fruit and vegetable intake in adolescents

There are several theories which have become widely accepted as a basis for research on dietary behaviors. These include The Social Learning Theory (a.k.a. Social Cognitive Theory) and the Ecological Model (a.k.a. Social-Ecological Theory). Central to both theories is *reciprocal determinism*, a concept that sees behavior and the environment as reciprocal systems where affect is flowing in both directions (26).

Social-Cognitive Theory

The Social Cognitive Theory (SCT), also known as the Social Learning Theory (27) was originally developed by Albert Bandura (28). SCT describes the interplay of an individual's personal characteristics, such as their knowledge and expectations or beliefs about a certain behavior, their surrounding environment, and their actual behavior (26). In the example of fruit and vegetable intake, an adolescent's household availability of fresh vegetables may affect their preference for certain vegetables, causing them to select or bypass them in the lunch line or at a restaurant. Learning more about the health benefits of FV might change their expectations about eating vegetables. Participation in a school or community garden, as another example, could increase their motivation for eating that vegetable the next time around. The individual is not a passive recipient in this process, but rather their environment is continually shaping and being shaped by their eating behavior. See figure 1.1 for a simple illustrated explanation of SCT in fruit and vegetable intake.

Figure 1.1. ***Social Cognitive Theory and fruit and vegetable intake***



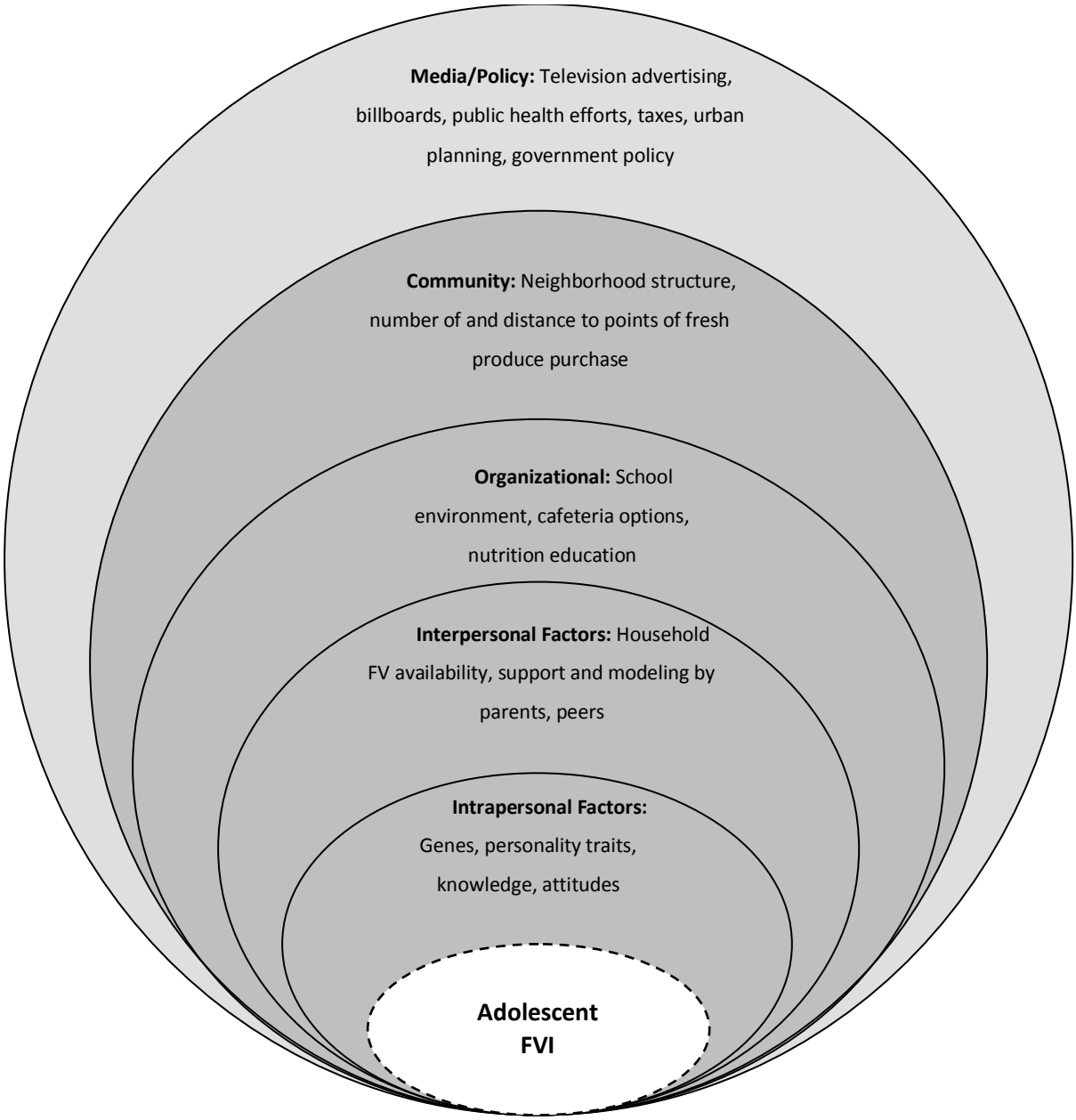
*** Within this theory certain key forces are at work that determine behavior change, including: *reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning* and *reinforcement*. "No amount of observational learning will lead to behavior change unless the observer's environments support new behaviors." (27)**

1.2.1.2. Social-Ecological Model

The development of eating behaviors can be further understood in the context of the Ecological Perspective (29). Like SLT, the Ecological Perspective is based upon the active exchange between the individual and their environment. However, this perspective addresses the multiple social, physical and cultural dimensions that can either enable or inhibit behavior change. Bronfenbrenner categorizes these dimensions into four main levels of influence: The *individual* (intrapersonal), *social* (interpersonal), *physical* (community), and *environmental* level (30). Glanz referred to this as the Social-Ecological Model (SEM) and redefined the levels in relation to health promotion, naming them: *personal, interpersonal, organizational, community, and public policy* (31). The *intrapersonal* layer includes personal factors such as personality traits, genes, knowledge, attitudes and beliefs. The *interpersonal* level includes the influence of family, friends and peer groups. The *organizational* level includes the influence of policy and informal structures that promote certain behaviors, such as the school environment. The *community* level encompasses social networks and norms or standards that exist within these networks. For an adolescent, this might include extracurricular activities like an after school club or sports team. The outer-most level,

media & public policy, includes the influence of media as well as local, state and federal policies that uphold public health recommendations. See figure 1.2 for a visual representation of the SEM model in relation to FVI Intake.

Figure 1.2: Social-Ecological Model and adolescent fruit and vegetable intake



According to SEM, behavior change, such as increasing fruit and vegetable intake, can only be achieved by creating supportive environments across all levels in the model. For different subpopulations, some environments may play a more important role. This thesis

aims to explore the household environment and the factors that may influence fruit and vegetable intake in low-income, minority adolescents, since very little research has been done in this area.

The following section is a review of research on demographic, household and personal factors and their association with adolescent FVI.

1.2.2. Correlates of FVI among adolescents

1.2.2.1. Demographic Factors

For an adolescent, fruit and vegetable consumption may be highly dependent on predetermined factors. A systematic international review including 98 quantitative studies found *gender, age/grade, social economic status (SES), race/ethnicity,* and *urbanization* to be the most significant demographic determinants of fruit and vegetable intake among children and adolescents (32). A more recent review by Pearson, *et al.* looked at adolescent and children studies separately, and found that *parental education, household income, occupational status and SES* were the most researched demographic variables in adolescent studies (34).

Gender, in particular, has been found to be strongly related to FVI in adolescents (21). Quantitative evidence shows that girls tend to skip meals more often than boys at this life stage and boys tend to consume more overall, making it more likely that boys are meeting their vitamin and mineral recommendations than girls (21). On the other hand, adolescent females' concern with health and body image is positively associated with fruit and vegetable intake (35). A study on the correlates of FVI in low-income and urban Mexican children by Perez-Lizaur and colleagues, found a significant difference of FVI by gender, where 15.2% of girls ate three or more fruits and vegetables a day, compared to 6.7% of boys (36).

Most research has found age to be negatively correlated with FVI during the adolescent period. It is hypothesized that as children transition into adolescence, self-efficacy for choosing their own foods increases along with influence by their peers. Along with eating

less fruits and vegetables, consumption of soft drinks and fast foods also increases during this time period (37). This trend may also vary by gender and income. To illustrate, the percentage of adolescents meeting the recommendation for 5 fruits and vegetables a day in a large Minnasota-based cohort study was found to increase with age among adolescent females; the reverse was true for males (38). However, the consumption of "other vegetables" (excluding fried potatoes) increased with age for both sexes in this study. Research from other countries has also identified sex to be a determinant of FVI in young people. A longitudinal study of FVI patterns in Norwegian youth aged 14 to 21 found a 1-2.5 times decrease in mean frequency of FVI (39). Other research reviews including quantitative studies from more developed settings, have identified moderate tracking of FVI with age especially for low-intake and high-intake groups (35).

Evidence has also shown that there is a difference in adolescent consumption of fruit and vegetables by ethnic group (40). People from different ethnic backgrounds have been found to consume different foods (41). The eating patterns of adolescents may mirror that of their parents, who choose to eat more foods that are traditional to their own ethnic group. Consumption within ethnic groups also varies by country. Rasmussen, *et al.*, performed an extensive international review of published papers on the correlates of FVI in children and adolescents and identified one British study that observed that Black adolescents consumed more fruits and vegetables than their White and Asian counterparts (32). A Danish study found that as an unspecified group, immigrant adolescents were found to consume higher amounts of fruits and vegetables than Danish children (42). Overall most U.S. research that looks at race/ethnicity as a determinant has inconsistent results. In a study based in Minnesota with a very large sample size, it was found that Hispanic children consumed the least amount of fruits and vegetables compared to non-Hispanic Black and non-Hispanic White children (38). However, only teenage boys that were not of white, black or Hispanic ethnicity in this study consumed an average of four or more FV daily. Additional research in Minnesota and Georgia has found fruit and vegetable intake to be related to ethnicity (43). African-American children aged 8-10 were found to consume more fruits and vegetables compared to other children in other ethnic groups in the Minnasota study, whereas in Georgia, European-Americans consumed the most fruits and vegetables.

More fruit and vegetable consumption along with other healthful patterns has been observed among adolescents whose parents have a higher level of education (44). The level of *parent's education* can influence fruit and vegetable intake through a number of avenues. Increased education can lead to higher paying jobs which lead to a higher budget for purchasing food, as well as increased knowledge about the benefits of fruits and vegetables. A review of studies examining parental education as a determinant for fruit and vegetable intake found the majority of samples studied were related positively to fruit and vegetable intake as a composite variable (34). One study examining dietary quality and demographic variables in adolescents found a positive association between parental education and vegetable consumption, along with higher intakes of carbohydrates, calcium, protein, fiber, folate, and vitamin A (45).

Income has been widely researched as a major determinant of dietary patterns. Fruit and vegetable intake has been found to be poorer in lower socio-economic (SES) groups (44). In the U.S., state-level surveys on adolescents have found that as many as 40% of low-income adolescents do not meet recommendations for fruit and vegetable consumption (46). However, Pearson's review of family correlates of FVI in adolescents found that household income has a different relationship with fruit intake and vegetable intake (34). The majority of the studies included in this review were from the U.S. and Europe. In four studies household income was found to be related to fruit intake, in three studies unrelated, and one study inversely related. As for vegetable intake, it was found to be unrelated in all nine studies reviewed (34,40,45).

Parent's *occupational status* has also been shown to have a relationship with young persons' fruit and vegetable intake. Pearson's review of family correlates of FVI intake found that all studies that included occupational status of parents were positively correlated with fruit intake (34). In an earlier review of studies, occupational status was found to be positively correlated with FVI as a combined construct (32). Including research mostly from the U.S. and Europe (due to a lack of English-language studies from other countries), this review also revealed that the relationship of occupational status might be dependent on the role of the parent. When comparing occupational status by parent, mothers' occupational status was associated in more studies than fathers' occupational status.

1.2.2.2. Household Factors

Household Accessibility and Availability of FV

In terms of the household environment, *availability* may refer to the how plentiful and visible FV is in the house and *accessibility* may refer to whether FV is available in the home in a manner that facilitates consumption (47). Together, availability and accessibility are seen as environmental influences that can either enable or inhibit consumption (48). Research is limited on parent and household factors associated with fruit and vegetable intake in adolescents, however, published studies have thus far found availability and accessibility of fruits and vegetables in the home to be strongly correlated to intake (16,48,49).

One large study conducted on 4,746 adolescents in Minnesota, called Project EAT-I, Neumark-Sztainer and Colleagues found adolescent-reported home availability to be the strongest correlate to adolescent FVI (50). A subsequent study selected a random sample of adolescents from Project EAT-I and conducted phone interviews with their parents using an adapted version of the Project EAT survey. In this sample of 902 adolescents and their parents, Hanson and colleagues discovered that parent-reported household availability was found to be positively associated with adolescent-reported fruit and vegetable intake in girls (51). Among the adolescents who lived in homes where fruits and vegetables were always available compared to sometimes available, they reported consuming an additional 1.3 servings of fruits and/or vegetables daily. Longitudinal research was also conducted on the same sample of adolescents five years later (52). When examining parent reported home *availability* from baseline (1999), adolescent intake of fruits and vegetables at time 2 (2005) was not significantly correlated. Household availability was only assessed with one question in this survey: "How often would you say fruits and vegetables are available in your home." On the other hand, those adolescent's whose parent's reported "always" serving vegetables at dinner vs. sometimes/never reported between .45 and .62 additional daily servings of fruits and vegetables at time 2.

A European study including four countries (Belgium, Netherlands, Portugal and Spain) examined the determinants of FVI in normal weight compared to overweight boys found

that *availability* of FV at home was related to increased FVI consumption in overweight boys (53). Availability in this study was measured with by a scale that included three items on availability of a variety of FV, availability of preferred FV, and whether or not preferred FV was purchased. Another study on Mexican adolescents found a positive association between high FV *accessibility* and frequency of FV consumption (Chi-square=6.699, P<.01) (36). The scale for accessibility was not described in this study.

There are a variety of ways used to measure accessibility and availability of fruits and vegetables, as mentioned in the literature. Although no known studies have compared the two constructs to see if they are interrelated, it can be speculated that they are highly related within the home environment. If accessibility is high in a home (foods are available in a manner that facilitates easy consumption) than they are more than likely available (present in the home). In relation to fruit and vegetable intake it is probably important that foods not only be available but also accessible, therefore should probably be measured together. In this study, they are examined as a combined construct (*Household AA*).

Parent Intake and Modeling of FV

Parental FVI has been found to be strongly associated to both child and adolescent FVI (34,49). A study done on a sample of 1106 primarily low-income and multi-ethnic middle school students in Montreal, Canada, found that elementary aged children's intake was higher when parent's intake was higher (33). The Project-EAT study, conducted in Minnesota with a large representative sample, also found parent intake to be a significant correlate/predictor of FVI in children in both cross-sectional and longitudinal studies of the same sample (51,54). A study on mostly White, married women in Washington who identified themselves as the head Family Food Preparer (FFP), found that fiber intake by the FFP significantly predicted children's FVI (55).

Although it is speculated that adolescents are more highly influenced by their peers, research suggests this may not be the case. Woodward *et al.* surveyed a large group of Australian adolescents (aged 12-15) and found that student's self-reported perception of their parents' intake of specific foods had a larger regression coefficient in relation to their own intake of the same foods, as compared to a much lower regression coefficient of perception of peers' intake of the same foods (56).

Other studies have suggested that the relationship of parent intake and child intake may differ between fruits and vegetables. Gibson, et al. surveyed 92 women (mostly White and middle-income) and their children in London and found that the children's intake of fruits did significantly correlate with the mothers' intake of fruit, but their intake of vegetables was not related to their mothers (57).

Parent & family support

In a U.S. study examining psychosocial correlates on adolescent dietary behavior by Zabinski *et al.,* family support was a positive correlate for fruit and vegetable intake across all stratified subgroups (gender and age). The family support scale specifically included questions measuring parental encouragement for consuming fruits and vegetables (58). Lien and colleagues found positive relations with parents to be a related factor in fruit and vegetable intake of the total sample of 613 Norwegian adolescents; when stratified by gender and SES, it was found only to be significantly related in low SES girls in particular (59). Perceived parental evaluation of diet was also found to be associated to FVI of adolescents in the bivariate analysis of this study, with a higher correlation found in low SES males and females.

Active parental encouragement was found to be related to vegetable intake in overweight boys that took part in the pro-children's study (beta>.10) but not normal weight boys (60).

Family Meals

The frequency of family meals and family dinners have both been found to have positive impact on adolescents' dietary quality, including increased consumption of fruits and vegetables (34). Gillman and colleagues compared the dietary intake patterns of children and adolescents who ate dinner with their family most nights and children who ate dinner with their family infrequently (61). A significant positive association was found between those that consumed family dinners more frequently and more healthful eating patterns, including more fruits and vegetables.

Surveys and studies examining the family meal have found that both parents and adolescents still perceive it as an important activity and conducive to healthier eating (21). At the same time, these surveys have found that a very small percentage of adolescents in the U.S. eat dinner with their family on a daily basis, and this percentage decreases as children get older.

Other household correlates

Other family or household correlates to FVI that have been identified in research, but have not been measured in this study, include parenting styles, family connectedness, eating out with parents, helping to prepare food, and parent-child interactions (34). Parenting style is thought to be an important household psychosocial correlate to FVI in adolescents and children, however statistical evidence from large multi-country studies suggest that this relationship is actually very weak (60).

1.2.2.3. Personal Factors

A myriad of personal or "intrapersonal" correlates to adolescent fruit and vegetable intake have been identified in research with a breadth of operational definitions for each construct. This review only attempts to cover the main research findings, but comparison of definitions is beyond the scope of this study. Some of the most common personal predictors of fruit and vegetable intake in adolescents found in both longitudinal and cross-sectional studies included *preferences, intention, awareness, self-efficacy, belief in health* (females), and *concern for body image* (females) (35).

Preference, Taste and Liking of FV

Food preference has been found to be an important predictor of food choices (21). Food preference was also found to be a primary influence on fruit and vegetable consumption of adolescents in an extensive review of longitudinal and cross-sectional studies by Geller and Dzewaltowski (35).

Like preference, taste is highly related to food choices in adolescents (21), both the taste for healthy and unhealthy foods. Several U.S. based studies have shown that adolescents who rank taste as an important motivating factor for their food choices have less healthful eating choices than adolescents who rank parent influence or health reasons as top factors that motivate food choices (62,63). The quality and freshness of fruits and vegetables usually affects their taste. In adults, eating freshly-picked vegetables has also been shown enhance consumption across some ethnic groups (64).

A meta-analysis of studies on 6-12 year old children by Blanchette and Brug found that *taste preferences* was one of two factors that was most frequently positively related to FVI in this age group (49). The majority of these studies were conducted in the North America or Europe, due to a lack of peer-reviewed research in other places. Gibson and colleagues found that in the South of England, 9-11 year olds' taste or "liking" for vegetables was positively correlated to children's vegetable intake (R^2= .33, p<.005) (57). Another study of overweight and normal weight adolescent boys in Europe found that liking vegetables was found to be a predictor of intake across both weight groups (Beta > .10) (60).

Self-Efficacy

Self-efficacy is defined as an individual's perceived ability to perform a behavior (65). Self-efficacy has been considered an important and necessary determinant of fruit and vegetable intake in children and a predictor for eating behavior in studies with adolescents (21). Self-efficacy for making healthful food choices has also been associated with eating less high-fat and high-sugar foods (66).

De Bourdeaudhuij and colleagues found self-efficacy to be one of two common predictors identified in a subsample of both normal and overweight 9-13 year old adolescent boys from the Pro Children study that spanned across four countries in Europe (60).

Motivation/Outcome-expectancies

Outcome-expectancies, a term that emerged from Bandura's Social Cognitive Theory, describes a positive set of beliefs about the outcome of a particular behavior, which can also be understood simply as *motivation*. Dibsdall *et al*. suggest that motivation is a key

psychosocial correlate to fruit and vegetable intake in his qualitative analysis of attitudes and behavior towards access, availability and motivation for eating fruit and vegetables in low-income consumers (67). Without recognizing there is a problem, the researchers suggest that dietary improvement is unlikely (67).

An interesting study about adolescent motivation and food choices by Contento *et al.*, found that adolescents whose parents served healthy foods that the students liked had more healthful eating patterns than those who selected "taste" and "social orientation" as top reasons for food choices (62). Another study found that 9-11 year olds who perceived confectionaries as unhealthy ate less of them (57). On the other hand, the same study found that the kids who gave vegetables the highest rating for being "healthy" tended to eat less vegetables overall.

The importance of nutrition has been found to increase with age, and qualitative data has shown that the majority of adolescents do not perceive nutrition as high priority.

Nutritional knowledge

There is very little evidence that knowledge alone can cause adolescents to eat healthier (68). Most studies in the past decade have failed to find a strong association between nutritional knowledge and dietary intake. In one meta-analysis that included literature of adults, adolescents and children, the average association was very low (R=.01) (69). Poor association has been explained by the use of ad hoc knowledge instruments in most studies as well as the fact that most studies that examined knowledge primarily looked at knowledge of fat intake, where the majority of the population has been inoculated over the past decade with education on fat-intake and cardiovascular health (70).

However, a study on a large and representative cohort by Wardle, et. al., examined nutrition knowledge and dietary intake using a psychometrically validated instrument (70). They found that nutrition knowledge was not only significantly associated with higher levels of fruit and vegetable consumption and lower intake of fat, it was also a partial *mediator* of education level and occupational class influence on fruit and vegetable consumption. The highest quintile of nutrition knowledge was almost 24 times more likely to meet the "healthy diet" description in the study, which included more fruits and vegetables.

Alluring to note, mother's nutritional knowledge has been found to have a stronger relationship with children and adolescent dietary intake. In particular, one study found a negative association with children's energy intake and a positive association with the proportion of fiber consumed (57). Mothers' nutritional knowledge was also strongly related to the fruit intake of children in this study.

Experience Gardening

Although very little longitudinal research has been done, most likely due to the time involved and the difficulty in getting a large enough sample size, cross-sectional research has shown that experience with gardening food can be beneficial towards mental and physical health and is related to increased levels of fruit and vegetable consumption. Studies that have looked at gardeners as a population have found that they consume more servings per day of fruits and vegetables compared to non-gardeners and to the average population (71). Urban community gardeners in Philadelphia were found to be more frequent consumers of vegetables and more infrequent soda drinkers (72).

Adolescents who have been exposed to garden experiences at school have been found to increase their intake of fruits and vegetables. A case-control trial on 6th graders in southeastern Idaho found that 6th graders who participated in garden-activities along with nutrition education reported a significantly higher intake of fruit, vegetables, vitamin A, vitamin C, and fiber at the end of 12 weeks, compared to students who had only nutrition classes and students in the control group (73). Overall their FVI significantly increased by over 2 servings from the start of the intervention.

1.2.3. Cross-sectional studies, paired samples of parents and children

Only a few studies have looked at the associated factors of young adolescent FVI using both parent and child self-reports.

One London-based study recruited mothers and their 9-11 year old children from primary care registers and compared a set of demographic, dietary and psychosocial variables reported by mother's and a set of variables reported by the children (57). The sample was primarily White, scored low/medium on the deprivation index, and all were English speaking. A food frequency questionnaire was used to assess parent's diet and a 3-

day dietary diary was used for the children, with the help of parents. Parent and student nutritional knowledge, factors influencing food choice, and preference for certain foods were reported separately by each group. In addition, demographics and belief and attitudes regarding diet-disease relationships were assessed from the mothers. Predictors for fruit and vegetable intake were assessed separately. Multiple regression models were constructed using the stepwise method to find the best predictors for fruit, vegetables and confectionary intake of children. For fruit intake, mother's nutritional knowledge, mother's fruit consumption frequency and mother's attitude to fruit, vegetable and child's cancer risk explained 34% of the variability in the sample of children's fruit intake. Child's *liking for common vegetables* and mothers *concern for disease prevention* were the only significant predictors for vegetable intake, explaining 17% of the variability. Another noteworthy association found in this study was that mothers liking for confectionary (but not children) was associated with children's intake of confectionary. One could speculate that mother's preference for confectionary could translate into higher availability in the household, inviting more frequent consumption by children.

Another cross-sectional study by Hanson et al.(51), used both parent and child reports to examine correlates related to the home environment (AA of FV and parent intake) with adolescent FVI. A total sample of 902 parents and students were surveyed. Students filled out the Project Eat Survey along with the Youth Adolescent Food Frequency Questionnaire, and parents were interviewed via telephone about their own intake and about household AA. General linear modeling was used in the statistical analysis and the sample was stratified by gender. Both home availability and parent intake were related to FVI of girls but not for boys.

Bere and Klepp also used parental and self-reports of 6th and 7th grade adolescents in Norway to investigate the correlation of parent and child intake, and to compare reported AA, preferences, and skills in relation to FVI (74). Multiple linear regressions were used in the statistical analysis. The model that included both parent and self-reported variables explained 34% of the variance in fruit and vegetable intake. Child-reported preferences and AA explained the most unique variance of FVI, however parent intake was also important.

1.2.4. Examining correlates across domains

Only a few cross-sectional studies on adolescents have attempted to analyze the combined relationship of correlates across multiple domains (household, personal, etc.) with FVI. None however, have looked at household, demographic and personal factors in low-income adolescents.

The Bere & Klepp study, mentioned in the previous section used multiple household and personal correlates reported by both children and parents in a combined multiple regression model. The focus in this study was comparing the predictive ability of child and parent reports to child FVI, and the study found that child reports explained more of the variance in FVI (31% compared to 12%). However, fewer parent variables were included than child variables which limit the findings.

A large cross-sectional study including Norwegian adolescents at age 15 (n=616) examined reported demographic, personal, and environmental correlates to FVI, sweet/chocolate intake and soft drink intake (59). Lien *et al.* measured FVI by summing the responses to two questions that asked to rate the average frequency of consumption of fruits and vegetables over the past three months. SES was measured by parents' reports of occupational status however the all other study variables were reported by the child. Multiple regression models were created to find the best predictive models within personal factors, family factors, friend factors, and school/society factors and one model was created that identified the best predictors across domains. Several demographic variables, including gender and SES were significant in the combined model. Dieting, *perceived parent's evaluation of his/her diet*, *perceived teacher evaluation of academic performance* and *antisocial behavior* were found to be significant predictors in a model that predicted 20.4% of the variance (Adjusted R^2) in FV intake.

1.3. Austin, Texas and Sprouting Healthy Communities

The Austin metropolis makes up 6.8% of the people in Texas, with a population of 1,652,602 people. The population is estimated to grow to about 2,292,737 in 2020 (75). Austin has a relatively young population, with a median age of 32.6 years. Twenty-six percent of the population in Austin is below 18 years of age. About one third of the population is ethnically Hispanic (30.1%), with the remainder of the population being 56.5% White, 7.2% Black or African American, and 4.4% Asian (75). The majority of the Hispanic

population comes from Latin American countries and over a third of the population speaks a language other than English at home.

Austin is home to the University of Texas, a university with over 50,000 undergraduate and graduate students, and several other smaller universities and colleges. As a result of the high number of educational institutions, about 38.4% of the population has a bachelor's degree or higher, compared to 25.5% of the population in Texas and 27.5% of the U.S. population. Almost 86% of the eligible population graduated high school, compared to 79.1% of the Texas population and 84.5% of the U.S. population (75).

Despite a highly educated population many remain unemployed. Austin ranked 4th among the 50 largest metro cities in the U.S for the highest unemployment rate (6.9%). Along with unemployment, poverty is high. The overall poverty rate in Travis County is 14.4%, whereas the child poverty rate is 18.2% (76). Almost 32 percent of Hispanics, 31% of Blacks and 11% of Whites are living under poverty in Texas (77). Compared to national figures for the average cost of living in the U.S., Austin is a slightly cheaper place to live. Households, on average, earn over 3000 more a year than the national median household income of $52,029. Median home price is 10,000 dollars less than the national average. Groceries make up about 92.5% of the national average for grocery expenditures for each family, taking up about 12% of each family's income in the U.S. Other cost-of-living expenditures in Austin include 29% for housing, 10% for utilities, 11% for transportation, 4% for healthcare, and 33% for miscellaneous expenditures. Although overall expenses are less than the national average, cost-of-living is higher than other cities and towns in Texas. Sales, property and other tax is higher than the national average for these taxes, but there is no income tax in Texas so overall taxes are less than the national average (78).

The food environment has its advantages and disadvantages. As of writing (May 2010), there are 9 farmers markets that happen throughout the week, but this is only .009 per 1000 people (76). There are 19 registered community gardens. The number of fast food restaurants is over five times as high as the number of grocery stores. There are more pounds of sweet snacks and soft drinks available per capita than fruits and vegetables. It is also cheaper to buy a soda than low-fat milk in Austin and cheaper to buy refined flour. On the other hand, fruit is cheaper than packaged sweets and salty snacks. Austin is an urban

area, but urban farms in the city and on the outskirts exist. There are 94 farms with a total of 47 acres used to harvest vegetables. Only 1.3% of the farms sell directly to the consumer (76).

Despite plentiful farmland and cheap food, Texas ranked second highest for percentage of "food-insecure" families in 2008, according to a recent report by the Center for Public Policy Priorities (79). Food insecurity can be defined as "the limited or uncertain availability of nutritionally adequate safe foods, including experiences such as running out of foods, running out of money in order to buy food or buying cheaper foods because of financial constraints"(80). Children and adolescents that come from homes with poor food security are more likely to have poor health then those that are food secure and have less fruits and vegetables in their home (81). Obesity is also linked to food insecurity and nearly 1/3 of children and youth ages 10-17 were considered overweight or obese in Texas in 2007 (82). One way to measure food security in an area is to observe the level of activity by emergency food assistance programs. On average, there are over 3 million people who participate in the Supplemental Nutrition Assistance Program (SNAP) in Austin per month. However, this is less than one-third of the low-income population in Austin.

The geographic area of Austin where the research for this thesis study took place is called East Austin (see appendix 1). Select zip codes in East Austin were selected for the *Sprouting Healthy Communities* (SHC) grant because of the high percentage of low-income minority residents and relative poor food security. A large percentage of food assistance requests on the Travis County emergency calls line (2-1-1) were made by residents living within East Austin zip codes in 2009, three of which (78753, 78723, and 78752) were part of the SHC target area (83). The combined impact of several negative health risk factors (low-socio-economic status, high minority population and poor food security) makes this part of Austin a target of health interventions, such as SHC. A sampling of the median income in East Austin neighborhoods shows that this area is slightly poorer than the rest of Austin; ranging from a low of $ 19,906 to a high of $52,533. Over half of East Austin residents are Hispanic, compared to an average of 31% in the city of Austin (77). East Austin is also home to a slightly younger population. One out of three people in the seven zip codes East of Austin, are under 18 (77).

SFC & the Sprouting Healthy Communities neighborhood-based intervention

The Sustainable Food Center (SFC) has been working to address the issue of poor security in this area of Austin. SFC is an Austin-based non-profit organization that was founded in 1993. Its overall aim is to strengthen the local food system by increasing knowledge of and access to affordable and nutritious foods (84)**.**

The *Sprouting Healthy Communities* intervention is a pilot project for the Sustainable Food Center. It focuses on expanding the Sustainable Food Center's main activities in a geographical area of east Austin covering four zip codes (78723, 78724, 78752, 78753), where income levels are especially low and resident's have been identified as being high risk for diet-related disease. The main objectives of the project have been to increase: 1) the number of school gardens along with nutrition education in schools, 2) local produce in school cafeterias, 3) community gardens & garden workshops in the community, 4) neighborhood farm markets, 5) cooking classes and 6) neighborhood demonstrations at community events.

The *Sprouting Healthy Kids intervention* is one part of *the Sprouting Healthy Communities intervention*. The components of this middle-school based intervention include hands-on school garden activities, complementary nutrition education and a farm-to-school program in the cafeterias, which together target the student's intrapersonal factors related to eating (85).

So far, a pre-post test study has been done evaluating the effects of SHK (86). The main finding of the evaluation was that there was a dose-response relationship with the number of components a child is exposed to in school. However, the sphere of influence on eating behavior is not limited to the school. No research has been done on the relationship of the household environment on the interpersonal (personal) factors and fruit and vegetable intake.

1.4. Rationale for Study:

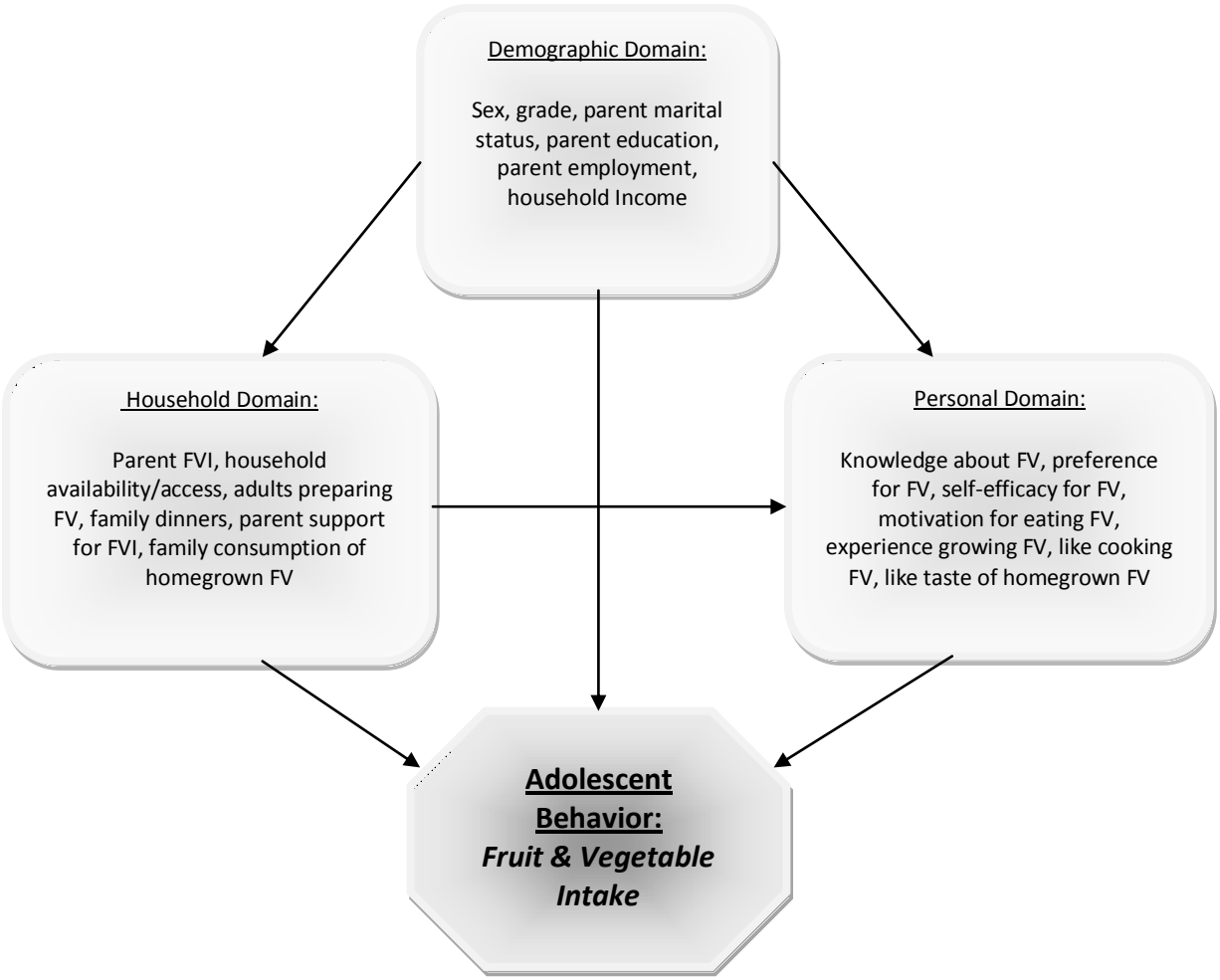
When it comes to low fruit and vegetable intake in the population, young adolescents are of special concern. It is an important stage of growth and development, yet it is characterized by declining healthy habits which are tracked into adulthood. Low-income

minorities are also at risk, both for poor FVI and related health problems. The research presented in this literature review only touches upon the complexity of adolescent eating behavior. Demographic factors, the household environment and personal characteristics all have an influence on adolescents' consumption of FV, but very little research has attempted to compare these levels of influence and used a combination of parent- and student-reported information. In addition, we know that FVI is contextual, yet there is a lack of information about the home environment and its relationship with FVI in low-income minorities. In Texas, the food environment is unfavorable and prevalence of diabetes and obesity are high among minority children and youth. The Sprouting Healthy Kids intervention, one part of the Sprouting Healthy Communities intervention, addresses this problem in a high-risk area through garden-based activities and nutrition classes in middle schools in Austin, Texas. A pre-post study has been done on the students and found a dose-response relationship with the school-based intervention components. To compliment this, it would be beneficial to understand what role factors in the household of the adolescent may play; and how different domains in an adolescents' environment (i.e. demographic, household, and personal) may interact and confound one another. This study attempts to address this gap, by examining correlates of FVI using information from both parents and students in sample of low-income, mostly Hispanic-American middle-school students.

1.5. Conceptual Framework and Objectives

1.5.1. Conceptual Framework

The following model has been chosen for the framework of this study. Both the SEL and SCT models overlap in this model, where environmental factors are divided into those that fall within the household and demographic domains. The model shows the hypothesized pathways of the student- and parent-reported demographic, household and personal factors in relation to FVI. Factors included in the demographic domain are independent socio-demographic characteristics that are thought to influence adolescent FVI as well as the household domain. The household domain includes those factors which may play a role in creating the home food environment of the adolescent and also may influence personal factors. The personal domain includes key SCT interpersonal factors as well as a few additional factors measured in the study that relate to SHK intervention components (i.e.



gardening and cooking FV). It is believed that both demographic and household factors may confound personal factors' influence on FVI.

Figure 1.3: Conceptual model for the study: fruit and vegetable intake of adolescents influenced by interacting demographic, household and personal factors

1.5.2. Objectives

The main objective of the study was to explore factors within household environment (HFs) as well as personal factors that characterize the adolescent (PFs), and their association with fruit and vegetable intake (FVI) within a sample of middle school students in primarily low-income, minority schools.

Five specific research questions were addressed in this study:

1. What are the main demographic characteristics/factors associated with FVI of students?
2. When considering the influence of demographic factors, how well do household factors relate to FVI of students?
3. When considering the influence demographic and household factors, how well do personal factors relate to FVI of students?
4. Since Household AA has been found to be an important determinant of FVI in other adolescent samples, are there any demographic, household or personal factors that are associated with Household AA in this sample?
5. Do measures of interest and experience with gardening and cooking give us information for current intervention development?

2. Methodology

2.1. Introduction

This is a secondary analysis of data collected for the *Sprouting Healthy Kids* (SHK) intervention evaluation. The aims of the Sprouting Healthy Kids (SHK) evaluation were originally to assess the middle school participant's change in *knowledge, self-efficacy* and *fruit and vegetable consumption* using a pre- and post-test design. Socio-demographic information psycho-social information and information about diet was collected at baseline using the *SHK Parent* and *SHK Student questionnaire*. Data from these two baseline questionnaires were then used in this study. Variables in the demographic, household, and personal domain were identified from this data using both previously tested scales and newly formed constructs tested for internal reliability. Data analysis was performed to answer the research questions based on the theoretical model for this study. Predictive Analytic SoftWare (SPSS) Version 18.0 was used for all statistical analyses.

2.2. Study Design & Sampling

This study is a cross-sectional study of students from 5 middle schools (grades 6 & 7) and their parents, that were invited to participate in a garden-based nutrition education program called *Sprouting Healthy Kids (SHK)*. This intervention was designed to reach a specific area of Austin that is the target of the *Sprouting Healthy Communities* (SHC) multi-level intervention, and all middle schools in the target area were invited to participate in the study. Therefore, the sample was strategic and non-randomized. Four of the middle schools (Dobie Middle School, Webb Middle School, Gus Garcia Middle School, and Pearce Middle School) fell within the Sprouting Healthy Communities target area. An additional fifth school (Ann Richards Preparatory School for Girls) was included because socio-demographic characteristics at this school were similar and a large percentage of the students came from the SHC target area. All five schools had a high percentage of students who qualified for

"reduced lunch" (a federally funded assistance program for low-income families) and had a student body that was predominantly Hispanic and African-American.

2.2.1. Recruitment

Data collection for SHK took place during January 2009. The study was approved by the UT Health Science Center Institutional Review Board (86). Research staff from the *Michael & Susan Dell Center for the Advancement of Healthy Living* (MSDC) contacted intervention school principals in December 2008 to identify an appropriate staff liaison to collaborate with during data collection. In early January 2009, school staff persons and MSDC staff coordinated a distribution of the parent packets at each school. The parent packets included: An invitation and informational sheet about the Sprouting Healthy Kids Study, a promotional flyer, a consent form, and a parental survey. All classes in grades 6 and 7 from each school were invited to participate and the only inclusion criteria for participation in the study were the ability to read English or Spanish, and consent to participate in the study from both parents and students. Exclusion criteria included students who did not return either a parent consent form or a matching parental survey.

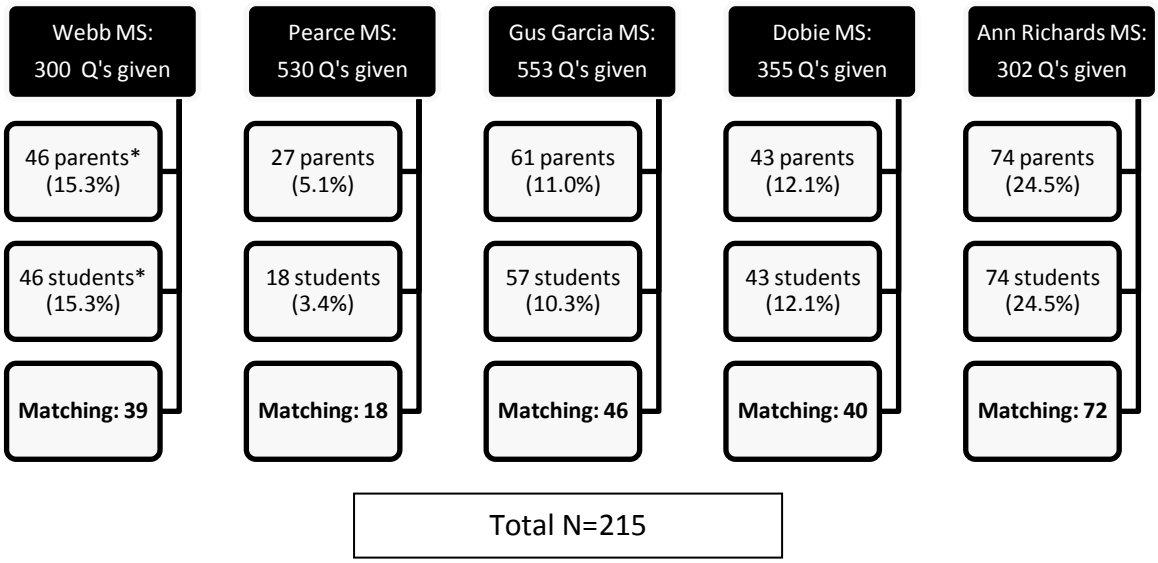
There were different recruitment procedures for each school because of their unique infrastructure and administration. The parental packets were either delivered directly to the students by the research staff during a selected class period, or delivered to the school staff member who then distributed the parental packets to the students. Students then were responsible for taking the parent packets home to parent/guardians and returning the completed packets approximately one week later to their teachers who collected and turned the packets in to the appropriate school staff member.

MSDC research staff returned to the school after one week's time to collect parental consent forms and distribute pre-test surveys to those students who returned signed consent forms. Students whose parents agreed to their child's participation in the study were usually asked to come to a specific room during an advisory period to fill out the pre-test surveys. This was overseen by trained research staff from MSDC and the Sustainable Food Center (SFC). After completing the pre-test surveys, student incentives were handed out and parental incentives (see ***incentives*** below) were post-mailed to parents. Some schools required multiple visits within the span of a few weeks time, to administer pre-test

surveys to students who may have been absent or attending field trips on the scheduled day.

A total of 2040 questionnaires were handed out amongst the 5 schools. Of these, 251 parents (12.3% response rate) returned consent forms and the parent questionnaire, while 238 students filled out a student questionnaire. Of the completed parent and student questionnaires, 214 students and parents could be matched. The diagram below shows the initial distribution of questionnaires, the response rate of parents and students, and the final number of questionnaires from all schools.

Figure 2.1. Questionnaire distribution and response from Sprouting Healthy Kids intervention schools



***Q denotes parent questionnaires. The first white box shows the number of questionnaires returned by parents, the second box shows the number of questionnaires filled in by the students, and the third shows the number of matching parent and student questionnaires. Out of a total of 2040 parents invited to participate, 215 (10.5%) parent and student pairs completed the questionnaires.**

2.2.2. Incentives

Students, parents and school staff who took part in the study received a small incentive for their participation. Parents received a grocery store (*HEB*) gift card of $5 for and students received a gift card to *Target* stores for $5. Support school staff received a $10 gift

card and all schools that agreed to participate in the SHK Intervention received a $500 incentive (86).

2.3. Data Analysis

2.3.1. Study Instruments: SHK Parent & Student Surveys

The SHK parent questionnaire and the SHK student questionnaire were the two instruments used in this study. Both questionnaires have been pilot tested and used in the SHK pre-post evaluation. Spanish language versions were created in order to meet the needs of the surveyed population that was over 50% Hispanic (86). Both questionnaires included: demographic questions, the Dietary Assessment Tool for Hispanics (DATH) food frequency questionnaire (Evans, Wakimoto), and home access/availability questions. In addition, the parent questionnaire was designed to measure family eating and shopping habits, participation in gardening/cooking classes, and food security. The student questionnaire included validated subscales to assess interpersonal correlates of FVI (preferences, knowledge, motivation and self-efficacy) (87), validated subscales to measure access/availability in the home (48,85,88), questions about family, friends and peers and additional questions designed to evaluate the SHK intervention (85,86).

For the purposes of this study, the parent questionnaire was used to measure parent demographic factors (*ethnicity of parent, language of survey, parent marital status, parent employment status, parents' highest education, number of adults in household,* and *household income*) and several household factors (*parent FVI, parents prepare FV*); the student questionnaire was used to measure student *demographic variables* (sex, age and grade), and additional *household factors* (household AA, frequency of family dinners, parent support of FV) and student interpersonal or "personal" factors (*self-efficacy/motivation/preferences/knowledge*). Several other descriptive variables were measured by the parent survey that were included in the univariate analysis, including parent participation in cooking & gardening classes, participation in federal assistance programs (SNAP/WIC), and food security. The questionnaires can be seen in detail in the appendix 2.

Factors the main analyses were chosen based prior research and availability of information in the questionnaires. A total of 7 independent demographic factors, a total of 6 independent household factors, and a total of 8 personal factors were examined. Specific measurement scales and indexes formed for each factor are described in the following section.

2.3.2. Study Variables

Demographic

Parent-reported (parent questionnaire):

Ethnicity of Parent was assessed by one question (#61) with 7 options. Ethnicity was later categorized into *Hispanic* and *Non-Hispanic* because the majority of participants (69%) were Hispanic. ***Marital Status*** was assessed by one-question (#63) with these options: "married," "single/never married," "divorced/separated," or "widowed." For analysis, this variable was changed to a dichotomous variable with *non-married* (divorced/separated, widowed, or single/never married) and *married* as the two categories. ***Employment Status*** was one question (#64) and also had four responses to chose from: "full-time," "part-time," "retired," and "stay-at-home full-time." For analysis responses were categorized into two categories: *employed* (full-time or part-time) and *unemployed* (retired or stay-at-home full time). ***Highest Education*** was assessed by one question (#65) with ordinal responses beginning with "<12 years of school" and ending with "higher than graduate level education." For analysis this variable was transformed into 2 categories: *no college* and *some college or higher*. ***Total Household Income*** was also one question (#66) with ordinal categorical responses ranging from a low of $0-$999 to a high of $5000 or more. A dichotomous variable was formed, with *low* ($0-999 and $1000-1999) and *medium/high* ($2000 or more). These categories were chosen according to the poverty level for a family of 4 since the average family in our sample had 3 children (89).

In addition, participation in WIC, SNAP, and Reduced Lunch was also assessed by a yes or no question in the parent survey and used in this study. Responses to two validated food security questions (90) were also assessed in the descriptive analysis. These questions were

Likert scale items that asked participants whether they *worried* or *ran out* of food at the end of every month.

Student-reported (student-questionnaire):

Grade and ***Sex*** of the student were demographic variables that were used for the purposes of this study. Sex was assessed with one question (#1) with possible responses being *male* or *female*, while grade was also one question (#3) with possible responses including 6th, 7th, or 8th grade; however all students sampled were either in the 6th or 7th grade so the 8th grade category was dropped from the analysis.

Household Variables

Parent-reported:

Parent's Fruit and Vegetable Intake (Parent FVI)

Daily intake of fruits and vegetables by parents was measured in two ways. One item (#51) asked for a numerical response to the average number of daily servings of fruit and vegetables. The second way of measuring FVI included a simple equation involving 7 items taken from the DATH questionnaire (questions 43-49). Each item asked the parent to rate their weekly intake frequency of certain fruits and vegetables. Response choices ranked between 1 ("never") and 7 ("two or more times per day"). These scores (1-7) were then recoded to match the weekly number of servings implied by the response. For example, 1 (never) was re-coded to 0, and 7 (2 or more times a day) was re-coded to 14. The total score was calculated by adding the ranked responses to the seven questions, with a maximum score of 49. This weekly score was then divided by 7 to obtain the average intake of fruit and vegetables per day. This number was operationalized as *servings* per day, since this is a concept and approximately one fruit or vegetable is equal to one serving. Possible scores ranged from a minimum of 0 to a maximum of 14 servings per day. A low score signified poor fruit and vegetable consumption, whereas a high score signified higher fruit and vegetable consumption (91).

The DATH food frequency questionnaire was previously tested for reliability and shown to have a good internal consistency (91). A group of 93 Hispanics were tested four weeks apart with the DATH, resulting in a reliability correlation coefficient of .64 (Cronbach alpha) for the test and retest scores of the fruit and vegetable screener. In the current study, this Cronbach alpha coefficient was .72. The DATH questionnaire is currently in the process of being tested for validity by Evans (86).

Parents Prepare Fruits and Vegetables (Parents Prepare FV)

This was a one item scale (#20) measured by a response to the statement "I prepare meals with fresh fruit and vegetables for my family," ranging from "never" to "5-7 days per week." These responses were skewed towards higher frequency, therefore were dichotomized for analysis into *lower frequency* (never to 4 days per week) and *high frequency* (5-7 days per week).

Student-reported:

Household availability and accessibility of fruits and vegetables (Household AA)

Household availability & accessibility of fruits and vegetables was measured by a summed score from student responses to nine questions (#28-36) in the student questionnaire. Students were asked to rate the level of access or availability of fruits and vegetables in their home, with possible responses ranging from "never" (1) to "yes, all the time" (4). These responses were re-coded from 0-3 for analysis and a score was then calculated by summing all nine responses. There was a maximum achievable score of 27 points and a minimum score of 0, indicated higher access/availability and lower access/availability to fruits and vegetables in the home, respectively.

Family dinner frequency (Family Dinners)

This was a one item scale (#60) in the student survey that is measured by degree to which they agree to the following statement: "In my family we eat dinner most days of the week," and there were four responses ranging from "not at all" to a lot. These responses were grouped into "low" (including "not at all" and "a little") and "high" (including "somewhat" and "a lot") and assigned a score of 0 and 1, respectively.

Adult Support

This was a 3 item scale (#56-58) from the student survey. A Cronbach alpha score of .84 was obtained from the sample responses, indicating a high internal consistency of the scale items. Each item (degree that adults in family *encourage* eating fruits and vegetables, degree that adults in family *care* about eating fruits and vegetables, and degree that parents *model* eating fruits and vegetables) had 4 response options each that ranged from 0 (not at all) to 3 (a lot). Total adult support for eating fruits and vegetables was then measured by the sum of these three scores, with a maximum of 0, indicating a low level of support for eating vegetables, and a maximum of 9, indicating a high level of support for eating fruits and vegetables.

Family consumption of homegrown fruits and vegetables (Family Eats HG)

This was measured by one item in the student survey (#18) that asks how often the family eats homegrown fruits and vegetables, ranging from "Not at all" to "A lot." This was treated as a scale item ranging from 1 (low) to 4 (high).

Personal Variables

Student-Reported

Student's Knowledge

Student's knowledge about healthy eating was measured by a total score from the responses to 6 questions in the student survey (#50-55). Each question tested students' food knowledge and were based on the objectives of the lesson component of the *Sprouting Healthy Kids* intervention. Students were asked questions like which vegetables could not be grown locally and what to read to know whether a food is good for you. Students scored one point for each correct answer and zero points for each incorrect answer. The maximum score achievable was 6, indicating higher knowledge of healthy eating, whereas the minimum score achievable was zero, indicating poor knowledge about healthy eating. The alpha coefficient for this scale using sample responses was .47, indicating moderate internal reliability.

Student's Preference

Student's preference for the taste of fruits and vegetables was measured by a total of the ranked responses to 2 questions in the student survey (#37, 38). The questions were phrased as statements regarding their preference for fresh fruits or fresh vegetables with possible responses ranging from "strongly disagree" (0) to "strongly agree" (4). Question 38 asked the student how well they agreed that vegetables taste bad, and therefore was reverse coded. A score was then calculated by adding the numerical value assigned to the responses for both questions. The highest score achievable was 8, indicating a high preference for healthy foods fruits and vegetables, whereas the lowest score achievable was 0, indicating a low preference for eating fruits and vegetables.

Student's Motivation

Student's motivation level for eating fruits and vegetables was measured by a total score of the ranked responses to 6 questions in the student survey (#66-71). Each question was a statement that student's were asked to rate their feelings about. For example, students were given statements such as: “If I eat fruits and vegetables, I'll have more energy," or "if I eat fruits and vegetables I'll have cleaner skin." Responses were in a Likert scale that ranged from "strongly disagree" (1) to "strongly agree" (5). A score was then calculated by adding the numerical value assigned to the responses for all four questions. Question #70 was a negative statement and was reverse coded for the scale. The maximum score achievable was 24, indicating a higher level of motivation for eating fruits and vegetables, whereas the minimum score achievable was 6, indicating low motivation for eating fruits and vegetables. The Cronbach alpha coefficient obtained for the motivation scale using responses from the sample was .725 for the 6 items, indicating a high internal consistency and that the scale is reliable for this sample.

Student's Self-Efficacy

Student's self-efficacy was measured by a total score of the ranked responses to 5 questions in the student survey (#61-65). The questions asked students to rate their level of confidence in certain situations such as choosing fruits instead of candy when they are under stress or choosing fruits and vegetables when eating at a fast food restaurant. Responses ranged from "not at all sure" (1) to "very sure" (5). A score was then

calculated by adding the numerical value assigned to the responses to all five questions. The highest score achievable was 20, indicating greater self-efficacy and the lowest score achievable was 0, indicating a poor level of self-efficacy. The alpha coefficient obtained for the motivation scale using responses from the sample was .73 for the 6 items, indicating a high internal reliability.

Likes growing food

This was a measured by one item in the student questionnaire (#10) that asks how well students' like growing food in gardens, ranging from "Not at all" to "A lot." This was treated as a scale item ranging from 1 (low) to 4 (high).

Experience growing food

This was measured by one item in the student questionnaire (#11) that asks students to rank the level of students' experience growing fruits and vegetables, with responses ranging from "Not at all" to "A lot." This was treated as a continuous scale item ranging from 1 (low) to 4 (high).

Taste for Homegrown Food

This was measured by one item in the student questionnaire (#12) that asks students to rank how much they like the taste of homegrown fruits and vegetables, with four responses ranging from "Not at all" to "A lot." This was treated as a continuous scale item ranging from 1 (low) to 4 (high).

Like Cooking Fresh Fruits and Vegetables (Cook FV)

This was measured by one item in the student questionnaire (#14) that asks students to rank how much they like cooking fresh FV, with four responses ranging from "Not at all" to "A lot." This was transformed into a dichotomous low (0) / high (1) scale.

Main Outcome Variable: Student Fruit and Vegetable Intake

Student fruit and vegetable intake was measured in the same manner as the parent intake scale, described previously.

Healthy Family Activities

In this study, participation in four healthy family activities measured from the parent questionnaire was also examined. Parents were asked whether they grew their own fruits and vegetables (#14), whether they have taken classes in the past three months that taught them how to grow fruits and vegetables (#15), whether they have attended any cooking classes in the past 3 months (#16) and whether their family shopped at farmers markets (#13). All questions had binary yes/no responses except for #13 (farmers market participation), that included "almost always," "sometimes," and "almost never or never." For the analysis in this study, this was combined into a participation ("almost always or sometimes") and non-participation ("almost never or never") category.

Statistics for the main study variables are summarized in table 2.1., which includes the number of items used for each variable construct, the range of possible scores, the total number who gave complete answers for the item or scale, the mean score and standard deviation for each continuous scale variable, and the Cronbach alpha coefficient. Variables are both student and parent-reported.

Table 2.1. Descriptive statistics for main study variables

Domain	Variable/Factor	No. Items	Range	*n*	Mean	SD	Cronbach Alpha Coef.
Student-Reported							
Behavior	*Student FVI (servings/day)**	7	0-14	194	3.75	2.3	.73
Personal	*Preferences**	2	0-8	193	5.8	1.6	~
	*Motivation**	5	0-24	189	18.4	3.6	.72
	Knowledge	6	0-6	188	2.8	1.5	.46
	*Self-Efficacy**	5	0-20	191	12.2	4.3	.73
	Experience Growing FV	1	1-4	193	2.2	.99	~
	Like Growing FV	1	1-4	193	2.4	1.0	~
	Like Cooking FV	1	1-4	193	0.4	.5	~
	Taste for homegrown FV	1	1-4	192	2.4	1.1	~
Household	*Household AA of FV**	9	0-27	194	15.4	5.6	.75
	Family Dinners	1	0-1	192	~	~	~
	Adult Support	3	0-9	192	7.3	2.0	.84
	Family Eats Homegrown FV	1	1-4	192	2.4	1.1	~
Demographic	*Sex*	1	0-1	192	~	~	~
	Grade	1	1-2	194	~	~	~
Parent-Reported							
Household	*Parent FVI (servings/day)**	7	0-14	179	3.5	2.3	.72
	Parents Prepare FV	1	0-1	192	~	~	~
Demographic	*Hispanic Ethnicity*	1	0-1	194	~	~	~
	Income	1	0-1	174	~	~	~
	Education	1	0-1	191	~	~	~
	Employment	1	0-1	188	~	~	~
	Marital Status	1	0-1	192	~	~	~

*** Scales or indexes that have been previously validated**

2.3.3. Statistics

Steps

Statistical analysis was divided into three parts. The first part included univariate analysis to describe the sample and bivariate analysis to look at trends in fruit and vegetable intake and the three domains of interest (demographic factors, household factors, personal factors). Healthy family activity variables were also examined in this step. T-tests and One-way Anova tests were performed on dichotomous and Likert scale variables with the lognormal *student FVI* variable (see ***outcome variable*** in the proceeding section) to assess group differences. Geometric means were used in reporting. Pearson correlations were also calculated to assess crude correlation values between the lognormal student FVI and the main explanatory variables.

In the second part of the analysis, three multiple regression models were built in order to answer the research questions. The strategy used to build these models is based on methods outlined in *SPSS Survival Manual* by Julie Pallant (92). Model 1 was built by first including all demographic factors as explanatory variables and lognormal Student FVI as the outcome variable. Multicollinearity and residual plots were checked. One outlier was removed since it was found to have residual values > 3.3 (92). Once entered, factors that had a p-value less than 0.25 were removed one by one from the model and all factors were re-evaluated. To build model 2, all demographic factors in Model 1 were included as potential confounding factors along with all household factors found to be correlated to the student FVI ($p<.25$) from bi-variable analysis. The same procedure was followed to remove variables that had a p-value greater than 0.25. To build model 3, demographic and household factors from model 2 (as potential confounders) and all personal factors were entered. The same method was used to decide on the final model variables.

In the third part of the analysis, Spearman correlations were calculated to assess the association of study factors (household, personal, demographic) with Household AA.

In the final part of the analysis, cooking and gardening variables reported by the student and healthy family activities reported by parents were analyzed to assess crude relationships with select demographic variables.

Outcome Variable

The main outcome variable assessed in the study was student's daily average fruit and vegetable servings (*student FVI*), measured on a continuous scale. Final scores from the student sample ranged from a minimum of 0 to a maximum of 14 servings daily. A high of 14 servings of fruits and vegetables equals approximately 7 cups of cooked vegetables or fresh fruits, and although this is a large quantity for an adolescent, only a few students reported consuming this amount. These cases were kept in the analysis in order to maintain a representative sample. Figure 2.2. shows a histogram of the distribution of scores for FV servings which is asymmetric and positively skewed. Since the variable was found to deviate from the requirements of normality (92) and was the main dependent variable in the study, the log function was chosen to transform scores into a *lognormal* distribution for the remainder of the analysis. This was done to improve pairwise linearity and residuals and to reduce extreme skewness and kurtosis. Figure 2.3 shows the distribution of scores for the log transformed student FV variable.

Figure 2.2. Histogram showing the untransformed distribution of student FVI scores

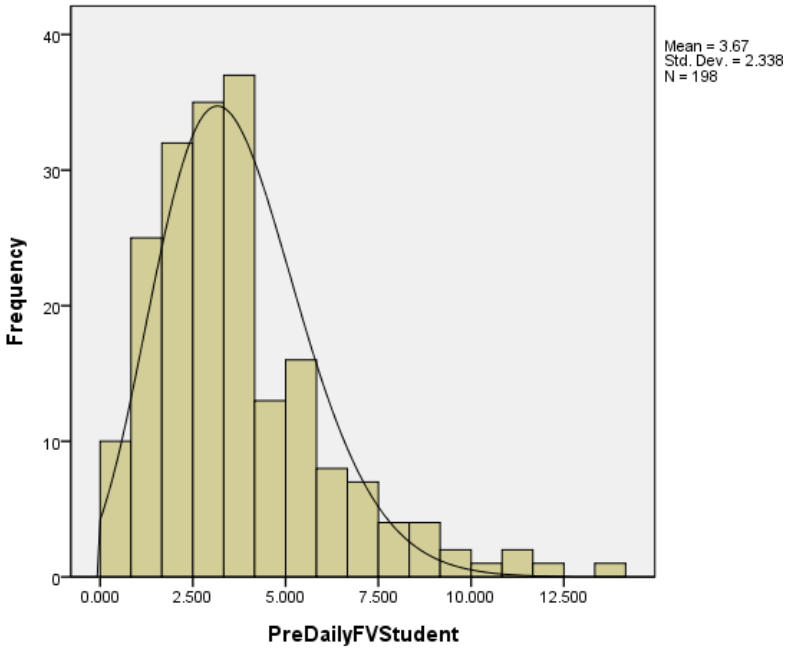
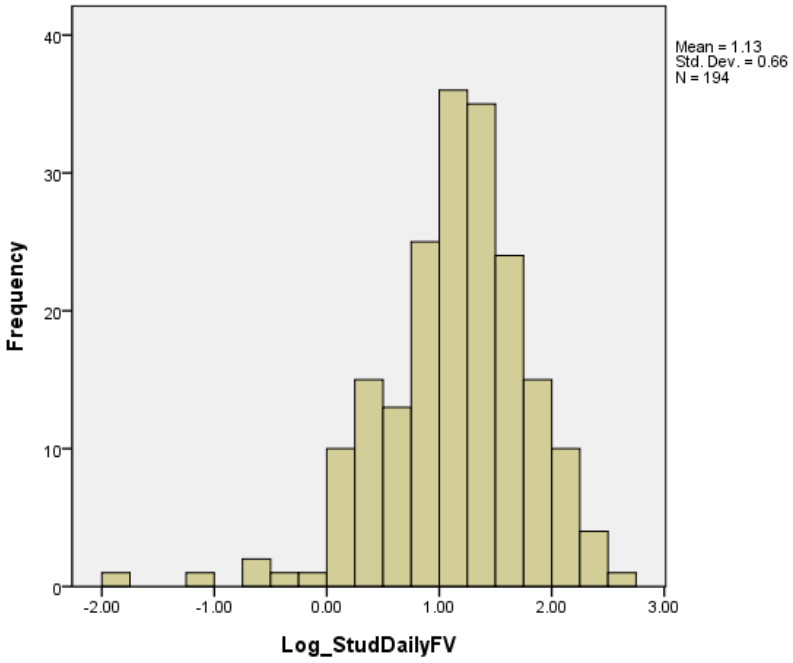


Figure 2.3. Histogram showing the log transformed distribution of student FVI scores



In the analysis of the 215 pairs of students and parents, 17 pairs were excluded due to incomplete responses to the questions that constituted the scale for student FVI. An additional four pairs were dropped when the student FVI was log-transformed since the scores became extreme negative outliers. The excluded sample of students (n=21) was compared to the retained sample (n=194) and found to be similar in terms of age, grade and income.

2.4. Ethical Considerations

2.4.1. Benefits to the participant

In participating in the Sprouting Healthy Kids intervention, parents may have benefited indirectly from the knowledge and skills the children bring home. Student's may have benefited from the lessons about eating healthy foods and increased exposure to locally-grown fruits and vegetables in the cafeteria and the school-gardens. One intention of this study is to bring about new knowledge about factors associated with FVI in order to improve interventions and ultimately the long-term health of the children and families involved.

2.4.2. Risks

This study has no known risks for participation. The information collected was considered low-sensitivity and participants were informed of their right to chose not to answer any questions that made them uncomfortable. There was no known risk of physical injury in participating in the survey.

2.4.3. Withdrawal

Participants were allowed to decline participation or withdraw from the survey at any time without penalty. Students could still participate in the intervention and fill out the pre-test questionnaire even if their parents did not fill out a parent survey; the only requirement is that they signed the consent form.

2.4.4. Confidentiality

Participants were informed that all data collected would be confidential; personal identifiers were removed per HIPPA requirements and replaced by a number. Data was stored in locked file cabinets only accessible to research staff in the interim between data collection and analysis. Research data is available upon request.

2.4.5. Ethical Approval

Prior to data collection, the Sprouting Healthy Kids evaluation study was approved by the Committee for the Protection of Human Subjects at the University of Texas Health Science Center at Houston as well as the Austin Independent School District Institutional Research Board (85). This study was reviewed in April 2009 and it was concluded unnecessary by the Norwegian National Committee for Medical and Health Research Ethics to receive official ethical clearance approval from their committee.

Written consent was collected from each parent for both parent and student participation. Compensation was given to all study participants and is described in the study design and sampling section of the *Methods* chapter. The participants were given notice that they could withdraw at any time and provided with contact information of the Principle

Investigator. The results of the study will be made available and all interested stakeholders will be informed of the location of these results.

3. Results

3.1. Sample Description

3.1.1. Demographic characteristics

Table 3.1 displays the main demographic characteristics of final sample of 194 parent/guardians. Since only 2.6% of the parent/guardians in the sample listed themselves as grandparents and "other," for the sake of simplicity they are referred to as *parents* for the remainder of the thesis. The table shows that the majority of the parents in the SHK sample were mothers, married, and worked either full- or part-time jobs. About the same percentage of parents who were either single or widowed reported that only one adult lived in the home (~18%). Less than half (36.6%) had ever attended college. A large proportion of the students' parents was Hispanic and lived in households with a net monthly income of $1999 or less. Most of the parents filled out an English questionnaire, however one-third filled out a Spanish questionnaire.

Table 3.1. Parent/guardian demographics

Parent/Guardian Demographics			
Relationship (n=194)	**n(%)**	***Marital Status (n=192)***	**n(%)**
Mother	168 (86.6)	Married	124 (64.6)
Father	21 (10.8)	Separated/Divorced	32 (16.7)
Grandparent	4 (2.1)	Single/never married	30 (15.6)
Other (Gaurdian)	1 (0.5)	Widowed	6 (3.1)
Ethnicity (n=194)		***Number of Adults in Home***	
White	24 (12.4)	One adult	34 (18.3)
Black or African-American	25 (12.9)	More than one adult	152 (81.7)
Hispanic or Latino	134 (69.1)	***Number of Children in Home***	
Other	11 (5.7)	1-2 children	82 (42.2)
Highest Education (n=191)		3+ children	110 (56.7)
<12 years	76 (39.8)	***Monthly Income - $USD (n=174)***	
High school graduate/GED	44 (23.0)	0-999	53 (30.5)
Some college	31(16.2)	1000-1999	50 (28.7)
College graduate	29 (15.2)	2000-2999	23 (13.2)
Advanced degree	11 (5.8)	3000-3999	16 (9.2)
Employment (n=188)		4000-4999	8 (4.6%)
Full-time	79 (42.0)	5000 or more	24 (13.8)
Part-time	42 (22.3)	***Language of Survey (n=194)***	
Stay-at-home full-time	64 (34.0)	Spanish	62 (32.0)
Retired	3 (1.6)	English	132 (68.0)

Figure 3.1 shows that more Hispanic parents had a monthly household income of $1999 or less than other ethnicities. Most of the White parents in the sample had a household income of $2000 or greater per month.

Figure 3.1 Histogram of Household Income by Parent Ethnicity

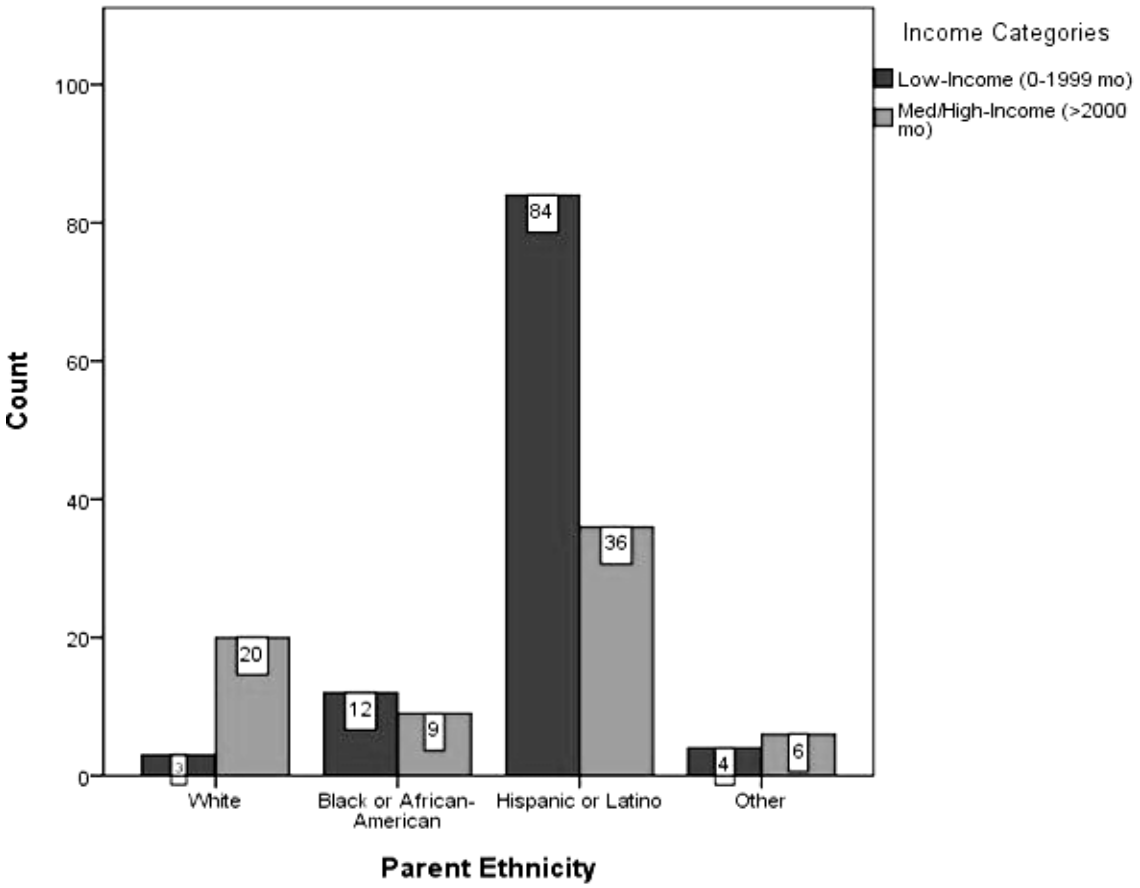


Table 3.2 shows that of the sample of student respondents, approximately two thirds described themselves as female, almost half of the respondents were 12 years old and over half were in the 6th grade. Nearly three-fourths of the student respondents qualified for reduced lunch.

Table 3.2. Student Demographic Characteristics

Student Demographics			
School Name (194)	**n(%)**	***Grade (n=194)***	**n(%)**
Ann Richards	68 (35.1)	6th	114 (58.8)
Dobie	35 (18.0)	7th	80 (41.2)
Garcia	41 (21.1)	***Sex (n=192)***	
Pearce	16 (8.2)	Male	47 (24.5)
Webb	34 (17.5)	Female	145 (75.5)
Age (n=194)	**n(%)**	***Reduced Lunch Program (n=191)***	
11 or under	53 (27.3)	No	55 (28.8%)
12	93 (47.9)	Yes	136 (70.2%)
13 or older	48 (24.7)		

3.1.2. Government Assistance & Food Security

Out of the total parent sample, 67 (35%) said they participated in the Supplemental Nutrition Assistance Program (SNAP) and 39 (26%) said they received Special Supplemental Nutrition Program for Women, Infants and Children (WIC) benefits. Thirty parents (15%) in the sample participated in both WIC and SNAP. Table 3.3 shows the responses of those participants in government assistance programs to food security questions in the parent questionnaire.

Table 3.3. Food security among government assistance participants in sample

Food Security Q's		WIC	SNAP	Both	Neither	Total
How often do you run out of food at the end of the month?	*Almost Never/Never*	5	9	10	64	88
	Sometimes	1	19	14	39	73
	Almost Always/Always	2	7	3	9	21
	TOTAL	8	35	27	112	182
How often do you worry about running out of food at the end of the month?	*Almost Never/ Never*	3	10	9	56	78
	Sometimes	3	16	12	39	70
	Almost Always/Always	2	9	6	17	34
	TOTAL	8	35	27	112	182

*** The numbers shown represent the number of participants within each response category.**

Almost 1/5th (n=31) of the entire parent sample *worried* about running out of food each month "sometimes" or "almost always/always" and 10% (n=12) reported actually running out of food at the end of every month. This figure was higher for the SNAP exclusive participants, the majority (74%) of which reported that they ran out of food "sometimes" or "almost always/always." Although there was a much smaller sample of WIC participants more than half (63%) reported that they "almost never/never" ran out of food at the end of the month. Of those that participated in both SNAP and WIC, 17 out of 27 reported running out of food "sometimes" or "almost always."

3.1.3 Health and Diet Trends

Only seven of the parents reported their child had a health condition and 35 were told they were overweight by their doctor, as shown on Table 3.4. T-tests were used to compare mean FV servings of FV between students with a special health condition to those without, and students who were overweight to those who were not; groups were not found to be significantly different so these 42 children were kept in the analysis.

Table 3.4. Health status and unhealthy habits of student sample

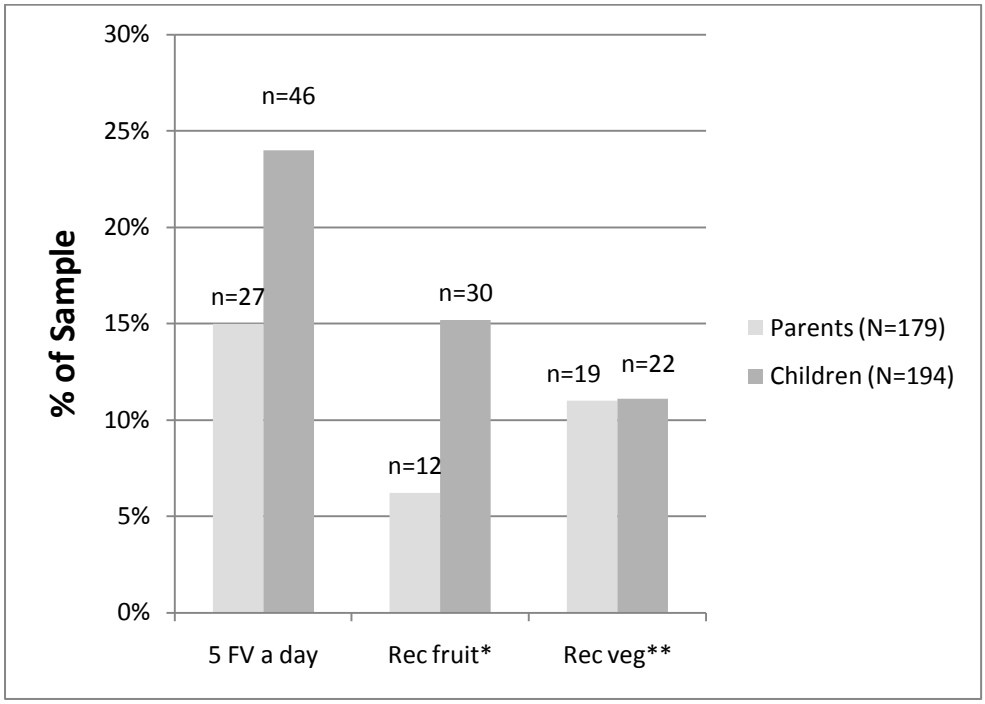
Health & Unhealthy Habits of SHK student sample	***n (%)***
Health status	*n (%)*
Overweight	35 (18.0%)
Health Condition	7 (3.6%)
***Average weekly* soda consumption**	
Low (>1 time/wk)	78 (42.2%)
Medium (1-2 times/wk)	57 (30.8%)
High (3+ times/wk)	50 (27.0%)
Fast food consumption *in the past week*	
Low (Never)	57 (30.8%)
Medium (1-2 times)	97 (52.4%)
High (3+ times)	31 (16.8%)

Table 3.4 also shows the reported fast food consumption the week prior to the survey. A majority of the students in the sample reported that they ate fast food 1-2 times in the week prior, however almost one-fifth ate fast food closer to 3-7 times. Most students reported that on average, they drank at least one soda a week and over a quarter reported their average soda consumption to be closer to 3 or more times per week. Of those students whose FVI fell below 5 servings per day (see discussion and figure below), 17.3% reported eating fast food 3-7 days per week, compared to 11.1% of those with a FVI of 5 or more servings who reported eating the same amount of fast food per week.

3.1.4. FVI by Parents and Students

In this study, we have operationalized FV intake as fruit and vegetable *servings*. It is estimated that both young adolescents and adults should eat at least 3 servings of fruit and 4 servings of vegetables per day (19). Figure 3.5 shows that students reported consuming more fruit servings than vegetable servings on average, but the percentage meeting the dietary guidelines for Americans was very small for both food groups (15.5% for fruit and 11.3% for vegetables). The parent sample reported consuming less fruits and vegetables than their children however they ate more vegetables than fruits. Of the parent sample, only 6.3% consumed the recommended fruit servings (12 out of 190 with complete data) and 10.7% consumed the recommended vegetable servings (19 out of 178 with complete data). Overall, 15.1% of 178 parents (16 missing data) and 23.7% of 194 students reported eating 5 or more fruit and vegetable servings per day, as displayed in figure 3.2.

Figure 3.2. Comparison of parents and students meeting Dietary Guidelines for Americans



***Recommended fruit is at least 3 servings a day for adolescents and adults. ** Recommended vegetables (veg) is 4 servings a day. The number above each bar represents the number of people meeting each guideline. Those meeting 5-a-day category reported eating at least 5 FV on average daily.**

Table 3.5. Parents and students intake of fruits and vegetables

	Parents			Students		
	Mean	*SD*	*N*	*Mean*	*SD*	*N*
Daily Fruit	1.25	0.90	190	1.63	1.08	194
Daily Veg	2.21	1.60	178	2.12	1.75	194
Daily FVI	3.45	2.14	178	3.75	2.30	194

***SD denotes standard deviation and N denotes number in sample with complete information for scale. The table includes mean daily fruit servings, mean daily vegetable (veg) servings, and mean daily fruits and vegetables as a combined measure.**

3.2. Demographic factors and student FVI

Bivariate analysis with student FVI (log) revealed that students with parents who were employed ate more fruit & vegetable servings than those who were unemployed ($p<.05$),

and students who lived in a household with a high monthly income ate more FV servings than those living in a low/medium income household (p<.01). Students whose parents reported having at least some college education ate more fruits and vegetables than students whose parents had no college education (p<.05). *Sex, Grade, Ethnicity* and *Marital status* did not differ significantly in group association tests. Table 3.6 shows mean scores for demographic variables with standard deviation and group association test p-values.

Table 3.6 Student FV servings by demographic variables

Demographic Factor	Category	Mean FV servings*	SD	Count	P-value**
Sex (n=192)	Male	2.64	2.14	47	0.052
	Female	3.27	1.84	145	
Grade (n=194)	6th Grade	3.27	1.94	114	0.181
	7th Grade	2.88	1.92	80	
Ethnicity (n=194)	Non-Hispanic	3.37	1.82	60	0.240
	Hispanic	2.99	1.98	134	
Marital Status (n=184)	Not Married	2.91	1.85	60	0.268
	Married	3.25	1.97	124	
Employment (n=189)	Unemployed	2.57	2.19	67	0.006
	Employed	3.47	1.72	121	
Education (n=191)	No College	2.83	1.98	120	0.017
	Some College +	3.58	1.82	71	
Income2Cat (n=174)	Low (0-1999 mo)	2.71	1.96	103	0.002
	Med/High (>2000 mo)	3.65	1.72	71	

*** Sample size with complete information is shown in parentheses next to each variable. Means and standard deviations expressed are converted from bivariate analysis with log of student FVI. P-value corresponds to T-tests with log of student FVI.**

Pearson correlations of all study variables are displayed in Appendix 3. *Employment* (r=.221, p<.001) and Income (r=.230, p<.001) were both moderately correlated and *Education* (r=.179, p<.05) had a low correlation with FV servings. *Sex* (r=.14, p=.054) had low correlation, with a significance level of only slightly above .05. *Ethnicity* and *Marital Status* were not correlated with student FV servings below the .05 significance level. Figure 3.3 shows the demographic characteristics which are highly correlated with student fruit and vegetable servings, amongst males and females. All categories except for medium/high

income show a slightly higher daily FV serving average for females as compared to males. The graph also reveals a greater difference between males and female student's FV servings among those, whose parents have no college education, are unemployed and have a lower income.

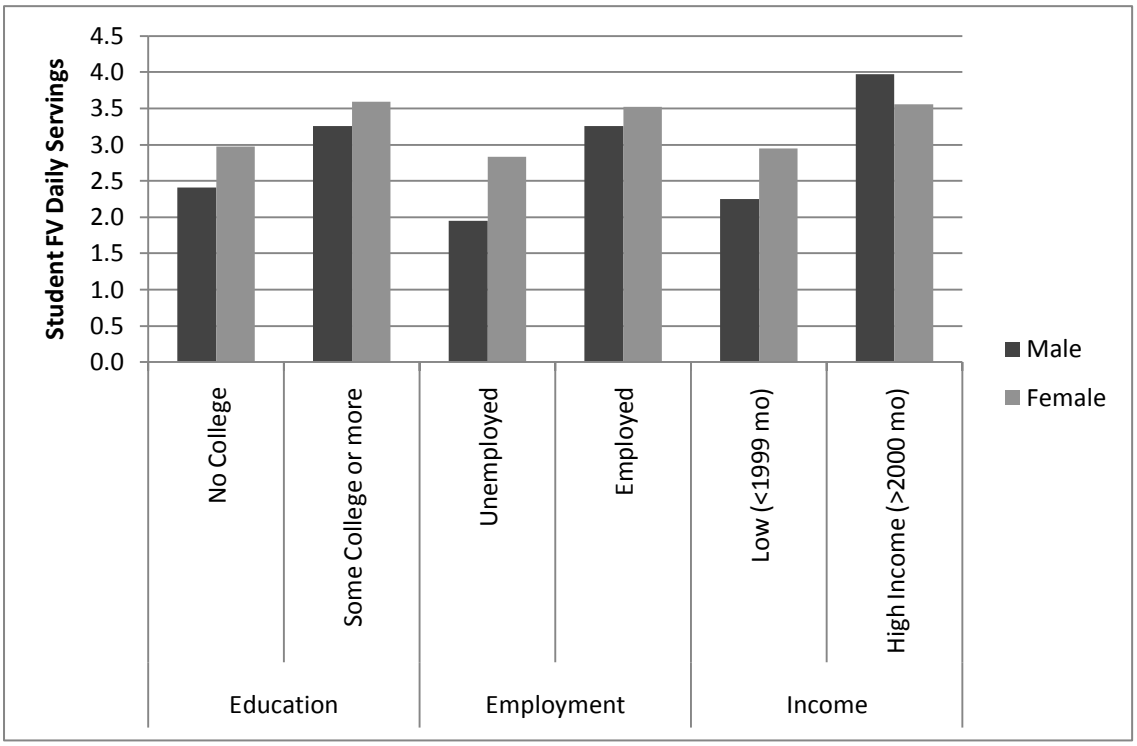


Figure 3.3: Student FVI by sex and socio-economic demographic factors

3.3. Household Factors and Student FVI

Results from bivariate analysis of lognormal distribution of *Student FVI* with main household factors are shown in table 3.5 and in the correlation matrix in Appendix 3. Main household factors included *Family Dinners*, *Adults Prepare FV*, *Family Eats Homegrown FV*, *Adult Support*, *Parent FVI*, and *Household AA*. Continuous scale variables *Household AA*, *Parent FVI* and *Family Eats Homegrown FV* were examined in high/low categories with student FVI (log), as shown in table 3.7, as well as in their original scale, as given on table 2.1. in the *Methods* section of the text. Table 3.7 shows that within each household factor, low and high groups had significantly different means ($p<.05$). Those students who reported high household access/availability to fruits and vegetables ate on average 1.61 more

servings of fruits and vegetables than those who reported low household access/ availability of fruits and vegetables. Those students whose parents reported that they prepared fresh fruits and vegetables often ate on average 1.55 more FV servings than those whose parents reported preparing FV seldom.

Table 3.7 Student fruit and vegetable servings within household factors

Household Factor (n)	Category	Count	Mean*	SD	p-value**
Family Dinners (n=192)	Low frequency	83	2.50	1.97	<.001
	High frequency	109	3.64	1.83	
Parents Prepare Fresh FV (n=192)	Low frequency	119	2.59	1.88	<.001
	High frequency	73	4.14	1.84	
Family Eats Homegrown FV (n=192)	Low frequency	105	2.72	2.05	0.003
	High frequency	87	3.61	1.74	
Parent Support (n=192)	Low level	110	2.75	1.93	0.003
	High level	82	3.66	1.88	
Parent FVI (n=179)	Low (<5 servings/daily)	152	3.01	1.84	0.046
	High (5+ servings/daily)	27	3.97	2.48	
Household AA (n=194)	Low (0-<24)	98	2.41	1.93	<.001
	High (24+)	96	4.02	1.74	

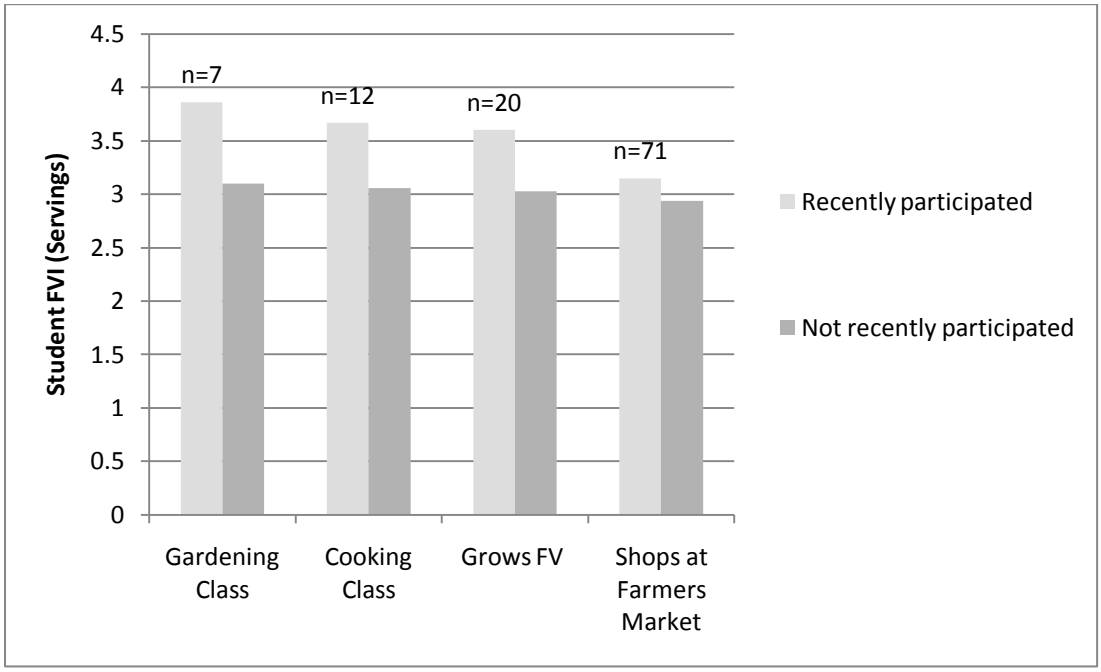
*** Sample size with complete information is shown in parentheses next to each variable. Means and standard deviations expressed are geometric means corresponding to lognormal distribution of student FVI. P-value corresponds to T-tests with lognormal distribution of student FVI.**

Pearson correlations of all household factors can be seen in the correlation matrix in Appendix 3. *Household AA* had the strongest correlation with student FV servings (r=.412, p<.001).

An additional set of healthy family activity variables were reported by parents that relate to the SHC intervention. Bivariate analysis with student FVI (log) and these variables are shown on figure 3.7. The figure shows that the mean FVI for those students whose parents are participating in gardening and cooking classes, and for those that grow FV and shop at

farmers markets, is higher than for those whose parents do not participate in these activities. The seven parents who took gardening classes had children with the highest FVI. However, t-tests between healthy family activity groups show that these differences were not significant. These variables were not examined further in the multivariate analysis.

Figure 3.7: Student fruit and vegetable intake by healthy family activity



*** Gardening classes and cooking classes refer to the past three months before the survey. None of the healthy family variable groups were significantly different below the .05 level (t-test values). This figure shows geometric means that correspond to the lognormal distribution of Student FVI, and "n" represents the number of participants of each healthy family activity.**

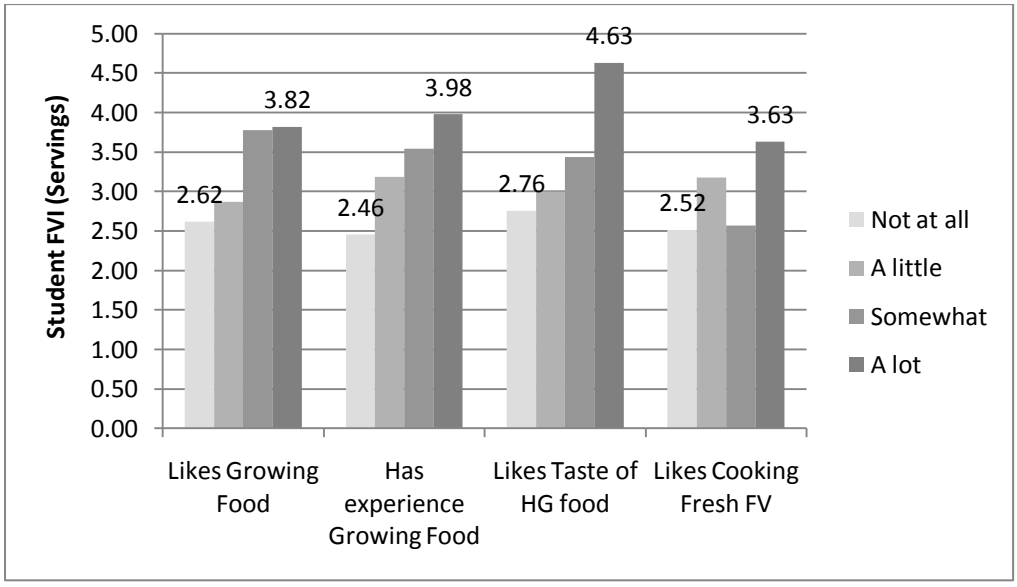
3.4. Personal Factors and student FVI

Results from bivariate analysis of lognormal distribution of *Student FVI* with main personal factors are shown in the correlation matrix in Appendix 3 and Figure 3.8. Main personal factors included student's *knowledge* of FV, student's *preference* for FV, student's *self-efficacy* for eating FV, student's *motivation* for eating FV, student's *experience growing food*, students *like growing food*, students *like the taste of homegrown food,* and students *like cooking fresh FV*. Scatter plots were examined for scale variables and error bar plots were examined for Likert scale variables, revealing a linear distribution of mean FV scores

with all variables except for like cooking fresh FV, which was subsequently transformed into a low/high dichotomous variable. All personal factors except for student *knowledge* was significantly correlated with the DV, and *experience growing FV* showed the highest correlation (r=.273, p<.001).

Figure 3.8 compares the distribution of student FVI by personal factors related to cooking and growing food. Students who liked the taste of homegrown food "a lot" had the highest FVI among all factors, consuming on average almost two FV servings more than students who reported "not at all" liking the *taste of homegrown food*. Students who had the lowest FVI among these factors were students that reported the least *experience growing food*. This figure also shows how there is a positive linear trend among all factors except for *like cooking fresh FV*.

Figure 3.8 Student fruit and vegetable intake by personal factors related to growing and cooking FV



*** This figure shows converted geometric means that correspond to the lognormal distribution of Student FVI. One-way Anova-tests showed significant differences between groups in each variable below the .05 level; *experience growing food* was significant below .01 level.**

3.5. Multiple Regression Analysis

Three multiple linear regression models were created based on the study objectives. The results are displayed in Appendix 4.

The final model 1 included four demographic variables (*grade, marital status, employment*, and *income)*. All factors except for *Income* made a statistically significant contribution in the regression model ($p<.05$). The model as a whole was significant ($p<.001$) and explained 10% of the variance in students' FVI. Grade had the largest beta value (0.18) followed by employment (.16). Beta values in multiple linear regression are standardized coefficients that express strength of an independent variable's unique contribution in the linear model (92). Model 1 also shows the unstandardized coefficients, which can be interpreted in terms of measurement units. According to the B coefficient values found in this model, students whose parents are married in the sample are predicted to eat 25% more fruits and vegetable servings than students whose parents are not married. Students who are in the 7^{th} grade are predicted to eat 19% less fruits and vegetables than students who are in the 6^{th} grade, and students whose parents are employed are predicted to eat 22% more fruits and vegetables than those whose parents are unemployed.

The final Model 2 included 1 demographic control factor (*employment*), along with 5 household factors (*Parent Intake, Household AA, Family Dinners, Parent Prepares FV, and Family Eats Homegrown FV*). All factors contributed significantly to the model except for *Family Dinners*. The model as a whole was significant ($p<.001$) and explained 31% of the variance in students' FVI. Household AA made the strongest unique contribution of all variables in the model ($\beta=.27$). Interpreting the unstandardized B coefficient, we see that for every unit increase of access and availability to fruits and vegetables in the home, a student's FVI is predicted to increase 3%. This means that a student who reported the highest level of household AA is predicted to eat 83% more fruits and vegetables than a student who reported having zero access and availability to fruits and vegetables in the home (range of the AA scale = 0-27). Model 2 also shows us, that for every serving of fruits and vegetables that a parent eats in this sample, the student is predicted to eat 4.65% more fruits and vegetables. For example, a student that has a parent that eats 5 fruits and

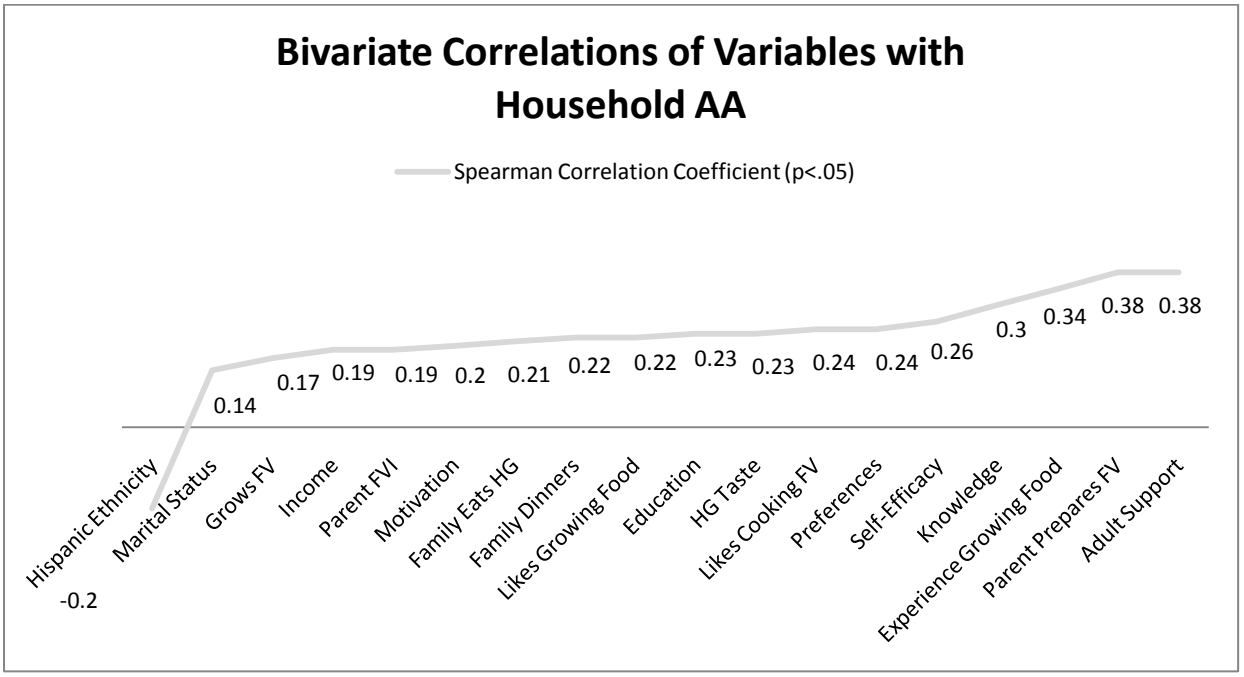
vegetables a day would be predicted to eat 23.25% more fruits and vegetable servings daily than a student whose parents report eating no fruits and vegetable servings. When controlling for all other household factors in the model, frequency that the *Family Eats Homegrown FV* is also a significant household factor with a beta value of .13 and an unstandardized B coefficient of 8.3%. This variable ranged from a high of 4 to a low of 1, so a student whose family eats homegrown fruits and vegetables the most often is predicted to eat almost 68% more fruits and vegetables than a student who reports never eating homegrown fruits and vegetables. *Parent Prepares FV* was also an important correlate, with students whose parents prepare FV most often predicted to eat 25% more fruits and vegetables than those whose parents never prepare FV.

The final model 3 included 1 demographic control factor (*Employment*), 4 household control factors (*House AA*, *Parent Prepares, Family Eats Homegrown FV, Family Dinners*) and 2 personal factors (*Motivation* and *Preferences*). Although two personal factors contributed to the variance explained by the overall model (R=.600, Adjusted R^2=.327, p<.001), no personal factors had a significant association with student FVI when adjusted for model 2 demographic and household factors. Only *House AA, Parent FVI* and *Employment* significantly contributed to this model (p<.001). The unique contribution of each of these three variables dropped only slightly with the addition of students *Motivation* and student *Preferences*. Although it was small (-.031), the beta value dropped the most for Household AA, compared to the drop in beta value of Employment and Parent FVI. As a whole, final model three explained the largest variance (33%) of all three models.

3.6. Correlates of Household AA

Spearman correlations were run on *Household AA* and the main demographic, household and personal variables analyzed in this study. As seen on Figure 3.10, the most highly correlated factors (non-adjusted) to *Household AA* included *Adult Support* (r=.38,p<.05), and *Parent Prepares FV* (r=.38,p<.05). *Experience Growing Food* also had a moderate correlation with *Household AA* (r=.34, p<.05). Significant crude correlations with *Household AA* are shown in the graph below. Three SCT personal factors (*Self-Efficacy*, *Preferences* and *Knowledge*) had unadjusted correlation values greater than 0.2. *Hispanic Ethnicity* was the only factor that had a negative correlation with *Household AA*.

Figure 3.10.



*** Crude significant correlations with Household AA are shown from low to high in this figure. All main variables were examined with the addition of parents growing FV (Grows FV).**

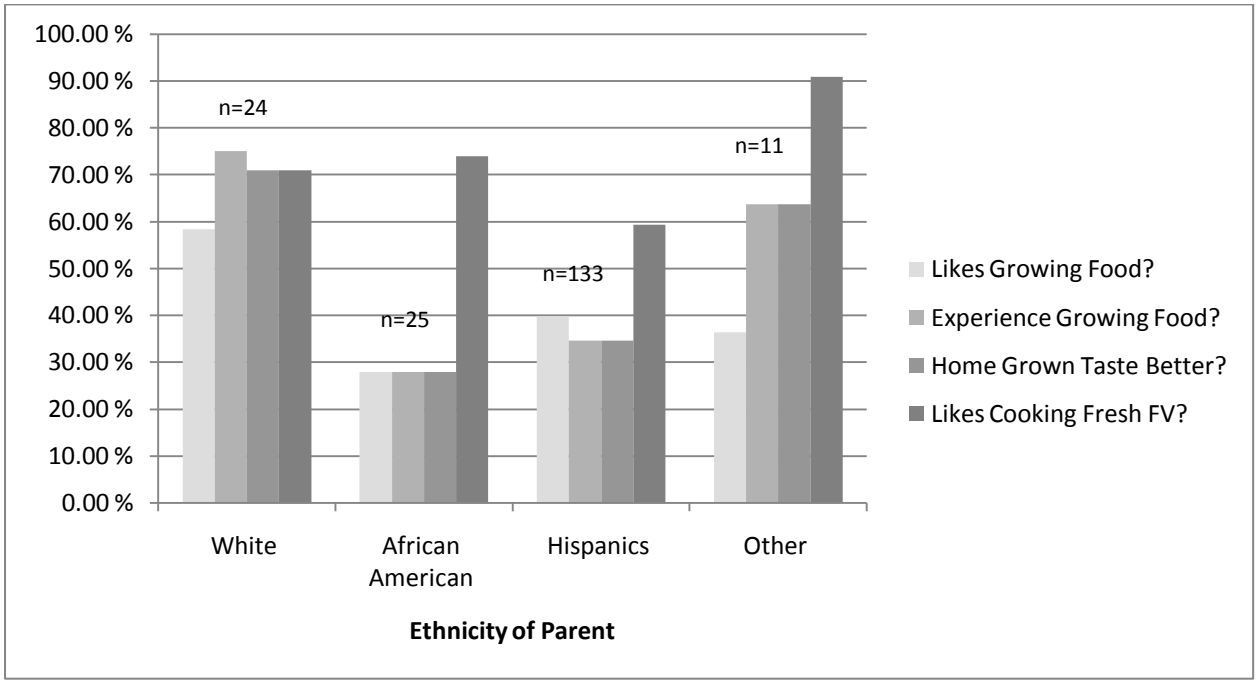
3.7. Gardening Interest and Experience

Bivariate analysis was performed on variables related to gardening and cooking food (both student and parent-reported) and select demographic characteristics (income, sex, and ethnicity). Figure 3.11 shows that a higher percentage (58.4%) of total students with White parents (n=24) reported liking gardening "somewhat" or "a lot" compared to all other ethnicities. Only 28% of students with Hispanic parents had this same level of interest. Within each parent ethnicity, a greater proportion of students responded to liking cooking fresh fruits and vegetables "somewhat" or "a lot" when comparing it to the question about liking growing food. The lowest proportion of students with African American parents and the highest proportion of students with White parents appeared to have at least some experience growing food. For students with Hispanic parents, less than one third (28%) reported having at least some experience.

As seen in Figure 3.12, females appear to enjoy gardening, cooking, and the taste of homegrown FV more than males. They also appear to have more experience growing food,

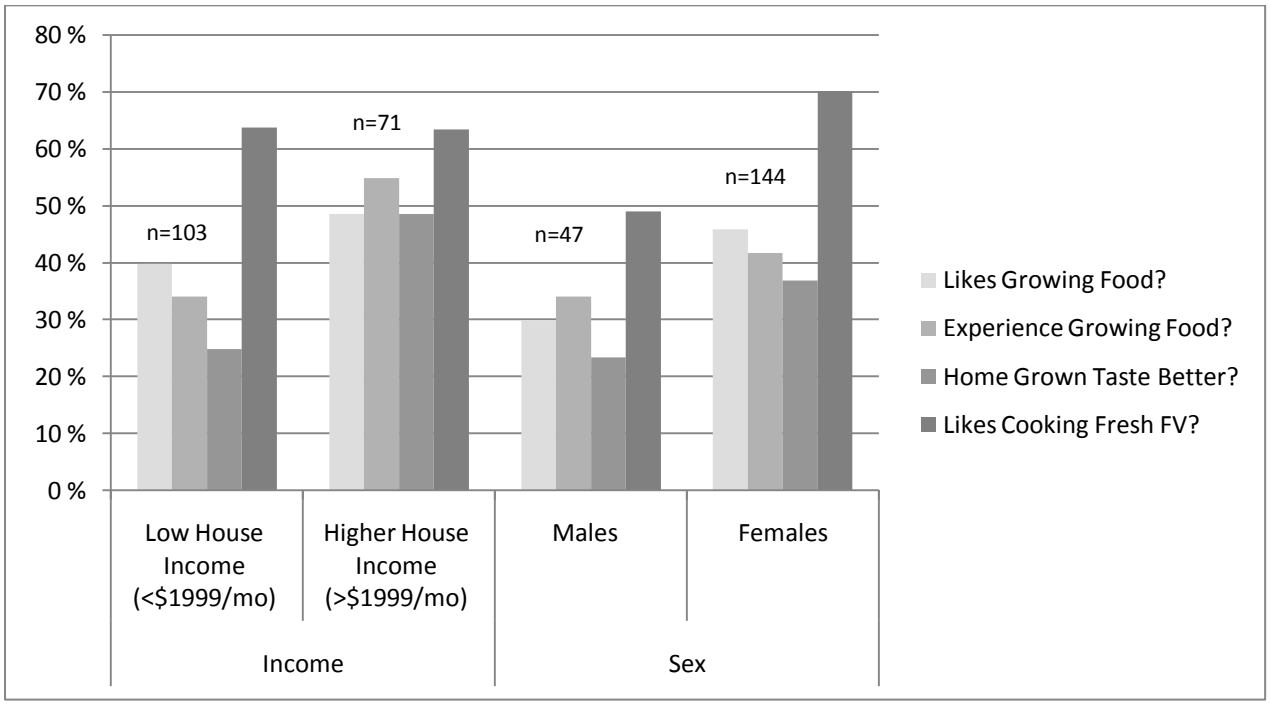
although this difference is not as extreme (41.7% girls with at least some vs. 34% boys with at least some). A higher percentage of students whose household income is greater than $1999 like growing food, have experienced growing food and think home grown food taste better. However, almost an equal percent of high income and low income respondents liked cooking fresh fruits and vegetables "somewhat" or "a lot."

Figure 3.11: Percent of students by parent's ethnicity who agreed "somewhat" or "a lot" to cooking & gardening questions



*** The number displayed above each bar cluster represents the total number within each ethnicity.**

Figure 3.12. Percent of students by income or sex who agreed "somewhat" or "a lot" to cooking & gardening questions.



*** The number displayed above each bar cluster represents the total number of parents within that category**

The use of farmers markets was examined by the ethnicity, education and employment of parents. Among different parent ethnic groups, about 64% of Hispanic parents say that they never shop at farmers markets compared to 60% of non-Hispanic parents. A larger percentage of unemployed parents (70.1% of n=47) and parents who had never gone to college (65% of n=78) had never visited a farmers market compared to employed parents and those who had attended at least some college. Among those who reported shopping at a farmers market "sometimes" or "always," the majority were Hispanic (n=48), the majority were employed (n=50) and the majority had never been to college (n=42).

Among the few parents in the sample who reported participating in gardening classes in the past 3 months (n=7), almost all were Hispanic (n=6). More parents had participated in a cooking class in the past three months (n=12) and these parents were also mostly Hispanic (n=10). Eight of the 12 people that had participated in a cooking class were employed part time of full time and more than half (n=7) had less than a college education. Of those that

had participated in a gardening class a little over half (5 out of 7) were employed and a little over half (4 out of 7) had a college education or higher.

Twenty parents had reported gardening fruits and vegetables in the past three months. Of those more were White (n=11) than Hispanic (n=9), most were employed (n=15) and most had attended some college or more (n=12).

4. Discussion

4.1. Summary of key findings

This study shows that household factors (HFs) are highly associated with the fruit and vegetable intake of the 6th and 7th grade students sampled, whereas personal factors (PFs) were found to be unrelated to fruit and vegetable intake when considering household and demographic confounders. In line with other findings on larger sample sizes, Household AA of FV was found to be the strongest individual correlate of FVI. Overall the demographic factors (DFs) measured in this study explain very little of the variance in the students FVI, but employment remained significantly associated with FVI even when adjusted for HFs and PFs. Students in this sample had a higher intake of fruits and vegetables then what has been found previously in adolescents in Texas. Several parent-reported household factors were related to Household AA in this sample along with experience growing FV, but further statistical tests would need to be preformed to adjust for possible confounding factors.

4. 2. Characteristics of the Sample

By examining the findings of the SHK I baseline survey, a few interesting highlights about the health and dietary habits of the student and parent sample have emerged. Less than 1/5th of the student sample had been told by their doctor that they were overweight. In a recent prevalence study measuring overweight in Texas school students, 19.2% of 8th graders were classified as overweight using BMI cut-off points (93). The current study is based on secondary reports by parents from their doctors rather than BMI or the parents' perception of that child. However, a recent report shows that although most doctors calculate BMI, only 37% of overweight children report actually having been told by a doctor that they were overweight (94). It is also possible that there are children in the study who

are overweight but are unaware of their status because they have not been to see a doctor recently. It is likely, therefore, that this statistic was underreported in the current study.

Soda consumption in the study sample appears lower than in previous reports. The Youth Risk Behavior Surveillance Report found that 37.7% Texas high school students drank soda at least once a day (82). This is much higher then what was found in our sample (16% drink soda 5+ days a week). However the students in this study were a younger age group than high school, grades 6 and 7. A study done by the UT School of Public Health comparing the differences between food choices of 4^{th}, 8^{th} and 11^{th} grade students showed a positive trend for increased soda consumption by grade (37). Sixty percent of students in the 4^{th} grade sample had reported drinking soda the day before compared to 70% in the 11^{th} grade sample. Regardless of the difference in previous findings, the knowledge that 16% of the adolescents in this study are drinking soda almost on a daily basis is discouraging. Soda contains 39 grams of sugar per can, which is almost the entire recommended allowance of added sugar per day (40 grams). Sodas also have a high calorie count and these are "empty calories," providing very little nutrition for the body while replacing more preferable fluids such as water, juice and milk. A higher percentage of high soda drinkers were found to eat under 5 FV per day than the infrequent soda drinkers which echoes previous reports on the dietary habits of adolescents (21). Many schools have banned the sale of sodas on campus grounds, which implies that consumption is occurring outside of school.

Overall, about 24% of students consumed an average of at least 5 combined servings of fruits and vegetables daily. This is higher than reported in Texas high school students (17.4%) previously (82), and considerably higher than the 0.9% estimate from National Health and Nutrition Examination Survey that included a randomized sample of 1667 12-18 year old adolescents (5). There are several reasons that may explain this discrepancy. First of all, the median age of the sample is younger (12 years) than the other two studies that include 12-18 year olds (median age = 15) and it has been shown that healthy habits decline with age during adolescence. It could also be a result of measurement bias. Although it has been shown to be a reliable method for estimating FV serving sizes, the brief dietary assessment method does not describe serving sizes for each item in each question which could have caused over-reporting of intake. Parents reported consuming less fruits and

vegetables overall, however they ate more vegetables than fruits. This is consistent with other findings that show that parents tend to eat more vegetables than their kids.

Participation in federal assistance programs was fairly high in this sample. One discouraging finding was that a large percentage of those receiving food stamp (SNAP) benefits also reported running out of food at the end of every month. If SNAP benefits are not providing needy families with the supplemental amount of food to make ends meet, then perhaps other more sustainable efforts are needed to assist families in becoming more "food secure." Food insecurity has been found to be associated with lower consumption and household availability of FV. Previous research also has found that among low-income Latino households with young children, those who were food insecure over the past three months were more likely to have low availability and lower variety of FV (90). There were also a high number of WIC participants in the sample.

At baseline, very few of the parents had participated in cooking classes or vegetable gardening classes. One of the aims of the Sprouting Healthy Communities intervention is to increase the number of cooking classes and gardening classes to families in five target zip codes. Since the study sample size is small and the response rate was small, there are limitations to the conclusions we can reach from these statistics; qualitative data would be useful to bring some insight as to why few parents have engaged in these intervention activities.

4.3. Associated Demographic Factors

When comparing the unadjusted or crude association of demographic factors to FVI, the results match well other studies, with the exception of a few factors. Employment, education, and income have all been found to major demographic determinants of FVI in adolescents (34). Employment showed the strongest unadjusted relationship with FVI. On the other hand, it is challenging to compare parent/guardian employment status measured in this study to other studies. In many FVI studies looking at demographic determinants, employment is used as a proxy for SES. It should be noted also that there may be some uncertainty in interpreting employment in this study. Participants were grouped into "employed," and "unemployed," however in the U.S. this can include a wide range of economic situations "Employed" combine those parents who reported both part-time and

full-time employment, and "unemployed" combined those parents who reported being stay-at-home full time. The level of responsibility, earning, working conditions and health benefits for example, cannot be measured by these categories. On the other hand when included in a regression model with household income and education, these uncertainties are adjusted for. Employment remained a significantly associated factor in all three multiple linear regression models, suggesting that in this population employment plays an important role in FVI. Perhaps this is indicative of the importance of parent employment at a time when the U.S. economy is not as strong as before and people are struggling to stay employed.

Marital status was associated with FVI in the middle school students when grade, employment and income were held constant. A student in this sample whose parent is married is predicted to eat more fruit and vegetable servings than a student in the same grade, and whose parent has the same employment status and income, but who has an unmarried parent. Research has found that married people consume more fruits and vegetables and that FV is more available in the home (95). Parents who are married are more likely to work as a team to share in the responsibility of childcare and preparing meals. It has been found previously that adolescents living in single-parent homes in the U.S. are more likely to snack and have fewer meals (21). It is likely that single parent households, especially among low-earning households include a parent that is working to support the family and does not have the energy to prepare home-cooked meals very often. Since Parent FVI is shown to have a stronger crude correlation, perhaps it is an important confounder here for the benefits of marriage.

The relationship between fruit and vegetable intake and *sex* in this sample differs from previous findings (21,35,96). There is a slight difference between the mean daily FVI in the sample across genders both alone and within education, and employment subgroups. However, this difference was not statistically significant, probably due to the small sample of males. If the group sizes had been larger and more equal it is possible we would have seen a statistically significant difference. When examining sex by income it is curious to note that higher income group males ate slightly more fruits and vegetables than females. One might presume that adolescent females who are more weight conscious are more likely to

be in higher income subgroups. However this cannot be reliably inferred, since the sample size is small and since weight-consciousness is not measured in this study.

Grade was used as a proxy for age since age categories in the questionnaire were unspecific (see student questionnaire in appendix 2, question #2). Sixth graders (n=114) ate more fruits and vegetables than 7th graders (n=80) but the difference was not statistically significant. Research has consistently shown that age does matter with eating behavior and several studies on Texas youth have shown that healthy eating behaviors decline during adolescence (37). Perhaps continuous data on age or a larger sample size would have produced significant differences between grades.

Although income was associated with FV servings, the finding was not significant when adjusted for the other demographic factors. This could be a result of the limitation in dichotomizing this variable in this study since most of the sample is low-income. Income was split into two categories according to the federal poverty level guidelines. Having a continuous scale for income might have also produced more interesting results. However, employment remained significant when adjusted for other factors, and employment begets income. This is important to note in light of the role of federal assistance programs, including SNAP (Supplemental Nutrition Assistance Program) benefits and WIC (Supplemental Nutrition Assistance Program for Women, Infants and Children). A large percentage of our sample participates in either one or both of these programs (39%, n=76). In the U.S. in 2008, sixty percent of SNAP participants lived in households without any earnings and almost one quarter of the monthly funds available to a typical participating household come from SNAP (97). With such a large percentage of cash resources coming from SNAP and the average SNAP household only having $25 in countable resources at any point in time, it is vital that there are nearby affordable sources of fruits and vegetables to purchase using their benefits. Currently the WIC program has increased its percentage of benefits allotted for the purchase of fruits and vegetables which is a hopeful step. In Austin, WIC has also collaborated with the local farmer's market vendors to have stands outside once a week. They have also recently made it possible to use SNAP benefits at farmers markets. However, organic fruits and vegetables sold by independent farmers are generally more costly than what can be found at a supermarket. Ease of access and visibility may influence some mothers to buy fruits and vegetables who are time-pressed and have limited

transportation, but when 68% of WIC participants are below the poverty level and 60% of SNAP participants are living in households without any earnings, finding the cheapest food to feed their family is a priority. In our sample, the large percentage of WIC and SNAP participants that are unemployed paired with the low fruit and vegetable intake in these beneficiaries reflects the need for lowering the cost of fruits and vegetables for these populations.

Employment and income both have a medium correlation with Hispanic ethnicity which may explain why ethnicity becomes non-significant when adjusted for these two factors. In this sample, and in the general population, a larger proportion of Hispanics are unemployed and do not have a college education; it is the latter two factors that are more related to how many fruit and vegetable servings an adolescent gets rather than their ethnicity.

However, the regression model with demographic variables only accounts for a small percentage of the variance in fruit and vegetable intake. Around 90% of the variability is unexplained by the demographic factors measured. This could be a result of how the demographic variables were dichotomized. At the time of writing (May 2010), no other studies exist that examine the same demographic factors for adolescent fruit and vegetable intake separately in a model. In one other study that used similar techniques to examine the relationship of demographic, family and personal traits on both fruit and vegetable intake in pre-school children only found sex to be a significant demographic predictor of vegetable intake when controlling for other factors (15). However when adjusted for household factors this relationship became statistically non-significant.

4.4. Associated Household Factors

The main household factors assessed in this study were all found to have a significant unadjusted correlation with fruit and vegetable intake in the middle school students. The association found between family dinner frequency, preparation of fruits and vegetables by the parent, and adult support (which included encouragement and modeling) has also been confirmed in previous research on children and adolescents (21,44,47). Household AA of fruits and vegetables emerged as having the strongest relationship to FVI, which is consistent with previous research in adolescents where it was found to be a primary associated factor (35). When adjusting for employment along with other household factors

both adult support and family dinners became insignificant factors in the model. It could be that the association of family dinners shrinks in the presence of more strongly correlated factors such as household AA and parent intake, or it could be because of measurement bias. It was transformed into a dichotomous variable which is said to bring associations closer to the null. The *Parent Support* scale, although it had a high Cronbach alpha coefficient suggesting a high internal reliability of the items included, it has never been used before in previous analyses and its validity has never been assessed. How often homegrown fruits and vegetables are consumed in a family is something that has never been studied in previous research and therefore cannot be compared. However, research has shown that adults are more likely to eat freshly picked FV (64). It should be mentioned that how often *Families Eat Homegrown Vegetables* has a stronger relationship with FVI in the sample than how often adolescents reported having *Family Dinners*. Since taste and preferences have shown to be important mediating factors in FVI of adolescents and homegrown vegetables are generally more flavorful than industrially produced FV, it is possible that homegrown produce is more appealing to this age group. It can also be speculated that parents who serve homegrown produce may also create a generally more healthy food environment in the home. Further research would be needed for any conclusive inferences from these findings.

4.5. Associated Personal Factors

Preference is a primary predictor of FVI and also as one of the strongest predictors of food choices in previous research with children and adolescents (21). One study examining the relationship of FV intake with three of the same personal or psychosocial variables included in this study, found preference to be the main predictor, explaining 12% of the variance in fruit and vegetable intake (43). In this study, it was not found to be a significant factor when adjusting for household and demographic factors. Cooke *et al.*'s study that used a similar method of combined regression models to adjust for independent personal, household and demographic factors associated with FV intake in pre-school students in the UK, found that "child's enjoyment of food" became an insignificant factor for fruit intake in the presence of parent intake, early feeding, child food neophobia, age of introduction to

fruit and ethnicity (15). However "child food neophobia," which could also be considered a proxy for preferences, was found to have a significant contribution in the final prediction model for children's FVI ($p<.05$). For vegetables, both child enjoyment of food and child food neophobia remained significantly associated factors. However this study included mostly white, middle-class, and highly educated participants so it is difficult to generalize these results in the mostly Hispanic, lower-income, and less-educated population included in this study.

Bere and Klepp also used combined multiple linear regression model based on SCT to assess the relationship of personal, environmental and behavioral correlates and found preference to be associated in the presence of access to FV, modeling, intention, self-efficacy, awareness (to eat 5-a-day), and parent FVI (98). This study used four questions to measure preference (as opposed to 2) and had the advantage of a large sample size. Lien, *et al.* measured mostly psycho-social family factors in a sample of Norwegian adolescents and found that, when included in a multivariate model with other personal and school/society factors, only perceived parents' evaluation of his/her diet contributed uniquely to the model ($\beta=^{-}.08$).

The scale for knowledge used in this study was an ad hoc measurement instrument, designed with learning objectives for the future garden-based nutrition education classes in mind and has not been validated. Since a very poor relationship was found with fruit and vegetable intake of the students in this study, a more thorough instrument for knowledge may have resulted in a different association. However, in many dietary studies knowledge is found to have a very poor relationship with dietary behavior.

Motivation helped to explain the total variance FV intake when these covariates were included in the model: parent employment, grade, income, preference and experience growing food. Motivation, is also referred to as *outcome expectancy* in other research and has been shown to be related to FV intake. One study in particular found outcome expectancy to explain 14% of the variance in fruit and vegetable consumption measured in a sample of fourth and fifth grade children (n=231) (99).

When controlling for parent income, grade, parent employment, preference and motivation, *experience growing fruits and vegetables* did not stand out as having a strong relationship with student FVI. Since a large proportion of White students and students whose parents had a higher income also had experience growing fruits and vegetables, SES may be a confounder in this relationship. There are no studies that have examined experience growing fruits and vegetables with other household and personal predictors, so it is difficult to draw conclusions. A few peer-reviewed experimental studies that included a food gardening component have shown a positive impact on fruit and vegetable intake and contributing factors. Results from a qualitative study on the benefits of neighborhood-based community gardens for youth development and nutrition did show improved nutrition as one of the positive outcomes of the gardens (100). A study by Morris and Zidenberg-Cherr found post-test preference scores on certain vegetables to improve in fourth-graders after a six month intervention including gardening and nutrition education, compared to those that only received nutrition education (101).

All personal factors became insignificant predictors when household factors were included into the model. When comparing the unique variance explained by personal factors and demographic factors, it appears that household factors have a stronger relationship with fruit and vegetable consumption in the sample. This is indicative of the overall importance of the household environment and parental influence in adolescents' fruit and vegetable consumption. Since preference was measured by only two questions, it is possible that the measurement scale was not adequate in this study. It is difficult to compare this study with prior research because of the utilization of a large number of independent variables (some of which have never been used), the method of linear regression analysis and the limited studies on adolescents. However, Cooke preformed a similar analysis using a combination of demographic, parental and personal traits measured in preschool children and found similar results (15). A household/parent measure, adult fruit intake was found to be the strongest predictor ($\beta = .35$, $p<.005$) for both fruits and vegetables, along with child's food neophobia for fruit ($\beta=-.12$, $p<.05$) and vegetables ($\beta=-.19$, $p<.001$) and the child's enjoyment of food for vegetables (Beta=.13, $p<.01$). This study found a much smaller relationship with parent FVI ($\beta=.160$), however more factors were controlled for, including Household AA.

4.6. Associations with household AA

Since the most associated demographic variables and personal variables had a very small affect on the beta value of household AA in a combined linear regression model, it is interesting to see what factors measured in the study are related to household AA. Only a few studies before have examined correlates of household AA. Neumark-Sztainer et al. found social support for healthy eating family meal patterns, family food security and SES to be associated to AA (54). This is similar to the findings in this study, where adult support for eating FV had the strongest association followed by parents preparing FV. Dave studied FV AA in low-income Hispanic homes and found that preferences and parent intake were the strongest correlates to FV AA. It is interesting that experience growing fruits and vegetables is found to be correlated to FV AA in this study. This finding makes sense. Experience growing fruits and vegetables has been shown to increase preferences for FV in children (102) and preferences are associated with household AA. More of these children's parents also grew FV. Observational learning is one postulate of the Social Cognitive Learning Theory that is said to facilitate behavior change. More research should be done to explore this relationship

4.7. Gardening interest and experience

Although most of those parents who report having a garden over the past three months are White, mostly Hispanic parents are attending both the gardening and cooking classes. This is encouraging, since the SHC target population is low-income minorities, however there is a limitation to what can be measured by the questionnaire. The survey does not specify the sponsor of the vegetable gardening and cooking classes, it only asks if the parent has taken a class over the past three months. Other classes led by WIC and perhaps private classes could have been included in these responses. Regardless, the mean FVI of adolescents whose parents have engaged in either cooking classes or gardening classes is higher than those who have not. This finding suggests that these healthy family activities parents engage in have a positive relationship on their children's FVI. Because the sample size is small for these groups, it is difficult to explore confounding factors.

In this sample, those who visit farmers markets are mostly of Hispanic ethnicity and have less than a college education but those who have never visited farmers markets are also

mostly Hispanic and have less than a college education. This most likely reflects the skewed distribution of our sample. A sample with an equal number of Hispanic and non-Hispanic parents and an equal number of non-college educated and college educated parents might give us more indicative results. The fact that more employed parents had visited farmers markets and more unemployed had never visited farmers markets makes sense. For one, it may be difficult to justify spending more money on produce when you are unemployed. Research has shown that fruits and vegetables are the first things to go when money is short, and fruits and vegetables at farmers markets in Austin are usually slightly more expensive than what you'd find at a supermarket. Secondly, if you are unemployed you are less likely to have a car. At the time of the survey there were several weekly farmers markets happening in Austin, but none of them were on the East side of Austin. The Sustainable Food Center has worked with farmers to have farm stands at six WIC clinics in Austin (several of which are on the East side) however these only run from May to July. Therefore, without a car someone would have to take a bus or walk a far distance to reach a farmers market in the fall and winter months. At the time of writing a new weekly farmers market is happening in the east side of town.

Overall, White females in the sample seem to enjoy gardening the most as well as have more experience gardening. By parent ethnicity, it appears that roughly the same percentage of students believe that homegrown FV tastes better and have experience gardening. Across all ethnic groups, most students reported liking cooking fresh fruits and vegetables somewhat or a lot. Since we know that cooking can increase a child or adolescents skills, help to create a healthier food environment and increase exposure to a variety of FV, this is a promising strategy in this group of students.

The popularity of cooking in this group is further emphasized by the fact that almost an equal percentage of low-income and higher-income students like cooking, and both sexes enjoyed it more than gardening. Since it is a cross-sectional study, there are limitations to discussing these results. Those parents who did report having a vegetable garden where mostly White parents, so it is not surprising that a higher percentage of children with White parents reported having garden experience and liked growing food more than within other ethnicities. On the other hand, more Hispanics (around 40%) liked growing food than had experience growing food. This could be indicative of a general interest in gardening food,

however since a larger percent of Hispanics were low-income, this could be due to a lack of family resources or land to garden on. When the survey was done in January 2009, no community gardens existed in the study area, however one community garden has been introduced since that time and more are being planned.

4.8. Limitations & Strengths

The limitations of this study should be mentioned in light of the findings and conclusions. For one, cause and effect cannot be measured with a cross-sectional design. Since the study examined a non-randomized sample of participants, thus the scope of inference cannot be generalized outside this specific study population. The small sample size may have also limited significance of the statistical tests performed.

Several types of bias could have been introduced in this study. Students were chosen from primarily low-income schools with a high proportion of Hispanic students, which is a selection bias that limits the generalizability of the study (35). Since this study was limited to those students whose parents also filled out the survey, this could have also presented a sampling bias; those who had more responsible/caring family members may be more likely to be in the study. However, since a small financial incentive was involved this could have also had an effect on who signed up.

The data gathered in this study is primarily self-reported data, which is subject to reporting bias (both over- or under-reporting) and several other types of bias, including recall bias, response bias and measurement bias. Since serving sizes are not specified in the DATH FFQ questionnaire, response bias could have occurred depending on the student's concept of a serving size. Since the DATH FFQ asked students to think back over a week period of time, students may have a difficult time recalling their average intake in a week. In many studies examining dietary information, other methods are used in addition to the FFQ, such as the 24 hour recall, to correct for these biases; however, due to time and budget constraints this could not be done. During the analysis, fruit and vegetable servings were treated as one construct rather than separately (possible measurement bias). Geller and Dzewatowski blame this as one possible weakness in fruit and vegetable intake studies, instead recommending that predictors for fruits and vegetables be examined separately

(35). Finally, the method of calculating daily intake could also present measurement bias, although it has been used reliably in other studies (86).

Besides fruit and vegetable intake, several of the measurement scales differed from other studies which examined similar constructs. For example, Gillman and Colleagues measured frequency of family dinners and eating behavior by comparing those who at never or a few days a week with their family and those that ate most days of the week with their family (61). This is similar to the measurement of family dinners in our study but because several categories were combined, if the same sample answered both measurement tools it is possible we would have different numbers within each category. Other studies which have examined self-efficacy as a predictor for eating behavior looked at specific types of self-efficacy in relation to eating behavior but not necessarily fruit and vegetable intake (i.e. self-efficacy about low-fat vending machines). Some of the scales in the questionnaire are *ad hoc* for the study (knowledge, garden variables). However, the questionnaire was pilot tested before administration and found to be appropriate for the population tested.

Using multiple regression to analyze data has its limitations. We can only identify relationships between the explanatory factor and the outcome variable. There could also be unmeasured factors that are the true underlying cause of a dependent outcome. For example, perceived cost of FV has been cited as a factor associated with a young person's FVI in the literature. This was not measured in this study, however the researcher found that relative to other states, the cost of fruits and vegetables are not high. Another limitation of using multiple linear regression technique is transforming many of the ordinal and categorical variables into scale/dichotomous variables, which results in a loss of information. At the same time, multiple linear regression was the method of choice for this study because the main outcome variable (student FVI) was measured on a continuous scale, which gives more informative results.

Despite the limitations in this study, there are quite a few strengths that should be acknowledged. This study adds to the limited research available about the relationship of the household and FVI in low-income adolescents in Central Texas. A high level of statistical analysis was used, in which factors were controlled for according to the researcher's assumptions gathered from previous findings. Very few studies were found in the literatures

that examine known personal correlates of FVI while controlling for household correlates. This study covers a breadth of factors related to FVI in this sample which gives us new directions in research and insights into current/future intervention development. Another unique feature of this study is the assessment of garden-related variables. Current interventions are underway which aim to increase fruit and vegetable consumption through gardening-based nutrition classes and hands-on learning in schools. The results of this study help us to see the potential impact of such an intervention in this subpopulation and reveal some of the confounding factors that should be addressed in a multi-level intervention.

An additional strength of the study is that the DATH food frequency questionnaire used has been tested and proven reliable for use in the Hispanic community. This is significant since over half of the sample in this study was Hispanic. Currently the DATH questionnaire is also being assessed for validity within the Hispanic community (86). Lastly, analysis of the data was done by the same investigators who entered the data, reducing the likelihood of random error.

5.Conclusions & Recommendations

This study has allowed us to gain some insight into factors surrounding fruit and vegetable consumption in a subpopulation of mostly low-income, Hispanic adolescents in Austin, Texas. We know that fruit and vegetable consumption is associated with lower risks of chronic disease, including diabetes, heart disease, and some cancers. Since young minorities in Texas, especially Hispanics, are at higher risk for several of the top dietary diseases that plague this country, it is vital that the factors associated with fruit and vegetable consumption in this population be realized. The results of this study naturally inspire some recommendations for future public health research and intervention development.

5.1. Current Interventions, Future Directions

True behavioral change in a population cannot occur without the consent of that population and the awareness that change is needed. The results of this study suggest that factors within the household environment can be important determinants of adolescent fruit and vegetable consumption in this population of high risk students. Since we know that parents are a critical part of forming this environment, it is essential to know whether parents perceive low fruit and vegetable consumption as a problem prior to further intervention development. Formative research through focus groups would be a valuable way of assessing this information. Randomized control trials in low-income populations in the U.S. have shown that dietary behavior change and weight loss is more successful over time when parents are involved in the intervention with children (103).

Focus groups could facilitate an open dialogue regarding current efforts, and generate new ideas for improvement. Some talking points that might be raised in a focus group discussion include:

- Do parents relate low FVI to health outcomes (one study showed that children whose parents were concerned with negative health consequences of low FVI had children that ate more FV)?
- Are parents in the target population interested in the activities being offered by the interventions (i.e. cooking/gardening classes)? Is there something else they may need?
- Are the parents in the classes effectively gaining the skills they need to increase availability in the home and to prepare healthy meals that include fresh fruits and vegetables?
- How can cooking classes and gardening classes reach out to more mothers in the target population, especially those who are unemployed? What barriers do those who are not coming face?
- Is there stigma related to gardening among parents or children in the target population?
- Does FV cost and/or time present a challenge to these parents?

Although cost of FV was not assessed in this study, it has been found to be inversely related with children's intake and adult intake in low-income households in the U.S. (104). It has also been found to be associated with household availability of fruits and vegetables. Since household availability and parent intake are highly associated with children's intake in this sample, it would be important to find out how whether perceived cost is indeed a barrier to purchasing FV in this sample. If this is the case, intervention efforts will be difficult to sustain and measures should be made to address this barrier.

In Austin, costs of fruits and vegetables are not high compared to the rest of the country; however perceived costs and availability of fresh produce in low-income areas may be more of an issue. Teaching parents and kids to garden vegetables and integrating this with nutrition information could be a very appropriate approach this problem. The growing season is long and on the East side where over half of the schools from this study are

situated and where Sprouting Healthy Communities is taking place, there is rich agricultural land called *Blackland Prairie*. Gardening classes can empower them with skills and knowledge to grow seasonal FV could help to keep overall costs on food lower. Other studies have shown that classes that teach food gardening are an ideal time to promote healthy forms of cooking (105). Parents who have food gardens were also associated with preparing FV in this sample, which is not surprising. In homes where food gardens are grown, it is likely that parents are cooking more and children are exposed to a greater variety of fruits and vegetables. Both children's experience growing FV and families eating homegrown FV were associated with FVI intake in this study which indicates garden related activities may be a promising strategy. At the same time, barriers to growing food such as access to land, input costs and time should also be addressed. Participation in home gardening by adolescent children would likely reap greater benefits, but interest may vary by gender, income and ethnicity; this should be explored further. Since cooking FV was enjoyed to a greater degree across all income, gender and ethnicity in this sample, perhaps teaching parents how to teach their kids to cook could be another component of cooking or gardening classes offered to parents. Since many of the parents in this sample spoke Spanish, it would be important that all teaching materials are in Spanish and pilot tested before use.

Change has to come through multiple channels. Systematic reviews of nutrition and obesity interventions have pointed to one common finding: approaches that involve the community, the school and the family are the most successful (106). These integrated approaches create a sustainable web of support and collaboration. Luckily, the Sprouting Healthy Communities grant-funded project aims to engage these three levels through increasing cooking & gardening classes, community gardens, and continuing the Sprouting Healthy Kids intervention in high risk schools. School-based efforts in the U.S. that have also utilized local organizations to offer low cost nutrition classes and physical activities for parents have shown greater success in improving fruit and vegetable intake in young people (106). As this study shows, and as the British chef Jamie Oliver's campaign to increase healthy eating in schools has also demonstrated to the public, only modifying the school food environment may be unsustainable in the long run if the home environment does not support healthy eating.

This study affirms that the Sprouting Healthy Communities project is a promising intervention for increasing fruit and vegetable intake in this community. Recent recommendations for research outlined in the "Let's Move Campaign" report to the president, include examining the effects of targeted strategies focused on subpopulations with a high obesity risk (i.e. racial/ethnic minority populations, lower SES populations, etc.) (107). Therefore, this intervention should be continually evaluated to see whether each component is effectively addressing barriers to FVI in the target population, the components are integrated, and the intervention is community-supported. The Community Food Security Coalition offers a handbook and project evaluation toolkit for carrying out community food projects like SHC (108). Since Sprouting Healthy Communities involves several different interventions it would also be useful to evaluate the dose-response effect on families that may be exposed to multiple interventions, looking at fruit and vegetable intake as well as household availability of FV as two possible outcomes. If it hasn't already been done, a community food systems analysis would also compliment any efforts nicely and facilitate easier inter-sector collaboration.

Since there are a large number of organizations and local government initiatives that attempt to alleviate the challenges of low-income minorities in Austin, it would be important to integrate efforts as best as possible. A reasonable number of people in the sample were participating in SNAP and WIC, so collaboration with these programs would make sense. Utilizing existing resources, such as English (ESL) classes, cultural groups and new immigrant centers, would also create natural partnerships that may overlap and increase awareness of the problem.

5.2. Recommendations for Local Policymakers

Ultimately change should be "locally grown," nurtured and sustained by human resources within the community. However the social-ecological model helps us see that the macro level is also important. Local policy can strengthen intervention efforts and make behavior change easier for families. A national public health campaign called *Let's Move* was recently initiated. Spearheaded by the first lady, Michelle Obama, the aim is "to solve the epidemic of childhood obesity [in the U.S.] within a generation," by increasing access and availability of healthy foods and increasing physical activity in young people (107). In a

recent report, recommendations for achieving this goal were outlined that are based on research findings and learning from current federally enacted policy. These focus on making nutrition information more useful, improving food marketing and labeling practices and strengthening the health care provider role. One of the priorities is to ensure that the wealth of nutrition information is not only useful but is also sending consistent messages. At a local level, this would mean that information is accessible in the target community of risk, low-income minorities, and that it is successfully reaching them. A survey may be useful in this case to see where parents are getting their nutrition information and what channels are most effective. The newly enacted *Affordable Care Act* has several requirements that will improve the food environment in each community (107). Local government can help to speed the process of enacting these changes.

The National Policy and Legal Analysis Network to Prevent Childhood Obesity (NPLAN) has many helpful resources for policymakers working in the public health field (109). Some of these resources include fact sheets and policy models for getting more fresh produce into the local communities both through increased selling points and production through gardening. The Centers for Disease Control in the U.S. have recommended that nutrition education (cooking classes, gardening classes, and classes in schools) should be paired with environment modification to successfully adopt healthier eating behavior (5). This would include improved access to fresh fruits and vegetables not only in schools but also the neighborhood and in the home, as this study has shown. Mobile grocery carts in neighborhoods, paired with nutrition education for parents, are one example of this type of an intervention that achieved success (improved household AA) in low-income families in Brazil (110). NPLAN has a Model Produce cart ordinance among other resources related to mobile produce vending (109).

Although home gardens and community gardens present a cost effective way of increasing fruit and vegetable availability and intake in the home, some people do not like to garden or do not have the time. More work has to be done to increase the sale of fresh fruits and vegetables in low income communities. Increasing points of purchase that allow the use of SNAP and WIC benefits should also be considered. If a SNAP recipient cannot use their benefits at a farmers market near their home, parents without transportation may end up buying their food at the local convenient store where fresh produce is unavailable. If

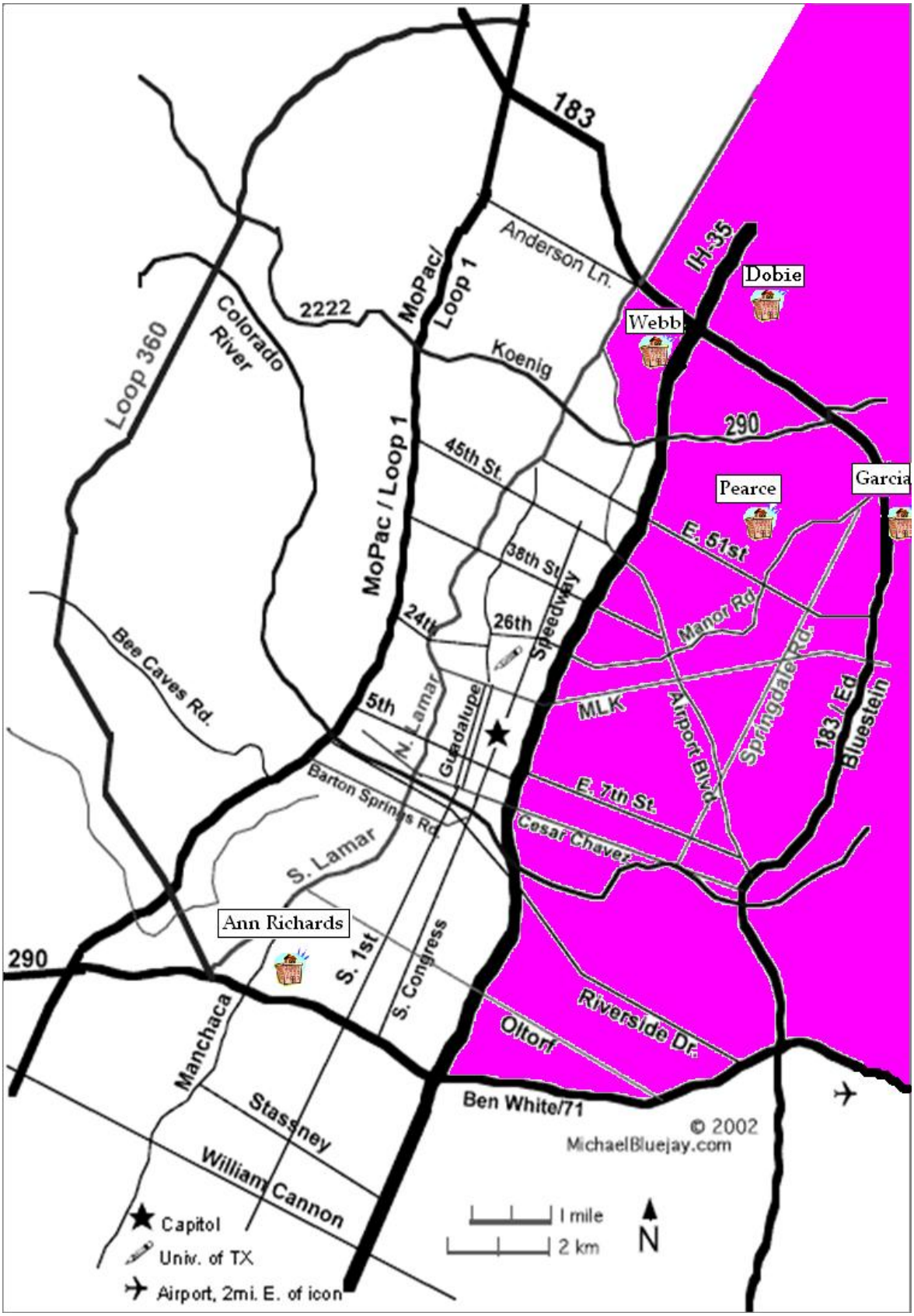
local community-supported agriculture farms (CSAs) were able to accept food assistance programs like SNAP and WIC, this would eliminate several barriers to healthy eating for the sample of parents in this study and low-income parents like them. Receiving a box of produce on a weekly basis would save WIC and SNAP clients a trip to the store, expose them and their children to a greater variety of fruits and vegetables. This study and other studies showed have shown that children's fruit and vegetable intake is related to eating homegrown produce as opposed to not homegrown. A pilot study using a case-control design would be an innovative way to explore this concept. This could involve SNAP or WIC participants and local farms and measure both the cost and health benefits to clients. In practice, local farmers selling produce at farmers markets and through CSAs will probably face challenges selling to low-income consumers with government benefits; however NPLAN and CFSC offer model policies and documents that could help facilitate local government support (109).

In conclusion, preventing diet-related chronic disease through increased fruit and vegetable consumption is a complex issue. The finding that parent intake and household availability have a strong association with the adolescents' intake of fruits and vegetables in this sample concurs with other research that point towards the importance of the home environment. However, dietary change must also be supported by other environments, including the adolescent's school and the local community. Longitudinal research needs to be done on household availability and to monitor outcomes of current intervention efforts such as Sprouting Healthy Communities. Strengthened policy paired with families who are invested, actively deciding on local solutions to increase consumption of fruits and vegetables will inevitably improve the health of low-income adolescents in Austin and other similar communities tremendously over time.

Appendices

Appendix 1:

Map of SHK Schools



Map of Austin (East Austin in Pink) with Sprouting Healthy Kids Intervention Schools

Appendix 2:

SKH Surveys

The SHC Student Survey

Think about what you normally <u>eat in a month</u>. About how often do you eat each of the following foods/drinks <u>either at home or when eating out</u>? Mark an "X" in one box for each food.

	How often do you eat or drink…	Never	Once per MONTH or less	2-3 times per MONTH	1-2 times per WEEK	3-4 times per WEEK	5 or more times per WEEK
1	Eggs						
2	Whole milk or flavored milk (not low fat or skimmed)						
3	Flour tortillas (not corn)						
4	Hamburgers or cheeseburgers						
5	Tacos, burritos, or enchiladas						
6	Other mixed dishes with meat						
7	Roast pork/chops, roast beef, or steak						
8	Fried chicken						
9	Cheese or cheese spreads						
10	Pizza						
11	Refried beans						
12	French fries or fried potatoes						
13	Potato chips, corn chips, or peanuts						
14	Cake, sweet rolls, doughnuts, or Mexican sweet bread						
15	Salad dressing						
16	Regular sodas or other drinks with sugar						

Please answer the following questions by circling the answer that best fits you.

17. **If you wanted to, how sure are you that you could choose to eat a piece of fruit instead of chips or candy when you are stressed out?**

Not at all sure		Somewhat sure		Very sure
1	2	3	4	5

18. **If you wanted to, how sure are you that you could choose to eat fruit or vegetables when you are eating with friends?**

Not at all sure		Somewhat sure		Very sure
1	2	3	4	5

19. **If you wanted to, how sure are you that you could choose to eat fruit or vegetables when you are eating at a fast food restaurant?**

Not at all sure		Somewhat sure		Very sure
1	2	3	4	5

20. **If you wanted to, how sure are you that you could choose to eat fruit or vegetables instead of chips or candy when you are watching TV?**

Not at all sure		Somewhat sure		Very sure
1	2	3	4	5

21. **If you wanted to, how sure are you that you could choose to drink 100% fruit juice instead of a soda?**

Not at all sure		Somewhat sure		Very sure
1	2	3	4	5

Think about what you normally eat during a week. About how often do you eat each of the following foods either at home or when eating out? Mark an "X" in one box for each food.

How often do you eat or drink…	Never	Less than once per WEEK	About 1 time per WEEK	2-3 times per WEEK	4-6 times per WEEK	Once per DAY	2 or more Times per DAY
22. Fruit juice, like orange, apple, grape, fresh, frozen or canned (not soda or other drinks)							
23. Not counting juice, how often do you eat any fruit fresh, frozen, canned, or in smoothies?							
24. Green salad (like lettuce or spinach salad)							
25. Tomatoes or salsa fresca							
26. Vegetable soup or stew with vegetables							
27. Potatoes, any kind, including baked, mashed (**do NOT count French fries or chips)**							
28. Any other vegetables, including green beans, peas, corn, broccoli, or any other vegetable							
29. Beans, cooked from dried or canned							

The following questions ask whether there were certain fruit and vegetables in your home in the past week. Please mark the circle that best describes you.

30. Was there **100% fruit juice** (please do not count drinks that were not 100% juice, such as Gatorade, Sunny Delight, etc) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

31. Was there **vegetable juice** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

32. Was there **fresh fruit** (do not count canned, frozen, or dried fruit) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

33. Was there **canned, frozen, or dried fruit** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

34. Were there **fresh** vegetables (do not count canned or frozen vegetables) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

35. Were there **canned or frozen vegetables** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

36. Was there **salad** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

37. In the last week, was there **fresh fruit** in an easy-to-reach place (for example, on your kitchen counter or in the refrigerator)?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

38. In the last week, were there **cut-up fresh vegetables** an easy-to-reach place (for example, on your kitchen counter or in the refrigerator)?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

39. On a regular day, I eat _____ servings of fruits and vegetables (please fill in a number)

How strongly do you agree with the following statements? Please mark the circle that best describes you.

40. If I eat fresh fruits and vegetables every day, I'll have more energy.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

41. If I eat fresh fruits and vegetables every day, it will be easier <u>not to</u> gain extra weight.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

42. If I eat fresh fruits and vegetables every day, I'll do better in sports.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

43. If I eat fresh fruits and vegetables every day, I'll do better in school.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

44. If I eat fresh fruits and vegetables every day, I'll get teased by my friends.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

45. If I eat fresh fruits and vegetables every day, I'll have clearer skin.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

How strongly do you agree with the following statements?

46. I like the taste of most fresh fruits.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

47. Most fresh vegetables taste bad.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

48. Most healthy foods just don't taste that great.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

49. Most unhealthy foods taste better than healthy foods.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

50. I like the taste of potato chips and other salty snack foods.

O Strongly disagree O Disagree O Neither agree nor disagree O Agree O Strongly agree

How strongly do you agree with the following statements about your family and friends:

51. Adults in my family care about eating fresh fruits and vegetables.

O Not at all O A little O Somewhat O A lot

52. Adults in my family encourage me to eat fresh fruits and vegetables.

O Not at all O A little O Somewhat O A lot

53. How often do you see adults in your family eating fresh fruits and vegetables?

O Not at all O A little O Somewhat O A lot

54. I see my friends eating fresh fruits and vegetables.

O Not at all O A little O Somewhat O A lot

55. In my family, we eat dinner together most days of the week.

O Not at all O A little O Somewhat O A lot

Some more questions about you:

56. I like to try new foods.

O Not at all O A little O Somewhat O Quite a bit O Very much

57. How often do you eat school lunches prepared by the school cafeteria?

O Almost always or always O Sometimes O Almost never or never

58. Do you like the food served in the school cafeteria?

O Not at all O A little O Somewhat O A lot

59. Do you have a vegetable garden at home?

O Yes O No

60. Do you have a community vegetable garden close to where you live?

O Yes O No O Don't know

61. I like to grow food in gardens

O Not at all O A little O Somewhat O A lot

62. I have experience growing food in gardens

O Not at all O A little O Somewhat O A lot

63. Food that I have grown myself tastes better

O Not at all O A little O Somewhat O A lot

64. Food that has been grown in local gardens or farms tastes better

O Not at all O A little O Somewhat O A lot

65. I like cooking with fresh fruits and vegetables

O Not at all O A little O Somewhat O A lot

66. Does your family shop at a farmer's markets?

O Almost always or always O Sometimes O Almost never or never

67. How important is it to you that the food you eat is not processed?

O Not at all O A little O Somewhat O A lot

68. How important is it to you that the food you eat is grown locally?

O Not at all O A little O Somewhat O A lot

69. How often do you and your family eat fruits and vegetables that are homegrown?

O Not at all O A little O Somewhat O A lot

70. Within the last 2 months, have your teachers taught any classes on local foods or gardens (during the school day – not after school)?

O Yes O No

71. Can you give an example of one of the lessons that was taught (you can give just the title)

_____

72. Within the last 2 months, have you participated in the after-school gardening program?

O Yes O No

73. **If yes, how often do you go?_____**

74. **Within the last 2 months, have you gone on any field trip to farms, gardens, or farmer's markets?**

O Yes O No

75. **Within the last 2 months, have you noticed any locally-grown fruits and vegetables in the school cafeteria?**

O Yes O No

76. **Within the last 2 months, have you participated in any recipe tasting or food sampling at your school?**

O Yes O No

77. Within the last 2 months, did a farmer visit your classroom or school cafeteria?

O Yes O No

78. **In the <u>past week</u>, how often did you eat something from a fast food restaurant (like McDonald's, Burger King, Taco Bell etc.)?**

O never

O 1-2 days per week

O 3-4 days per week

O 5-7 days per week

Some general questions … Please pick the answer you think is correct

79. Drinking fruit juice is just as healthy for you as eating a piece of fruit.

O True O False

80. Which of the following vegetables <u>cannot</u> be grown locally? (pick only one)

O Avocado O Broccoli O Tomatoes O Zucchini

81. **Which of the following foods is an edible root? (pick only one)**

O Spinach O Potato O Pumpkin O Pecan

82. **What is the word that describes food grown close to home? (pick only one)**

O Processed O Local O Engineered O Organic

83. Processed food is food that has been changed from its natural state (e.g.frozen or canned)

O True O False

84. **To find out if a snack is good for you, you can read the _____**

O Ingredients O Nutrition label O Both

Some more general questions about you…

85. **Are you…?** O Male O Female

86. What is your age?

O 11 or younger
O 12
O 13
O 14 or older

87. What grade are you in?

O 6
O 7
O 8

88. **Do you think of yourself as …** (You may choose more than one.)

O White
O Black or African American
O Hispanic or Latino
O Asian American
O Hawaiian or Pacific Islander
O American Indian or Alaska Native

Thank you for filling out this Survey

Parent SHC Questionnaire

The following questions will ask you about your family and <u>your middle school child</u>. Please answer the best you can. Remember that there are no right or wrong answers and that your responses are confidential. Please circle or fill in the answers below.

1. **What is your relationship to the middle school child?**

   o **Mother** o **Father** o **Grandparent** o **Other:** _____

2. **Age of the child in middle school:**
   _____ _____

3. **Child's gender:**

   o **Male** o **Female**

4. **What middle school does your child go to?**
   _____

5. **What is your home zip code:**
   _____

6. **Number of adults in your household (over 18 years old):** _____

7. **Number of children in your household:** _____

8. **Does your child have a health or physical condition that prevents him or her from eating fruits and vegetables?**
   o **Yes** o **No**

9. **Is your child currently on a special diet?**
   o **Yes** o **No**

10. **Has your child ever been told by the doctor that he or she is overweight?**
    o **Yes** o **No**

The following questions will ask you about your family's eating and shopping habits. Please answer the best you can.

11. How often do you and your family **have dinner together**?

o Almost always (6 or 7 days per week)
o Sometimes (3-5 days per week)
o Not very often (0-2 days per week)

12. In the **<u>past week</u>,** how often did you eat something from a **fast food restaurant** (like McDonald's, Burger King, Taco Bell etc.)?

o never
o 1-2 days per week
o 3-4 days per week
o 5-7 days per week

13. Does your family **shop at farmer's markets?**

o Almost always or always o Sometimes o Almost never or never

14. Do you **grow** your own **fruits and vegetables**?

o Yes o No

15. In the last 3 months, have you attended any classes that teach you how to grow fruits and vegetables?

o Yes o No

16. In the last 3 months, have you attended any cooking classes?

o Yes o No

17. In the last 3 months, have you bought any fresh fruit or vegetables at a farmer's market that was located next to the WIC clinic?

o Yes o No o I don't go to WIC clinics

18. I **prepare meals** with fresh fruit and vegetables for my family.

o never

o 1-2 days per week

o 3-4 days per week

o 5-7 days per week

19. Does your middle school child **help you prepare meals**?

o never
o 1-2 days per week
o 3-4 days per week
o 5-7 days per week

20. How important is it to you that your family **eats fresh fruits and vegetables**?

o Not at all o A little o Somewhat o A lot

21. I **encourage** my child(ren) to eat fresh fruits and vegetables.

o Not at all o A little o Somewhat o A lot

22. My children **see me eating** fresh fruits and vegetables.

o Not at all o A little o Somewhat o A lot

23. How important is it to you that the food you eat is **not processed**?

o Not at all o A little o Somewhat o A lot

24. How important is it to you that the food you eat is **grown locally?**

o Not at all o A little o Somewhat o A lot

25. How often do you and your family eat fruits and vegetables that are **homegrown?**

o Not at all o A little o Sometimes o A lot

What do you normally eat?

Think about what you normally eat during a month. About how often in one month do you eat each

	How often do you eat or drink…	Never	Once per MONTH or less	2-3 times per MONTH	1-2 times per WEEK	3-4 times per WEEK	5 or more times per WEEK
26	Eggs						
27	Whole milk or flavored milk (not low fat or skimmed)						
28	Flour tortillas (not corn)						
29	Hamburgers or cheeseburgers						
30	Tacos, burritos, or enchiladas						
31	Other mixed dishes with meat						
32	Roast pork or chops, roast beef, or steak						
33	Fried chicken						
34	Cheese or cheese spreads						
35	Pizza						
36	Refried beans						
37	French fries or fried potatoes						
38	Potato chips, corn chips, or peanuts						
39	Cake, sweet rolls, doughnuts, or Mexican sweet bread						
40	How often do you use fat or oil to fry, cook, or season?						
41	Salad dressing						
42	Regular sodas (not diet)						

Think about what you normally eat during a week. About how often in one week do you eat each of the following foods either at home or when eating out? Mark an "X" in one box for each

	How often do you eat or drink…	Never	Less than once per WEEK	About 1 time per WEEK	2-3 times per WEEK	4-6 times per WEEK	Once per DAY	2 or more Times per DAY
43	Fruit juice, like orange, apple, grape, fresh, frozen or canned (not soda or other drinks)							
44	Not counting juice, how often do you eat any fruit fresh, frozen, canned, or in smoothies?							
45	Green salad (like lettuce or spinach salad)							
46	Tomatoes or salsa fresca							
47	Vegetable soup or stew with vegetables							
48	Potatoes, any kind, including baked, mashed (not french fried or chips)							
49	Any other vegetables, including green beans, peas, corn, broccoli, or any other							
50	Beans, dried or refried or canned							

51. On a regular day, I eat _____ servings of fruits and vegetables (please fill in a number)

Fruit and Vegetables at Home

The following questions ask whether there were certain fruit and vegetables in your home in the past week. Please mark the circle that best describes you.

52. Was there **100% fruit juice** (please do not count drinks that were not 100% juice, such as Gatorade, Sunny Delight, etc) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

53. Was there **vegetable juice** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

54. Was there **fresh fruit** (do not count canned, frozen, or dried fruit) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

55. Was there **canned, frozen, or dried fruit** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

56. Were there **fresh** vegetables (do not count canned or frozen vegetables) in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

57. Were there **canned or frozen vegetables** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

58. Was there **salad** in your home **last week**?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

59. In the last week, was there **fresh fruit** in an easy-to-reach place (for example, on your kitchen counter or in the refrigerator)?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

60. In the last week, were there **cut-up fresh vegetables** an easy-to-reach place (for example, on your kitchen counter or in the refrigerator)?

o Yes, all the time o Yes, most of the time o Yes, some of the time o Never

Some more questions that ask about you. Please answer the best you can.

61. What is your ethnicity/race?

- o American Indian or Alaska Native
- o Asian
- o Black or African American
- o Hispanic or Latino
- o Native Hawaiian or Other Pacific Islander
- o White
- o Other: _____

62. If you consider yourself Hispanic or Latino, how do you most identify yourself?

- o Mexican
- o Chicano
- o Mexican American
- o Spanish American
- o Anglo American
- o Central American
- o American
- o Other (please note): _____
- o I don't know

63. Your marital status:

- o Married
- o Separated or divorced
- o Single, never married
- o Widowed

64. Employment status:

- o Full-time
- o Retired
- o Part-time
- o Stay-at-home full time

65. What is the highest level of formal education you have completed?

- o Less than 12 years
- o High school graduate/GED
- o Some college
- o College graduate
- o Advanced degree (ex. Masters, Doctorate, etc.)

66. Total household income per month: (what you bring home each month)

□ $0-999
□ $1,000-1,999
□ $2,000-2,999
□ $3,000-3,999
□ $4,000-4,999
□ $5,000 or more

67. What language would you say you speak most of the time?

□ Spanish □ English □ Other: _____ □ I don't know

68. What language do you mostly think in?

□ Mostly in Spanish
□ Mostly in English
□ Almost the same in Spanish and English
□ Mostly in another language (please note other language): _____
□ About the same in English and another language
□ I don't know

69. Where were you born?

□ Mexico
□ Central America
□ South America
□ United States
□ Other place

70. How long have you lived in the United States? _____ (years)

71. Do you receive WIC?

O Yes O No

72. Do you receive food stamps?

O Yes O No

73. Do you run out of food before the end of the month because you can't afford to buy more?

O Almost always or always O Sometimes O Almost never or never

74. Do you worry that you will run out of food before you can afford to buy more?

O Almost always or always O Sometimes O Almost never or never

75. Does your child participate in the free and reduced school lunch program? O Yes O No

Appendix 3:

Correlation Matrix

Appendix 3: Pearson correlation matrix of all study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1																					
2	-0.10																				
3	0.14	-0.02																			
4	-0.08	0.04	-0.14*																		
5	0.08	0.00	0.03	0.14																	
6	0.22**	-0.04	0.10	-0.06	-0.05																
7	0.17*	-0.10	0.17*	-0.42**	0.02	0.25**															
8	0.23**	-0.06	0.21**	-0.33**	0.11	0.24**	0.47**														
9	0.27**	-0.02	0.07	-0.01	0.11	-0.01	0.02	0.09													
10	0.41**	-0.05	0.12	-0.20**	0.15*	0.04	0.22**	0.18*	0.21**												
11	0.26**	-0.04	0.14	0.01	0.17*	0.05	-0.01	0.10	0.23**	0.35**											
12	0.28**	-0.15*	0.09	-0.11	0.13	0.13	0.10	0.14	0.17*	0.25**	0.37**										
13	0.34**	-0.02	0.02	-0.12	0.20**	-0.03	0.23**	0.29**	0.33**	0.37**	0.32**	0.18*									
14	0.23**	-0.10	0.01	0.05	0.23**	0.09	0.03	0.08	0.11	0.23**	0.19**	0.13	0.08								
15	0.13	-0.07	0.13	-0.30**	0.04	0.16*	0.43**	0.35**	0.05	0.29**	0.21**	0.04	0.28**	-0.04							
16	0.21**	-0.10	0.06	-0.11	-0.03	0.15*	0.23**	0.17*	0.11	0.29**	0.29**	.170*	0.19**	0.16*	0.18*						
17	0.22**	-0.04	0.11	-0.19**	0.12	0.04	0.11	0.17*	0.11	0.22**	0.26**	0.10	0.27**	0.11	0.24**	0.21**					
18	0.27**	-0.06	0.27**	-0.13	0.05	0.14	0.20**	0.16*	0.17*	0.20**	0.37**	0.11	0.30**	0.03	0.36**	0.40**	0.31**				
19	0.23**	-0.11	0.09	-0.15*	0.17*	0.03	0.23**	0.29**	0.01	0.23**	0.15*	0.08	0.30**	0.15*	0.25**	0.20**	0.24**	0.25**			
20	0.21**	-0.21**	0.19**	-0.10	0.04	0.05	0.18*	0.07	0.07	0.22**	0.20**	0.09	0.19**	0.25**	0.28**	0.27**	0.32**	0.39**	0.48**		
21	0.27**	-0.21**	0.02	-0.16*	0.22**	0.11	0.25**	0.24**	0.01	0.34**	0.27**	0.20**	0.22**	0.31**	0.31**	0.23**	0.30**	0.20**	0.64**	0.55**	
22	0.21**	-0.03	0.18*	-0.14	-0.08	0.01	0.19**	0.07	0.14	0.25**	0.24**	0.09	0.20**	0.04	0.18*	0.28**	0.25**	0.31**	0.25**	0.43**	0.26**

Variable Key

1. Student FVI
2. Grade
3. Sex
4. Hispanic Ethnicity
5. Marital Status
6. Employment
7. Education
8. Income
9. Parent FVI
10. Household AA
11. Adult Support
12. Family Dinners
13. Parents Prepare FV
14. Family Eats HG FV
15. Knowledge
16. Self-Efficacy
17. Preference
18. Motivation
19. Likes Taste HGF
20. Likes Growing Food
21. Exper. Growing Food
22. Likes Cooking FV

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

Appendix 4:

Multiple Regression Results

Appendix 4. Results of Multiple Linear Regression Models 1-3

	Model 1 R=.575, AR^2=1.02 F(4,165)=5.82 (p<.001)					Model 2 R=.575, AR^2=.306, F(6,161)=13.257 (p<.001)					Model 3 R=.600, AR^2=.327 F(8,154)=10.84 (p=<.001)				
Variable	B (%)	LCI (%)	UCI (%)	β	P-Val	B (%)	LCI (%)	UCI (%)	β	P-Val	B (%)	LCI (%)	UCI (%)	β	P-Val
Grade	-18.63	-31.64	-3.15	-0.17	0.021										
Marital Status	25.22	4.69	49.77	0.18	0.014										
Employment	22.43	1.99	46.96	0.16	0.030	25.35	6.02	49.21	0.17	0.009	25.35	9.18	18.43	0.17	0.011
Income	18.75	-0.59	41.85	0.14	0.058										
Parent FVI						4.65	0.80	8.66	0.17	0.018	4.48	1.92	17.38	0.16	0.023
Household AA						3.08	1.41	4.78	0.27	<.001	2.74	0.85	26.47	0.24	0.002
Family Dinners						16.53	-1.90	38.41	0.12	0.081	16.66	9.19	12.73	0.12	0.082
Par Prep FV						25.42	4.09	51.13	0.17	0.018	16.23	10.28	12.09	0.11	0.126
Family Eats HGF						8.29	0.02	17.24	0.13	0.049	7.75	4.22	12.97	0.12	0.073
Preferences											5.3	2.82	13.85	0.13	0.065
Motivation											1.59	1.27	9.29	0.09	0.213

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