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Fruit and Vegetable Intake, Attitudes, and Beliefs of
Multicultural Middle School Students in Central Massachusetts

A Thesis Presented

by

EMILY M. HARRINGTON

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
Of the requirements for the degree of

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FRUIT AND VEGETABLE INTAKE, ATTITUDES, AND BELIEFS OF MULTICULTURAL MIDDLE
SCHOOL STUDENTS IN CENTRAL MASSACHUSETTS

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ABSTRACT

FRUIT AND VEGETABLE INTAKE, ATTITUDES, AND BELIEFS OF MULTICULTURAL MIDDLE SCHOOL STUDENTS IN CENTRAL MASSACHUSETTS

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High fruit and vegetable (FV) intake is associated with healthy weights and decreased risk of chronic disease. Yet, adolescent FV intakes fall below national recommendations. Few studies involve racial/ethnic minority adolescents in formative research, despite their increased risk of poor FV intake. Consequently, the purpose of this study was to describe the type and frequency of FV intake of urban multicultural young adolescents, and to examine their attitudes and beliefs towards increased consumption of FV. A convenience sample (n=79) of racially diverse (e.g., 31% Hispanic/Latino, 27.4% Black/African American) grade seven students, participated in our study comprised of a self-administered survey with culturally adapted FV food frequency questionnaire (FVFFQ) and focus group discussions. The FVFFQ revealed that hand fruit was the most highly consumed fruit among our students, while consumption of vegetables was more evenly distributed. Preferred FV among racial/ethnic population groups ranged with Hispanic/Latino identifying citrus, leafy green vegetables preferred by Black/African American, tropical fruit by Asian and Whites reporting cooked vegetables. Availability of preferred vegetables as school significantly influenced vegetable intake ($p=0.038$).

Family attitudes towards vegetables also influenced student FV behaviors (diet diversity (DD) score, $p=0.008$; FV self-efficacy scores, $p=0.019$). The median DD score (73%) indicated moderate compliance with national FV intake recommendations among students with red, orange, and 'other' vegetables requiring the most improvement in intake. Focus group discussions revealed important barriers to FV intake, including a preference for consuming 'junk food' for snacks over FV, a lack of availability of preferred vegetables at school, and parental financial constraints, which limited availability of preferred produce at homes. Students' suggested strategies to motivate increased FV intake included greater incentives and modeling from parents, improved recipes and taste tests for vegetables served at school and greater availability of culturally diverse produce represented in school menu. Students emphasized social media for FV promotion targeted at adolescents. Overall, our findings suggest young adolescents are open to increased FV intake, but require a supportive home and school environment, with access to cultural and preferred produce; students indicated a keen interest in involvement with FV promotion initiatives undertaken in their school.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	iii
ABSTRACT.....	iv
LIST OF TABLES.....	viii
LIST OF FIGURES.....	x
CHAPTER	
1.INTRODUCTION.....	1
2.LITERATURE REVIEW.....	3
2.1 Health outcomes.....	3
2.1.1 Fruit and Vegetable Intake.....	5
2.2 Adolescence as a critical time period.....	10
2.2.1 Adolescence and Cognitive Processes.....	12
2.3 Influences on Adolescent Dietary Intake.....	13
2.3.1 Race and Ethnicity.....	17
2.3.2 Beliefs and Attitudes.....	18
2.3.3 Access to Fruits and Vegetables.....	21
2.4 Theoretical frameworks used to understand behavior.....	22
2.4.1 Self Efficacy.....	24
2.5 Adolescent Focus Groups.....	26
2.6 Adolescent Food Frequency Questionnaires.....	32
2.7 Summary.....	38
3.PURPOSE, AIMS, RESEARCH QUESTIONS AND SIGNIFICANCE OF THE STUDY.....	40
3.1 Research Purpose.....	40
3.2 Study Objectives.....	40
3.3 Research Questions.....	40
3.4 Significance statement.....	41
4.METHODS.....	42

4.1 Study Setting and Population.....	42
4.2 Study Design.....	43
4.3 Sample and Recruitment	45
4.3.1 Study Sample	46
4.4 Design of the Fruit and Vegetable Survey.....	47
4.5 Design of Student Focus Group Moderator’s Guide.....	49
4.6 Qualitative Analysis.....	50
4.7 Quantitative Analysis	53
4.8 Ethics.....	64
5.RESULTS	66
5.1 Demographics	66
5.2 Survey Results	67
5.2.1 Fruit and Vegetable Intake.....	67
5.2.2 Types of FV Consumed.....	68
5.2.3 Associations	75
5.3 Focus Group Findings.....	94
5.3.1 Beliefs and Attitudes.....	95
5.3.2 Barriers and Facilitators to FV Consumption	106
6.DISCUSSION.....	115
6.1 SURVEY DISCUSSION: quality of FV intake, preferences, availability and self-efficacy	115
6.2 FOCUS GROUP DISCUSSION: beliefs and attitudes.....	126
6.3 Conclusion.....	136
APPENDIX	
A.CONCEPTUAL FRAMEWORK OF INFLUENCES ON ADOLESCENT FRUIT AND VEGETABLE INTAKE.....	141
B.WORCESTER, MA DEMOGRAPHICS	142
C.KEY INFORMANT INTERVIEW GUIDE	144
D.STUDENT SURVEY AND ORAL INSTRUCTIONS	146
E.FOCUS GROUP GUIDE	157
F.DIET DIVERSITY SCALE DEVELOPMENT AND SCORING	162
WORKS CITED.....	164

LIST OF TABLES

Table	Page
1. Comparison of student Demographics for WEMS, Worcester School District and Massachusetts state schools	44
2. Qualitative Data Analysis Process Following Braun & Clarke’s guide (2006)	51
3. Data Analysis Schematic	62
4. Study Participant Characteristics in Comparison to WEMS Student Population	67
5. Self-identified Ethnicities	67
6. Distribution of Fruit (with and without Juice) and Vegetable Intake of Students.....	68
7. Student Examples of Favorite and Summer FV	70
8. Ranking of Median Sugar Sweetened Beverage Consumption by Students	73
9. Diet Diversity Score of Student Food Group Consumption	74
10. Students Consumption of Added Sugar and Saturated Fat Calories Compared to Recommendations	75
11. Associations Between School FV Survey Items and Student’s Confidence in FV Behaviors.....	76
12. Correlations Between Home FV Survey Items and Student Confidence in FV Behaviors.....	77
13. Correlations Between Self-Efficacy Survey Items and Family Value of Consuming FV	78
14. Inter-correlations Between Student’s Beliefs, Attitudes, and Behaviors towards FV	80
15. Ranked Consumption of FVFFQ Items for Each Race/Ethnicity Group	81
16. Regression Statistics for the best fit Stepwise Regression Models	87
17. Student Self Efficacy for Fruit and Vegetable Consumption Patterns and Preparation	89

18. Grocery Stores Identified as Utilized by their Families.....	105
19. Student’s Beliefs, Attitudes, Identified Barriers and Facilitators Towards Fruits and Vegetables by Theoretical Constructs	112

LIST OF FIGURES

Figure	Page
1. Bandura’s Social Cognitive Theory.....	23
2. Social Ecological Model.....	24
3. Ranked FVFFQ Vegetable Items.....	71
4. Favorite Vegetables and Vegetables Consumed in Summer.....	71
5. Ranked FVFFQ Fruit Items.....	72
6. Favorite Fruits and Fruits Consumed in Summer	72
7. Differences between Genders Attitudes on ‘Importance of Healthy Eating’.....	82
8. Self-Efficacy Scores by Availability of Preferred Fruits at School	83
9. Total Vegetable Intake by Availability of Preferred Vegetables at School	84
10. Residual Distribution of the Vegetable Regression Model.....	87
11. Residual Distribution of the Fruit Regression Model.....	88
12. Distributions for Self Efficacy Scores on Confidencein in Eating a FV: Eating Out, as Snack, or Dessert.....	90
13. Distributions of Self Efficacy Scores on Confidence in Eating Fruit 2x/day, Eating Vegetables 3x/day, and Preparing FV.....	90
14. Distribution of Self Efficacy Scores on Confidence in Eating a FV Every Day for Breakfast, Lunch, and Dinner.....	91
15. Distribution of Frequencies in Perceived Intake of FV	92
16. Distribution of Belief Responses on Importance of Being Healthy, Taste Preferences for Fruits and Vegetables.....	92
17. Distribution of Perceived Family Value of Fruits and Vegetables	93
18. Distribution of Frequency of FV Behaviors at Home and at School	93

19. Distribution of Availability of FV at Home and at School 94

CHAPTER 1

INTRODUCTION

This study is part of a larger research study entitled *Integrating Urban Agriculture and Nutrition Promotion to Increase Consumption of Fruits and Vegetables: A Focus on Worcester, MA*. The overall aim of the larger study is to understand what the barriers and facilitators are to fruit and vegetable intake of multicultural families residing in a low-income neighborhood of Worcester, MA. In addition, the study examines issues of access to culturally acceptable produce for families residing within the identified community, with the ultimate goal of developing an intervention that will help promote increased consumption of fruit and vegetable by these families. This larger study is undertaken through an interdisciplinary collaboration of University of Massachusetts (UMass) researchers including, Drs. Lindiwe Sibeko (PI), of the UMass Extension and Department of Nutrition, Frank Mangan (co-PI), of the Stockbridge School of Agriculture, Lisa Sullivan-Werner director of the UMass Extension Nutrition Education Program (NEP), Robyn DeCeiro, former program coordinator of the Worcester Extension office, and a wide range of community partners including a local middle school, Head Start, parenting groups, and organizations involved in the Worcester food system, as well as those serving diverse cultural sub-populations in Worcester.

Greater than a third of adolescents in the US are considered overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Low fruit and vegetable intake is associated with being overweight or obese (Boeing et al., 2012; USDA, 2104), risk factors that are major

contributors to chronic health conditions such as high blood pressure and diabetes (CDC Health Effects, 2015; Kleinman, 2009). Research indicates that adults and children who consume more fruits and vegetables have lower weights (Lin & Morrision, 2003). However, national estimates indicate that adolescents do not meet their recommended intake of fruits or vegetables with 6 out of 10 children not consuming enough fruit and 9 out of 10 children not consuming enough vegetables (CDC VitalSigns, 2014). In addition, racial and ethnic minorities tend to have lower intake of fruits and vegetables and are at greater risk for overweight and obesity (Satia, 2009; CDC, 2015).

The purpose of this current study is to identify the quality and frequency of FV intake of a multi-racial/ethnic population of middle school students from a low-income urban neighborhood. The study also aims to reveal valuable insight on the students' attitudes, beliefs and preferences in relation to fruit and vegetable consumption.

The study population was comprised of grade seven students at Worcester East Middle School (WEMS) in Worcester, Massachusetts. This is a school with a racially and ethnically diverse student population, 47.4% of Hispanic/Latino heritage. In 2014, 87% of students in the school were eligible for a free and reduced price lunch (MDESE, 2014).

Gaining insight into some of the potential pathways to promoting increased intake of fruits and vegetables in this population is important knowledge that can be used to shape interventions targeted at this population group. Outcomes of this study will be shared with WEMS and feasible interventions will be explored with the supervisor of the school's food service.

CHAPTER 2

LITERATURE REVIEW

2.1 Health outcomes

In the US, overweight and obesity in children has increased significantly and is currently identified as a national public health concern of high priority (CDC, 2015; Woodside, Young & McKinley, 2013). According to 2011-2012 NHANES findings, 34.5% of US adolescents (aged 12-19 years) were overweight or obese. The same report indicates 1 in 5 adolescents in the US are obese. Non-Hispanic black and Hispanic adolescents had higher overweight and obesity rates than non-Hispanic white and non-Hispanic Asian adolescents (Ogden, Carroll, Kit, & Flegal, 2014). Furthermore, obesity is known to be an independent risk factor for chronic disease, including coronary heart disease, hypertension, type 2 diabetes, metabolic syndrome and multiple cancers (CDC Health Effects, 2015). Estimates in 2008 indicate approximately 10% of overweight adolescents suffered from high blood pressure, and 30% had at least 2 metabolic syndrome risk factors (Kleinman, 2009).

Racial and ethnic minorities are at higher risk for poor health outcomes than their Caucasian counterparts. This is known as 'health status disparities', which is defined as "variations in rates of disease occurrence and disabilities between socioeconomic and/or geographically defined population groups" according to the 2009 Medical Subject Headings (National Library of Medicine, 2016). There are disparities in dietary intake, behaviors and patterns that result in poorer diet quality (partially characterized by low fruit and vegetable intake), inferior health outcomes and unequal

burden of disease in ethnic minority populations (Satia, 2009). These health disparities are a national public health priority (Wang & Stewart, 2012) and affect children and adolescents. Evidence shows African Americans are more likely to have hypertension at an earlier age than other ethnicities (Satia, 2009). Din-Dzietham, Liu, Beilo & Shamsa (2007) found Black and Hispanic adolescents (aged 8-17 years) have a higher prevalence of high blood pressure than Whites. Hispanics, the fastest growing population in the US, predicted to triple by 2050, have a higher prevalence of obesity and related cardiovascular disease risk factors than other minorities (Satia, 2009; CDC, 2015). The CDC NHANES 2011-2012 data indicates Hispanic adolescents, and non-Hispanic Blacks have the highest obesity rates (22.4% and 20.2% respectively), followed by non-Hispanic Whites (14.2%). Additionally, in 2011-2012, adolescents (aged 12-19 years) had higher obesity rates than younger children (CDC, 2015). Similarly, ethnic/racial trends of metabolic syndrome in obese adolescents mirror those of adults, with obese Hispanic adolescents having a higher prevalence of metabolic syndrome, followed by Non-Hispanic Blacks, then Non-Hispanic Whites (Falkner & Cossrow, 2014).

There are many individual, environmental, societal, cultural and behavioral factors that contribute to these health conditions and disparities. Additionally, each factor impacts individuals within each ethnicity (sub-ethnicities) differently (Satia, 2009). Despite these intra-ethnicity differences, cardiovascular disease risks and disease burdens negatively affect all Latino sub-ethnicities (e.g. Dominican, Puerto Rican) more than other ethnicities (Daviglius et al., 2012).

Modifiable risk factors for chronic disease that are present in adolescence include high blood lipids, hypertension, excess adiposity, and metabolic syndrome. Early prevention of chronic disease risk factors is critical since elevated cholesterol, blood pressure and being overweight follow youth into adulthood, resulting in the accumulation of fatty streaks beginning as early as childhood (Lynch & Smith, 2005). Furthermore, evidence indicates a dose response of obesity with the number and severity of co-morbidities later in life (Inge et al., 2013). There is a greater protective effect if these risk factors are lowered prior to reaching adulthood as compared to intervening during adulthood (Magnussen, Smith & Juonala, 2013). Fruit and vegetable consumption plays a preventative role in many of the diseases and conditions aforementioned (Boeing et al., 2012; USDA 2014).

2.1.1 Fruit and Vegetable Intake

Low fruit and vegetable intake is associated with being overweight or obese (Boeing et al., 2012; USDA, 2104). Fruits and vegetables are rich in soluble fiber, have a low glycemic value, low energy density and a high nutrient density, all factors which contribute to lower disease risk and possibly weight management to prevent and treat obesity (Pereira et al., 2004; Bazzano, He, Ogden, Loria & Whelton, 2003; Ludwig 2002; Mendoza, Drewnowski & Christakis, 2007; and Kant & Graubard 2005; Fulton, Cardwell, McKinley & Woodside, 2011). Accordingly, one study found adolescents with increased consumption of fruits and vegetables have lower body mass index (BMI), suggesting fruits and vegetables are a protective factor against obesity and chronic diseases, even in adolescence (Lin & Morrision, 2003). However, produce intake of American

adolescents (aged 12-18 years) do not meet the recommended intake of fruits and vegetables according to the 2015 Dietary Guidelines for Americans (DGA-2015). For adolescents (aged 13-18 years) 2-2½ cups of fruit and 2½- 3½ cups of vegetables are recommended for females (lower range) and males (higher range) (USDA&HHS 2015). Yet 2011-2012 NHANES data estimates adolescents aged 12-19 years ate on average 0.8-1.06 (female-male respectively) cup equivalents of fruit a day and 0.97-1.26 cup equivalents of vegetables per day (USDA ARS, 2014 Data Tables). Juice and potatoes accounted for approximately a quarter to a third of fruit and vegetable intake (Bowman et al., 2014; Larson, Melgar-Quinonex & Taylor, 2009). In relation to total calorie intake 2009 to 2010 NHANES data indicates adolescents (aged 12-18 years) ate on average about 0.60 cup equivalents per 1,000 Calories of vegetables per day and 0.46 cup equivalents per 1,000 Calories of fruit per day (Kim et al., 2014). Therefore, if a moderately active 13-year-old female was consuming enough calories to maintain a healthy weight (a diet based on a 2000 Calorie energy requirement according to the DGA-2015) she would be consuming just 1.20 cups of vegetables and 0.92 cups of fruit per day, still much below recommendations. The intake of fruits and vegetables in adolescence is below recommendations by at least one cup a day of vegetables, and over one cup a day of fruit.

Less nutritionally optimal forms of fruits and vegetables consumed frequently are french fries and fruit flavored sweetened beverages, including juice drinks. French fries account for on average 30% of vegetable intake of adolescents (Kim et al., 2013), and soda, energy drinks, sports drinks, and sugar-sweetened fruit drinks account for on

averages 39% of added sugar intake of Americans according to the DGA-2015 (USDA & HHS, 2015). Consumption of solid fats and added sugar should be limited because they contribute very few beneficial nutrients and high amounts of calories, which replace nutritionally dense and lower calorie foods, such as fruits and vegetables (USDA & HHS 2015).

Fruit and vegetable intake, along with other dietary components has been associated with waist circumference, an indicator of abdominal adiposity. Adolescent boys from NHANES III with a waist circumference (WC) above the 85th percentile consumed significantly less dairy, grains (whole and refined), fruits and vegetables than their peers with WC below the 85th percentile (Bradlee, Signer, Qureshi & Moore, 2010).

Adolescent fruit and vegetable intake is also associated indirectly with adiposity via energy density (Befort et al., 2006; Altman, Obbagy, Essery & CNPP, 2012). Energy density refers to the amount of calories per gram of food. Eating low energy dense foods means one can consume greater quantities for fewer calories than the same quantity of high energy dense foods. But adolescence is an extremely dynamic time, with varying degrees of growth and hormonal fluctuations. These changes complicate the relationships we know to be true for adults, and make drawing associations about adolescent fruit and vegetable intake and weight status challenging. For example, several studies have not been able to associate adolescent fruit and vegetable intake with body mass index (Field, Gillman, Rosner, Rockett & Colditz, 2003; Ledoux, Hingle & Baranowski, 2011).

Another example of the biological complexity of adolescence is demonstrated by Shi et al., (2014) who have found variable associations of fruit and salt intake on pre- and post-pubertal adolescent blood pressure. Health associated outcomes in adolescence that are strongly supported by evidence are the associations of fruit and vegetable intake with decreased chronic disease risks, such as decreased risk of high blood pressure and metabolic syndrome (Woodside et al., 2013; Boeing et al., 2012).

Rapid growth that occurs during adolescence requires a high amount of nutrients and calories. Fruit and vegetables are an important part of the adolescent's diet during these growth phases to promote bone health. A seven-year longitudinal study on bone mineral density found fruit and vegetable intake significantly predicted total body bone mineral content in boys, and had significant correlations of bone mineral density with female adolescents (Vatanparast, Baxter-Jones, Faulkner, Bailey & Whiting, 2005).

Although fruits and vegetables are often discussed as all-inclusive units, each color of a fruit and vegetable lends itself to unique nutrients that combined, provide important nutrients for adolescent health. For example, dark green vegetables are a good source of calcium and vitamin K, needed to support bone health as mentioned above. Red and orange vegetables boast plentiful amounts of Vitamin A and beta-carotene, an antioxidant which is important in mitigating cell damage that can occur during rapid cell multiplication during growth. Starchy vegetables are a good source of potassium, which helps regulate blood pressure and muscle contractions. Legumes provide plentiful fiber to help maintain a healthy digestive tract and decrease risk of cardio vascular disease. Many fruits and vegetables are a good source of Vitamin C and

many other minerals to support a healthy immune system, energy, and growth (USDA, HHS, 2015).

Although the DGA-2015 has specific intake recommendations for each of these vegetable subgroups, many research studies on adolescent fruit and vegetable intake do not discuss fruits and vegetable consumption in regards to these groups. Studies which breakdown vegetables into subgroups often exclude groups (Nielsen, Rossen, Harris & Ogden, 2014), or combine groups (Larson, Neumark-Sztainer, Hannan & Story 2007; CNPP Nutrition Insight 52, 2013) making it unclear how much of each vegetable subgroup adolescents are consuming.

Larson and colleagues (2007) reported total vegetable intake and one combined vegetable subgroup intake in servings per day. Adolescents in their study population consumed on average 0.32-0.51 servings of orange/green vegetables per day. The Healthy Eating Index-2010, based on the 2010 Dietary Guidelines for Americans also reports total vegetables consumed and one combined vegetable subgroup, beans and greens. Youth (aged 2-17 years) from 2007-08 NHANES scored 0.9 out of 5 points on the beans and greens subscale item (CNPP Nutrition Insight 52, 2013). According to NHANES 2009-10 more Non-Hispanic Black Youth (aged 2-19 years) consumed starchy vegetables yesterday than Non-Hispanic White or Hispanic youth, and more Hispanic youth consumed “other” vegetables yesterday than Non-Hispanic Black or Non-Hispanic White youth. Comparisons between ethnicities and legume intake were not included in the report (Nielsen et al., 2014). One study that did discuss many of the vegetable subgroups was by Kimmons, Gillespie, Seymour, Serdula, & Blanck (2009). They used

NHANES 2003-04 data for adolescents (aged 12-18 years) and adults and found few people met recommendations for dark green, orange, and legume subgroups. Their data indicated potatoes and french fries were large contributors of total vegetable intake and fruit juice was the primary contributor for total fruit intake of adolescents (Kimmons, et al. 2009).

2.2 Adolescence as a critical time period

Significant physical growth occurs during adolescence, requiring a high level of nutrient intake (Larson, Neumark-Sztainer, Hannan & Story, 2007). Nutritional deficits and poor eating habits established in adolescence have long-term health, growth, and developmental consequences (Jenkins & Horner 2005). Additionally, adolescence is a time to test limits and establish independence. This can translate into adolescents exercising more choice in what they chose to eat and not eat during a period when dietary habits are being developed, habits that may follow the adolescent into adulthood (Befort et al., 2006).

Compounding the issue is the commonly observed decline in fruit and vegetable intake from childhood to adolescence (Larson et al., 2009; Kim et al., 2014; Nielsen, Rossen, Harris & Ogden, 2014) with a steady decline seen through each stage of adolescence (Larson et al., 2007). A cohort study of adolescents found a decrease of 0.7 servings of fruits and vegetables per day from early (aged 11-14 years) to mid-adolescence (aged 15-18 years) and another decrease of 0.6 servings per day from mid to late adolescence (approximately 19+ years old) (Larson et al., 2007). Altogether that is a substantive decrease of 1.4 serving per day in fruit and vegetable intake from onset

of adolescence to almost adulthood. According to NHANES data from 2003-2010, child (aged 2-5 years) fruit intake was about 0.77 cup equivalents per 1,000 Calories, while adolescent consumption dropped to 0.46 cup equivalents per 1,000 Calories (Kim et al., 2014). Nielsen and colleagues (2014) found a similar trend again in 2009-2010 NHANES data with a significant negative linear trend observed with age and likeliness to eat fruits or vegetables on a given day.

Once the decline plateaus, there is evidence eating patterns established in adolescence may track into young adulthood, as discussed below. Tracking of eating patterns means the person's intake of certain dietary components, such as fruits and vegetables, maintains the same pattern (statistically, in the same quartile) over time, or they maintain a certain dietary pattern, such as a Western-like diet, over time. Studies tracking eating patterns from adolescence (aged 11-15 years) to young adulthood (up to 33 years old) have demonstrated weak or moderate correlation between the two time periods. Despite low correlations, multiple studies suggest a tendency for some people to maintain the same eating patterns over time (Lake, Mathers, Rugg-Gunn & Adamson, 2006; Patterson, Warnberg, Kearney & Sjostrom, 2009; Gallagher et al., 2006). One study found tracking present over a 21-year period for about 40% of their participants, with the starting age between ages 3-18 years. (Mikkila, Rasanen, Raitakari, Pietinen & Viikari, 2005). Another found 70% of 18 year olds tracked dietary patterns through age 21 (Lien, Lytle & Klepp, 2001). These results suggest dietary patterns established by the older adolescence time period are more likely to track into young adulthood, while

younger adolescents may have a more fluent dietary pattern. Few findings have shown no tracking from adolescence to adulthood (Post, de Vente, Kemper & Twisk, 2001).

Personal and social factors that may affect fruit and vegetable consumption also change from early adolescence to mid-adolescence. Granner and colleagues (2004) found compared to 11 year olds, middle adolescents (aged 15 years) had lower fruit and vegetable related self-efficacy scores, were less influenced by peer modeling of fruit and vegetable consumption, participated in fewer family dinners, and had less preference for fruits and vegetables (Granner et al., 2004). Although there was a lower level of peer influence on food choices noted for middle adolescents, there is still a high degree of peer influence on consumption practices of all adolescents. These findings illustrate the complexities of the adolescent developmental period, pointing to a need to understand the discreet periods of adolescence and what factors influence dietary choices and behaviors.

2.2.1 Adolescence and Cognitive Processes

There are several stages of adolescence; early adolescence is defined as 11-13 years of age, and middle adolescents are aged 14-18 years (AACA, 2008). Several complex cognitive and social processes begin to take place during early adolescence that renders this age group an ideal target for nutrition interventions. Early adolescents have a developing capacity for abstract thinking, meaning they can bring concepts together in order to solve problems or make generalizations. Furthermore, early adolescents begin to have a more flexible and adaptable thought processes, with the capacity to understand and create their own values and beliefs (AACA, 2008). These cognitive

processes make it possible for early adolescents to converse about their beliefs, values, and ideas.

A yearning for independence starts to emerge as adolescent's progress into middle adolescence. At this point they are making their own decisions and increasingly relying on peers, rather than parental figures for support (AACA, 2008). Therefore, understanding and utilizing the dynamic between peers would be useful for creating successful interventions.

Knowledge is gained at higher rates and in more sophisticated ways during middle adolescence, yet the rational decision making portion of the brain (frontal lobe) is not fully developed until the early 20's (Oswalt, 2005). Therefore, adolescents will not always draw upon their knowledge to make the best or right decisions for themselves; instead they will make impulsive and irrational choices at times. Collectively, these qualities illustrate the importance of understanding contextual (social, environmental and cultural) factors that affect adolescent dietary behavior.

2.3 Influences on Adolescent Dietary Intake

Several factors have been identified as important influences of adolescent fruit and vegetable intake. A research group from Denmark, led by Rasmussen and Krolner conducted two separate literature reviews on determinants of adolescent fruit and vegetable intake. One review included only quantitative studies; the other included only qualitative studies. They found quantitative and qualitative research methods have resulted in different types of information on the same subject, which when combined deepens our understanding of adolescent fruit and vegetable intake. Among the top

determinants of adolescent fruit and vegetable intake determined by quantitative research are preference or liking of fruits and vegetables (Neumark-Sztainer, Wall, Perry & Story 2003(a); Granner et al., 2004; Rasmussen et al., 2006) and social and peer support for consumption of fruits and vegetables (Neumark-Sztainer et al., 2003(a); Franko, Cousineau, Rodgers, Roehrig & Hoffman, 2013; Bruening et al., 2012; Granner et al., 2004). A major kind of social support includes parental influence on produce consumption (Di Noia & Byrd-Bredbenner, 2013; Pérez-Lizaur, Kaufer-Horwitz & Plazas, 2008), such as serving fruits and vegetables at meal times (Arcan et al., 2007), frequency of family meals (Neumark-Sztainer et al., 2003(a); Arcan et al., 2007), and parent modeling of fruit and vegetable consumption (Arcan et al., 2007; Granner et al., 2004; Rasmussen et al., 2006). Although not in the U.S., Pedersen, Grønhøj, and Thøgersen (2015) found despite adolescents growing need for independence, parents were still an integral part of their fruit and vegetable intake in Denmark.

Availability of produce (Di Noia & Byrd-Bredbenner, 2013; Pérez-Lizaur et al., 2008), especially at home (Neumark-Sztainer et al., 2003; Rasmussen et al., 2006) and accessibility of produce (Granner et al., 2004; Rasmussen et al., 2006), including the temptations of easily accessible less healthful foods on fruit and vegetable intake (Krolner et al., 2011) are also important predictors of fruit and vegetable intake by adolescents. But there are many ways to assess availability and accessibility of produce. Researchers can either ask parents about availability and accessibility, determine availability and accessibility through visual inspection of surrounding areas or can ask children directly. When either parents or children are asked and the researchers do not

visually confirm access, input from the parent of child may be considered 'perceived' availability or accessibility. Young et al. (2004) found adolescents perceived fruit and vegetable availability moderated the relationship between adolescent fruit and vegetable intake and adolescent reported parental modeling and support of eating fruits and vegetables.

Evidence indicates youth believe they are invulnerable (Sylvetsky et al., 2013). For example, adolescents did not believe they had to worry about eating healthy until they had heart disease (Neumark-Sztainer, Story, Perry & Casey, 1999). A lack of interest in eating fruits and vegetables despite awareness of the benefits of a healthful diet has been found among adolescents. These findings suggest using health related reasons to motivate increased fruit and vegetable consumption may not be the best approach for adolescents (Neumark-Sztainer et al., 1999). However, seventh and 10th grade students suggested making healthy food packaging "cool" and taking away unhealthy food as a tactic to increase adolescent produce consumption (Neumark-Sztainer et al., 1999). A focus group of African American adolescents found visual proof of benefits from eating fruits and vegetables was an expectation and motivation to consume produce. The same group suggests role models may be an important part of their food decisions. In addition, the adolescents identified the need for gender specific skills in regards to fruits and vegetables; such that females wanted to learn complex preparation techniques, while males desired to learn simple fruit and vegetable preparation methods (Molaison-Fontenot, Connell, Stuff, Yadrick & Bogle, 2005).

Empowerment is a strong motivator of change in adolescents (Skinner, Hanning & Tsuji, 2006; Brooks & Magnusson, 2006). Focus groups with 6th through 8th grade students found empowerment to be the core issue related to healthy eating in First Nation youth of Canada (Skinner et al., 2006). Giving students more choice and a say in changes made throughout a project, as well as rewarding students for behavioral change efforts all helped empower students and enhance program results (Brooks & Magnusson, 2006). Although adolescent viewpoints are essential for development of programs targeted for their population group, it is also valuable to obtain data from adults who influence adolescent's life. Obtaining adult viewpoints contributes to a more ecological view of the adolescent's fruit and vegetable environment. Findings from focus groups conducted with parents, stakeholders and adolescents found community, parental and personal factors affect adolescent eating behaviors. Furthermore, adolescents pointed out that unhealthy habits and lack of nutrition education among their parents were barriers to eating healthy at home. Findings from both focus groups showed there was a lack of awareness, knowledge and motivation surrounding healthy eating in parents, stakeholders, and adolescents (Ying et al., 2009).

Gender and weight status may also affect fruit and vegetable intake in adolescents. There is consistent evidence that female youth consume a higher percentage of recommendations for fruits and vegetables than males (Kim et al., 2014; Larson et al., 2009). Larson and colleagues (2009) found weight status and gender may predict less optimal forms of fruit and vegetable intake. Boys and those who were overweight or obese consumed a higher proportion of their fruits and vegetables in less

optimal forms (french fries and fruit juice) than females and normal weight students (Larson et al., 2009).

2.3.1 Race and Ethnicity

There are many factors that may influence fruit and vegetable intake, including race and ethnicity. Studies have focused on the differences in produce consumption between Non-Hispanic Whites versus African Americans, and Hispanic/Latinos. In examining NHANES 2009-2010 data, Nielson and colleagues (2014) found black adolescents (aged 12-19 years) were more likely to consume fruits, and less likely to consume vegetables than white adolescents, while white adolescents were just as likely to eat vegetables as Hispanic adolescents. Befort and colleagues (2006) also found black adolescents (aged 10-19 years) ate slightly more fruit than white adolescents, but consumed a higher percent of energy from fat than their white counterparts. In a different population of adolescents (average age 15.6 years), Mexican Americans were found to eat significantly more fruit than White American adolescents (Larson et al., 2009).

In interpreting these noted differences, it is important to recognize the variation within each broad race/ethnicity categorization. The above noted health disparities, plus the recognition of a need for culturally sensitive healthy eating promotion initiatives (Larson, Eisenberg, Berge, Arcan & Neumark-Sztainer, 2015), have led to nutrition studies focusing on low-income, minority populations, yet few of these studies specify the ethnicities of their study participants. The population identified most frequently is Mexican-Americans or Mexican descent Hispanics/Latinos. As a result, data from such

studies are often generalized as representative of Latinos/Hispanics and rarely identify the ethnic variation of the study population which may include ethnicities other than Mexican, such as Cuban, Puerto Rican, Dominican, or Salvadorians. The importance of identifying ethnicities in a study population is demonstrated by Siega-Riz and colleagues (2014). Within the adult Hispanic and Latino groups in the study, Puerto Ricans had the lowest fruit and vegetable intake, while Cubans had the highest vegetable intake and Dominicans had the highest fruit intake (Siega-Riz et al., 2014).

Given that race, ethnicity, age and gender are all un-modifiable predictors of fruit and vegetable consumption, it is important to find pathways to motivate increased fruit and vegetable consumption of adolescent's that can help promote and enhance health outcomes now and in the future. These answers may lie in initially understanding the beliefs and attitudes adolescents have towards fruits and vegetables.

2.3.2 Beliefs and Attitudes

Qualitative research has allowed many new ideas about adolescent fruit and vegetable intake to be discovered. A review of qualitative studies focusing on determinants of adolescent fruit and vegetable intake by Krolner and colleagues (2011) found a variety of beliefs and attitudes that influence fruit and vegetable intake of adolescents. Some beliefs about fruits and vegetables include the lack of guarantee that fruits or vegetables will always taste good, the expectation of how satisfying a food is thought to be compared to non-produce foods, and various other sensory and physical aspects of FV. Short-term outcome expectations of eating fruits and vegetables included better health, appearance and satiety. Children and adolescents discuss fewer long-term

outcome expectations, but when they were discussed, the review found that boys may be more concerned with long term outcomes, than females are. Adolescents shared attitudes about the appropriateness of time, occasion, and setting in which it is acceptable or not acceptable to eat produce. Adolescents were also found to value the health benefits of produce less than the amount of time fruits and vegetables take to eat. Additionally, produce may take on symbolic values that represent image, gender, and social interactions for adolescents. The review found availability of fruits and vegetables adolescents prefer, having more choices (variety), and the preparation methods of fruits and vegetables were all important determinants of produce intake of adolescents (Krolner et al., 2011). These findings tap into some of the constructs of the socio-ecologic model not found by quantitative research, including organizational and cultural constructs.

Adolescent's beliefs and attitudes about the benefits of fruits and vegetables intake were identified in a focus group of 5th to 11th grade Australian students (O'Dea, 2003). Benefits included improved concentration and school performance, physically feeling good and "clean", improved fitness, endurance and energy levels. Eating fruits and vegetables also helped students feel good about themselves. Barriers to eating produce, included convenience of less healthful foods, personal taste preferences for less healthy foods, cravings, and the attitude that produce "looks and smells dull and boring." Youth also felt there is negative social pressure from peers and parents to eat produce, and identified they ate unhealthy food as a reward or in response to their mood. (O'Dea, 2003).

While there may be evidence about general factors that influence adolescent beliefs and attitudes towards fruits and vegetables, individual beliefs and attitudes may be different within a group because of lived experiences. For example, in an adolescent focus group, overweight participants were more pessimistic about facilitators of change related to fruit and vegetable intake, while their normal weight peers had more optimistic views. Additionally, those with a personal success story about themselves or a family member's change of dietary intake were also more optimistic about influencing behavior change than students who did not have similar experiences (Sylvetsky et al., 2013).

Peer and family influence shapes adolescent beliefs and attitudes towards fruits and vegetables. A research group explored the differing effects injunctive and descriptive norms had on adolescents' eating patterns. They found injunctive norms (telling someone what to do/what is appropriate) decreased intentions of eating fruit but did not affect intake of fruit in high school students, whereas descriptive norms (sharing what others do) increased fruit intake of adolescents. The use of the concepts of injunctive vs. descriptive norms has become more popular in understanding adolescent intake and offers promising knowledge that can contribute to development of effective interventions aimed at increased adolescent produce intake (Stok, DeRidder, de Vet, de Wit, 2014). Pedersen and colleagues also found what parents did (descriptive norms) influenced adolescent fruit and vegetable intake more than what parents said (injunctive norms) (Pedersen, Grønjø, and Thøgersen, 2015).

Understanding the beliefs and attitudes of adolescents with regards to dietary intake and behavior change is often an overlooked factor that can contribute to successful nutrition intervention development. Formative research allows investigators to obtain this type of information from students through surveys, focus groups or interviews. Student feedback either through research prior to program development or testing a preliminary intervention idea has proven to increase the participation rate and successfulness of adolescent nutrition interventions (Nollen et al., 2013; Nicklas et al., 1997; Baranowski et al., 2003).

2.3.3 Access to Fruits and Vegetables

In general, low-income minority populations are at increased risk of food insecurity (Coleman-Jensen, Gregory & Singh, 2014), a complex multi-factorial vulnerability that includes poor access to food outlets that provide quality produce (Hosler, Rajulu, Fredrick & Ronsani, 2008; Morland & Filomena, 2007). The term Food Desert has emerged to encapsulate environments with significant challenges to access of quality food. Food Deserts are defined as “urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food” (USDA, AMS, 2015). These areas often have an over representation of low-income residents, a high proportion being racial/ethnic minorities, particularly in urban settings. Poor access to food outlets is defined as a lack of a supermarket or large food store within a one-mile radius of a person’s home in an urban area, and a 10-mile radius in a rural area. These distances account for the higher access to cars in rural areas (USDA, AMS, 2015). Accordingly, there is an association between living in such communities and poor diet quality and

health outcomes of area residents (Rose, Bodor, Hutchinson & Swalm, 2010). In contrast, Larson and colleagues (2009) found living closer to a supermarket, with less access to convenience stores is associated with healthier diets and lower obesity rates in area residents. These associations hold true for health outcomes of adolescents living in similar environments (Tang et al., 2014).

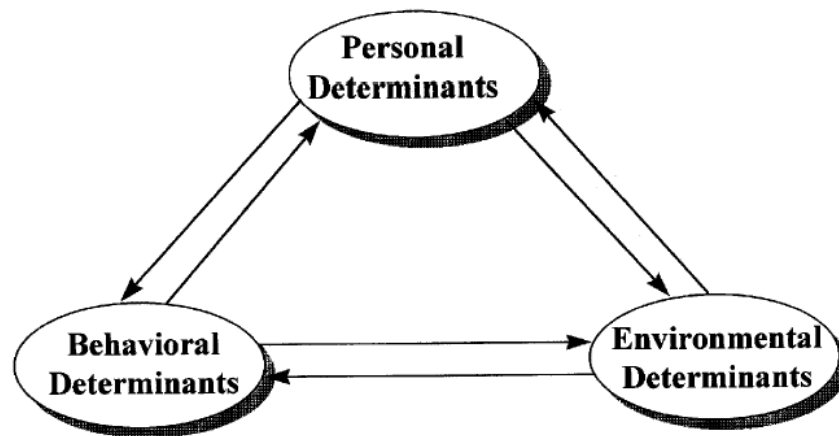
Furthermore, small food stores present in low income, racial/ethnic minority prevalent neighborhoods have been shown to have less variety of fruits and vegetables than similar food stores in non-minority neighborhoods (Morland & Filomena, 2007). In addition, the price of fruits and vegetables are often inflated in small stores, regardless of location. For low-income residents the cost of traveling to full service supermarkets often outweighs the lower prices and greater variety available within those stores (LeClair & Aksan, 2014).

2.4 Theoretical frameworks used to understand behavior

The social cognitive theory (SCT), developed by Bandura (1989), provides a comprehensive framework to explore nutrition related behaviors and behavior change. The SCT states that there are reciprocal relationships between personal factors, the environment in which the person is surrounded, and their behavior. In other words, intrapersonal, environmental and behavioral factors all affect one another (Figure 1). Mediators within the SCT include self-efficacy, outcome expectations, self-regulation and observational learning (Falbe & Davison, 2014). Self-efficacy is the belief of one's own capabilities to perform to a certain standard (Bandura, 1977). Outcome expectations are beliefs and values about what would result from actually carrying out a

certain behavior. Self-regulation includes the ability to set and monitor goals as well as rewarding oneself appropriately or solving problems as needed (Falbe & Davison, 2014). Lastly, observational learning is the belief people “learn from models” by observing others behaviors and there outcomes, also called modeling (Bandura,1989).

Figure 1: Bandura’s Social Cognitive Theory

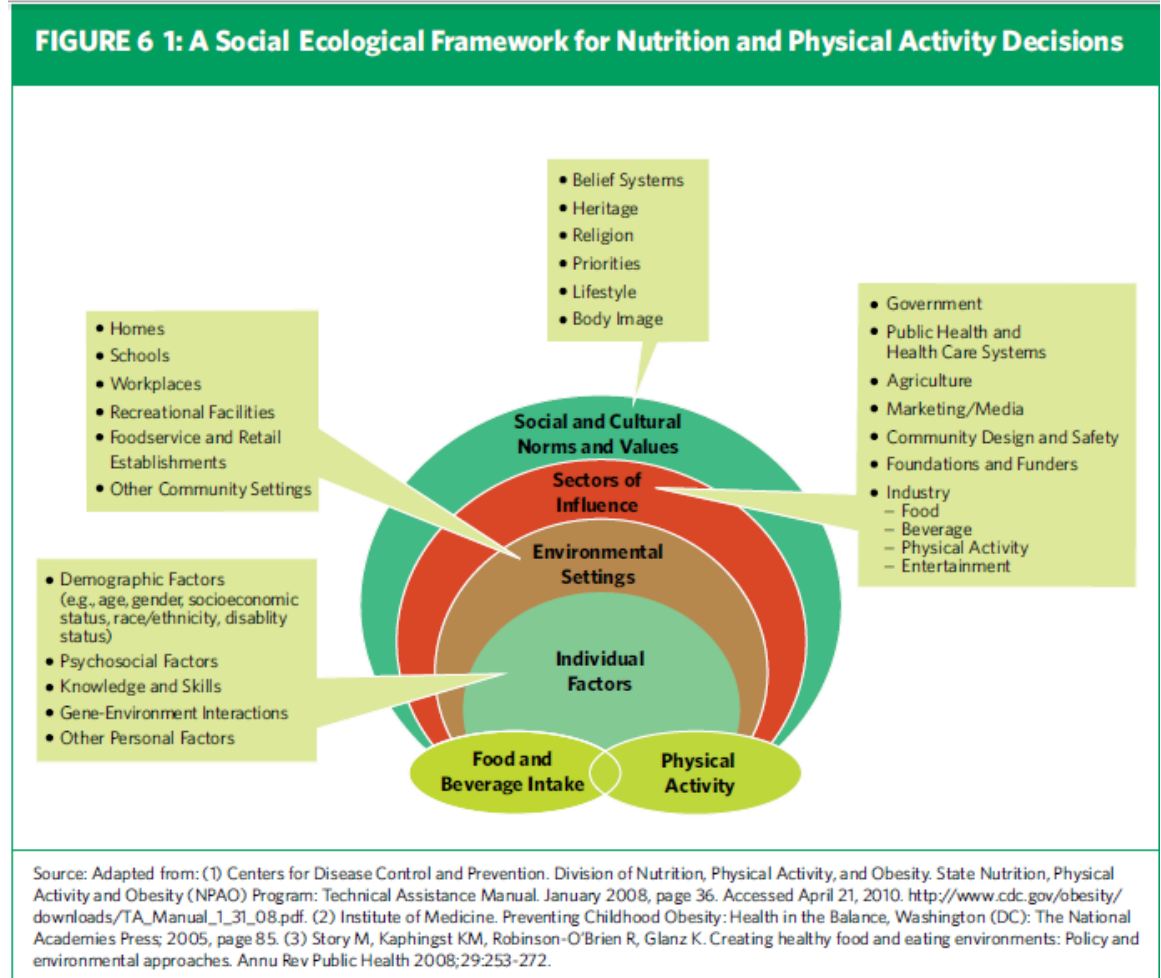


Another theoretical model often used in nutrition researcher is the social ecological model (SEM) (Figure 2), which is an evolution of Bronfenbrenner’s model of ecological human development (Bronfenbrenner, 1977). The SEM states that there are many levels of influence on behavior, some of which people have direct control over and some of which they do not. These levels of influence include individual, interpersonal (social), organizational/institutional, environmental, community, policy/society, and culture (Falbe & Davison, 2014).

There is a close interplay between the SCT and SEM, therefore this research will draw from a combination of the two as illustrated in the Conceptual Framework

(Appendix A). The theories will guide development of the data collection instruments and will be used in the interpretation of data, particularly in the qualitative analysis.

Figure 2: Social Ecological Model



Source: Dietary Guidelines for Americans, 2010

2.4.1 Self Efficacy

Self-efficacy has been identified as an important determinant of adolescent fruit and vegetable intake. Increased self-efficacy correlates with increased fruit and vegetable intake in adolescents (Franko et al., 2013, Granner et al., 2004). Di Noia found adolescents who ate 5 or more fruits and vegetables a day were more likely to seek and reflect on information about healthy behaviors, recognize their actions impact

other's actions and their environment, look for and use social supports, control their environment by removing cues to unhealthy behaviors and utilize reminders for healthy behaviors (Di Noia & Thompson, 2012). Young and colleagues (2004) found self-efficacy moderated the relationship between adolescents' perceived parent support for fruit and vegetable consumption and their actual consumption. Another intervention, *Back to Basics*, focused on building self-efficacy skills through cooking and nutrition lessons in an after school setting with students (mean age 9 years), found a multitude of SCT constructs, including self-efficacy, increased, as well as an increase in the number of fruit servings/week and variety (Burrows, Luca, Morgan, Bray & Collins, 2015). This shows a cooking skills program has many benefits, which may stem from the improved self-efficacy associated with the acquisition of cooking skills. Another intervention, which focused on improving self-efficacy of students, concordantly increased their fruit and vegetable consumption, was a computer game called *Squire's Quest*. Elementary students played the game for several short sessions during school. The majority of points accumulated in the game were based on setting and achieving fruit and vegetable related goals (Baranowski, T., et al. 2003). A review of primary school interventions focusing on fruit and vegetable intake indicate that computer based interventions were more effective than multi-component and free or subsidized fruit and vegetable interventions at improving produce intake of students (Delgado-Noguera, Tort, Martínez-Zapata & Bonfill, 2011). While computer games hold promise, other unique types of intervention platforms also prove successful with regards to improving self-efficacy and fruit and vegetable consumption by students. A board game was

developed for use in classrooms that focused on the students practicing real life decision-making skills. The board game *Kalèdo* was successful in improving vegetable intake and nutrition knowledge of students aged 11-14 years (Amaro et al., 2006). Using hands on approaches to practice self-efficacy skills, whether virtual, make believe or present, all provide ways to help increase fruit and vegetable, self-efficacy of students, and have also shown to improve their fruit and vegetable, intake.

Another SCT construct that also seems important in adolescent dietary intake is self-regulation. Morrill et al. (2015) found the use of tangible prizes to create greater and more sustained improvement in fruit and vegetable intake of elementary school students than did praise from the teacher. This indicates that students may respond more to self-regulation that is tangible rather than intangible rewards such as the satisfaction of superiors.

Despite the importance of self-efficacy for fruit and vegetable intake, little research has investigated how adolescents suggest changing their social, intrapersonal, and environmental surroundings to enhance self-efficacy and other SCT constructs related to fruit and vegetable consumption.

2.5 Adolescent Focus Groups

Qualitative methods provide a gateway to gaining insight and understanding of the lived experiences of a phenomenon (Creswell, 2014, p. 14). Qualitative methods enable the researcher to discover new ideas, perspectives, and deeper understanding of the motivations enabling participants' behaviors, in this case, adolescents' intake

behaviors of fruits and vegetables (O’Dea, 2003; Neumark-Sztainer et al., 1999; Krolner et al., 2011; Nicklas et al., 1997; Baranowski et al., 2003).

Focus groups, a key qualitative method, provide an ideal forum for exploration of participant’s perceptions, beliefs and attitudes as they relate to consumption behaviors (Krolner et al., 2011). Those who have used focus groups with youth have reported they are acceptable among adolescents and cost effective to implement (Nabors, Weist & Tashman, 1999). Furthermore, focus groups have been established as an effective method for exploring group norms and values, especially in cross-cultural studies (Colucci, 2007).

Focus groups reveal a deeper understanding of the motivation behind the variation in adolescent fruit and vegetable consumption (and non-consumption) behaviors, which improve intervention outcomes. Baranowski and Nollen’s research used focus groups with their target populations (4th grade students, aged 8-15 years) to revise their nutrition promotion programs and make them more acceptable and effective (Baranowski et al., 2003; Nollen et al., 2013). Additionally, Nicklas and colleagues (1997) claim their project was “guided and enriched” by adolescent input via focus groups.

Focus groups studies on youth fruit and vegetable intake are often conducted with only adults, such as caregivers or key informants (Nathan et al., 2011; Greaney et al., 2014; Bauer, Patel, Prokop & Austin, 2006). Although discussions with caregivers and key informants provide great detail on adult perspectives, the adolescent’s viewpoint is likely to be lost with this approach. It is understood between ages 8 to 11 years, youth

are able to self-reflect and express their ideas clearly (Krol, Sixma, Meerdink, Wiersma & Rademakers, 2013; O’Dea, 2003). Adolescents are also consumers, they influence what their caregivers buy including where they go out to eat and the groceries they purchase (Story, Neumark-Sztainer & French, 2002). Therefore, it is important to obtain adolescent’s opinions to help create interventions that will be effective with youth.

Previous research has provided suggestions for successful adolescent focus groups. Recruitment for student focus groups has taken place in school during home room (Bauer, Yang & Austin, 2004) or the lunchroom (Ying et al., 2009). Student study liaisons have also been used to help recruit for focus groups (Bauer et al., 2004). It is suggested adolescent focus group participants should be as homogenous as possible (Peterson-Sweeney, 2005). Many adolescent focus groups are structured to be homogenous, and are often separated by sex (Bauer et al., 2004; Ying et al., 2009; Peterson-Sweeney, 2005; Sylvetsky et al., 2013; Molaison-Fontenot et al., 2005), grade (Bauer et al., 2004; Molaison-Fontenot et al., 2005; Peterson-Sweeney, 2005; Sylvetsky et al., 2013), and if needed, by language (Ying et al., 2009).

Most focus groups with adolescents have between 5-8 students per group. Some have used as few as 4 participants and some have used up to 9-10 students per group (Molaison-Fontenot et al., 2005; Sylvetsky et al., 2013; O’Dea, 2003; Peterson-Sweeney, 2005; Ying et al., 2009; Bauer et al., 2004; Neumark-Sztainer et al., 1999; Krol et al., 2013; Skinner et al., 2006; Nago, Verstraeten, Lachat, Dossa & Kolsteren, 2012). Typically, focus groups with adolescents have a range of duration from 20 minutes to 90 minutes, with the duration of the focus group not identified as a limitation to facilitation

of a productive focus group (Nago et al., 2012; Nabors et al., 1999; Slater & Tiggemann, 2010; Ying et al., 2009; O’Dea, 2003).

Methodologically, semi-structured focus groups have been found to be effective with adolescents (Bauer et al., 2004, Ying et al., 2009, Neumark-Sztainer et al., 1999, Molaison-Fontenot et al., 2005). A general question route for semi-structured focus groups is suggested by Halcomb, Gholiza des, DiGiacomo, Phillips & Davidson (2007), it includes: an introduction question; one or two transition questions; a number of key questions which include the core research topics, each with multiple questions; a concluding question and finally, inquiring if participants have anything else they would like to add. Probes are used throughout the focus group to elicit further detail when needed (Slater & Tiggemann, 2010; Peterson-Sweeney, 2005).

The structure of the focus group should allow for a time in the beginning to help the participants feel comfortable. Participants should be assured all ideas are welcome (Peterson-Sweeney, 2005). In addition, certain types of questions have been used to help prepare the group for discussion. Situational questions, such as “What would you do or tell them?” can be used to build self-confidence in the students (Krol et al., 2013). Some have started with a worksheet for the participants to fill out about what they ate yesterday to help the students start thinking about the topic (Neumark-Sztainer et al., 1999). Furthermore, some have used introduction questions that are general enough for everyone to relate to and encourage everyone to talk (Slater & Tiggemann, 2010; Peterson-Sweeney, 2005; Halcomb et al., 2007). Using a variety of questions may also help participants to stay engaged and deliver the information the researcher seeks.

Examples of these may include; storytelling, case studies, films/photos to elicit responses (Peterson-Sweeney, 2005), concrete statements followed by short questions (Halcomb et al., 2007), ownership questions such as “what would you do?”, semantic differential questions to find out the meanings of words being used, choosing alternatives, making lists, fill in the blanks, rating, drawing pictures, developing campaigns (Krueger, 2002), and finishing the sentence or generating statements followed by ranking these statements (Stok, de Vet, de Ridder & de Wit, 2012).

Although open-ended questions are often the goal of focus groups, caution should be exercised to avoid questions that are “too open” because enough information may not be derived from them as participants fail to focus (Halcomb et al., 2007). Using probes and follow up questions to get further detail about what is being said is an important strategy to avoid this issue with adolescent focus groups (Slater & Tiggemann, 2010; Peterson-Sweeney, 2005). If the topic being discussed is sensitive, it may also be important to end the focus group with questions that are less invasive, to allow participants to “cool off” (Peterson-Sweeney, 2005).

Some challenges to using adolescent focus groups include varying communication abilities, confidence levels, and peer influence. Adolescents, especially younger ones may have varied abilities in expressing their thoughts clearly, which may make their statements seem unusual (Molaison-Fontenot et al., 2005). In addition, the presence of peer influence is an issue with all focus groups, but especially so for adolescents. Students may say certain things to be accepted or not rejected by the group (Moaison-Fontenot 2005; Sylvetsky et al., 2013). Conversely, there may be

adolescents who are more confident in their beliefs and seek to be rebellious. These participants may be more comfortable expressing opinions even when they are different from the rest of the group, which may demonstrate a subculture of the group. Some may also be confident enough to express vulnerable feelings, but more often the adolescent focus group will gather the dominant cultural norms of the community (Hyde, Howlett Brady & Drennan, 2005). Although peer influence is a concern, it has not proven to be an issue in many studies, which claimed their adolescents were comfortable in challenging each other's views. Slater and Tiggemann (2010) expressed the need to create methodology to use during adolescent focus groups to allow those less comfortable to still express opinions.

Despite challenges, focus groups may be more effective than individual interviews with adolescents. Interviews may intimidate adolescents because of a perceived pressure to give the right answers in a one-on-one setting (Hyde et al., 2005). Adolescents are used to talking with their peers and a focus group can allow for this natural conversation to take place. Allowing students to discuss may lead to some agreeing and some disagreeing, this utilizes the group dynamics (Hyde et al., 2005) revealing the richness and complexity of individual and group perspectives (Peterson-Sweeney, 2005). Additionally, adolescents tend to be egocentric, and feel invulnerable (Costa, Hayley & Miller, 2014). This in-vulnerability may be of benefit during focus group discussions and lead to expression of individual, divergent thoughts, which may provoke more conversation among participants.

Qualitative research aims to hear what participants believe and perceive, therefore it is important to find these themes from the text, not pre-conceived notions about the topic. Inductive thematic analysis is an analysis method used to give meaning to the data set, by letting themes emerge from the transcripts (Braun & Clarke, 2014). An advantage of thematic analysis is that it is a rigorous process. In addition, thematic analysis is particularly useful for those performing applied or practice based research (Braun & Clarke, 2014).

2.6 Adolescent Food Frequency Questionnaires

Surveys provide a method of obtaining quantitative or numeric measures of trends, characteristics, attitudes, opinions, or behaviors of a sample of a population (Creswell, 2014, p. 157). Surveys allow a larger number of participants because they are cost and time efficient. Administering food frequency questionnaires (FFQ) within a survey is a common practice. An advantage of a FFQ as opposed to other forms of diet assessment is similar to that of surveys; they are time and resource efficient (Lissner & Potischman, 2009), making them suitable for large numbers of participants (MRC PHSRN, 2015).

Food frequency questionnaires are a commonly used quantitative or qualitative assessment of usual dietary intake, and can be successfully applied to adolescent intake assessment (Ratcliffe, Merrigan, Rogers & Goldberg, 2011; Amaro et al., 2006; Preliip, Slusser, Thai, Kinsler & Erausquin, 2011; Hoelscher et al., 2010; Wright, Norris, Giger & Suor, 2012; Alaimo et al., 2013). More specifically FFQs are self-administered questionnaire that aim to discover the usual dietary intake of a person or population by

presenting the individual with a list of foods with which they need to respond how frequently they ate that food within the given time frame (Kolodziejczyk, Merchant & Norman, 2012). Unlike 24 hour recalls (24h-R), food records (FR) or observations, a FFQ collects dietary data on habitual intake usually in a one-time assessment. Although the accuracy of a FFQ is not as precise as that collected using a 24h-R or FR methods, it is a convenient assessment tool when precise data is not needed (Lissner & Potischman, 2009). A study tracking change of habitual dietary intake can also use a FFQ, since it can be easily re-administered with low respondent burden (Willett, 2007). Although a FFQ requires a high level of cognitive, literary, and mathematical skills it has been used successfully with youth as young as elementary school age (Hoelscher et al., 2010; Prelip et al., 2011; Wright et al., 2012). A FFQ is also more cost efficient to administer and analyze than 24h-R or FR (Lissner & Potischman, 2009).

Food frequency questionnaires can be used to create diet indices. Diet indices assess diet quality based on compliance with dietary recommendations, such as the DGA-2015. Characteristics of FFQs, such as assessing diet over time and by food or food groups, lend itself well to how dietary guidelines are often structured. With proper validity and reliability tests and adjustments a FFQ can be developed to suit a certain dietary guideline. But many current FFQs were not structured to be a basis of a Diet Quality/Diversity Index, lacking certain food categories and portion sizes (Bell, Golley, and Magarey, 2013). The Dietary Guidelines Adherence Index-2015 (DGAI-2015) (Troy, Dweyer, Folgi-Cawley & Jacques, in preparation) which is an updated version of the

DGAI-2005 developed by Fogli-Cawley, et al. (2006) is one of a few indices developed to access diet quality based on the DGA-2015.

Indications for use of a FFQ include having a large number of participants, studies where only a certain group of foods rather than the whole diet need to be assessed (e.s. fruits and vegetables), studies were summative descriptions of diet will suffice, and if being re-administered when types of foods eaten will not change dramatically (MRC PHSRN ,2015; Cade & Thompson, 2002).

Food frequency questionnaires can be developed from scratch or modified from existing ones. Both perform just as well, as long as proper adjustments have been made to ensure cultural and population appropriateness (MRC PHSRN, 2015). In fact, Cade and Thompson (2002) found newly developed and modified FFQs performed overall very similarly for various nutrients.

Since adolescent development varies from adults, special considerations should be taken in the design of a FFQ for this age group. The Youth/Adolescent FFQ (YAQ) is a common self-administered food intake measurement instrument for adolescents, used in a variety of studies. It was developed by Rockett et al. (1995), based on the Nurses' Health Study FFQ and adjusted specifically for children ages 9-18 years old. Since then it has been updated several times to reflect changes in dietary intake of youth, but the format of the YAQ is what makes it stand out from other FFQs. In a population of African American and non-Hispanic White 6th grade students the format of the YAQ was found to be the most reliable compared to the conventional horizontal grid format (Buzzard et al., 2001). The YAQ format lists each question individually in its own space with the

answer options listed directly underneath the question sequentially. In addition, studies that have added more culturally appropriate foods to a FFQ have found higher validity with adolescents. A Greek researcher added 22 Greek foods to the YAQ and found the validity of this tool to be high or moderate for most nutrients in his Greek study population (Papadopoulou et al., 2008).

Research demonstrates that assessment of portion sizes does not add to the validity of a FFQ. Also, it has been shown, asking youth to recall food eaten in the past week is the most valid time frame for a FFQ, compared to the past day, month, or year (Kolodziejczyk et al., 2012). Most studies indicated moderate to high reliability and validity when asking youth to recall their intake from the past week (Papadopoulou et al., 2008; Haraldsdottir et al., 2005; Van Assema, Brug, Ronda, Steenhuis & Oenema, 2002; Neuhouser, Lilley, Lund & Johnson, 2009; Wong, Parnell, Black & Skidmore, 2012; Buzzard et al., 2001).

Medium length questionnaires (19-63 items) are found to work best with adolescent populations (Kolodziejczyk et al., 2012). Thompson and colleagues (2002) found from their cognitive research on FFQs that foods must be grouped together in a manner in which items within a group are interchangeable (substitutes for each other). But precautions need to be taken to ensure the grouping of fruits and vegetables do not affect the validity or reliability of the FFQ, such as considering placing more specific versions of foods (e.g. fat free milk) before more general versions of a similar food (e.g. all other milk). In addition, explicit statements about what to include or not include in answering each question (Thompson et al., 2002) and recall cues, such as reminders of

people, place and time of eating occasions (Matt, Rock & Johnson-Kozlow, 2006), enhance the FFQs validity and reliability.

Drawbacks to using FFQs include the limitation to foods listed on the questionnaire, and some people may have difficulty interpreting the questions. These limitations can be avoided by pre-testing the questionnaire with a similar population to the target population and through formative research. Other concerns include students not completing the whole questionnaire (MRC PHSRN, 2015). During the administration of a FFQ research staff can be present to answer any questions, provide an example of how to complete the questions, and check that all questions are answered before turning in the questionnaire. Although some may be concerned that self-administered diet assessments will lead to bias, the UK Medical Research Council claims there may be less bias in self-administered FFQ than in interview administered questionnaires due to anonymity (MRC PHSRN, 2015).

Dietary Indices

Dietary indices are increasingly used in studies examining children's diet quality in developed countries. A diet index measures how closely ones' diet adheres to a dietary guideline (Lazarou & Newby, 2011). Since dietary guidelines, such as the DGA-2015, are developed to represent an overall healthy diet that can help prevent disease, these indices can technically be used to assess chronic disease risk. A review of dietary indices created for children in developed countries showed that most dietary indices have low to modest significant correlations with children's diet quality. Most dietary indices are found to be associated with socio-demographic characteristics such as age,

family income, and gender. Some diet indices are also associated with disease outcomes (Lazarou & Newby, 2011). Lazarou and Newby (2011) offer an explanation of why many associations with diet indices are weak, pointing out that diet indices in the studies reviewed were mainly developed to assess overall diet quality, not specifically to evaluate disease or socio-demographic outcomes. They believe diet indices for children need to be developed more rigorously so they become more discriminative, and that more analytical studies on the validation, reliability and use of diet indices need to be conducted (Lazarou & Newby, 2011).

Diet diversity, defined as “the number of different food groups consumed over a given reference period”, is one way of developing a diet index (Sealey-Potts & Potts, 2014). Researchers have started to use Diet Diversity indices to assess adequacy of diet and health outcomes, because consuming a variety of foods from all food groups helps ensure all essential nutrients are being consumed (as discussed above in reference to consumption of different color fruits/vegetables). Sealey-Potts and Potts (2014), found assessing the diet diversity of preschoolers’ intake in a developing country was significantly and positively associated with nutrient adequacy ratios of most nutrients measured. Advantages of using a diet diversity index include the fact that the diet is considered holistically (Sealey-Potts & Potts 2014; Lazarou & Newby, 2011), just as in the case of the DGA-2015. The diet index can also be used to target nutrition education for population groups, based on components of the index which scored the lowest in diversity/quality (Lazarou & Newby, 2011).

2.7 Summary

Adolescence is a critical time for physical and mental growth and development which requires high nutrient needs and supportive environments to obtain healthy lifelong habits. Fruits and vegetables play a vital role in a balanced healthy diet, which can promote health and prevent chronic disease in adolescence and into adulthood. Yet the intake of fruits and vegetables during adolescence fails to meet national recommendations. This is especially true for low-income, racial and ethnic minority adolescents. Consuming a variety of fruits and vegetables is also important during adolescence to ensure a range of nutrients needed for proper growth are being consumed. Diet diversity indices are useful for measuring the variety of food consumed and comparing consumption to national recommendations.

Intervention studies that have increased fruit and vegetable consumption by at least 1 serving per day have used formative research or parent/community involvement, and were based on the SCT (Nollen et al., 2013; Amaro et al., 2006; Baranowski et al., 2003) or the socio-ecologic model (Wright et al., 2012). Therefore, it seems important to use a socio-ecologic approach, with SCT constructs, and formative research to obtain clear results in nutrition promotion programs. Yet, many studies lack this vital first step produced by formative research. Much of the current research on determinants of fruit and vegetable intake are quantitative, which are useful for reaching a large number of participants and follow-up measures. Addition of qualitative methods allows for novel information and a deeper understanding of the phenomena to be discovered. While focus groups might be commonly used in health related studies and intervention evaluations (especially with adults), the review of literature yielded a clear lack of

qualitative research specifically on adolescent fruit and vegetable intake. Even though some studies used formative research with adolescents, often they tested the acceptability of an intervention after it had been initiated rather than letting the intervention emerge from qualitative and quantitative formative findings. Therefore, our research aims to use focus groups and a survey with adolescents to develop ideas for a nutrition promotion program that ultimately will benefit participants, their families and community.

CHAPTER 3

PURPOSE, AIMS, RESEARCH QUESTIONS AND SIGNIFICANCE OF THE STUDY

3.1 Research Purpose

The purpose of this study is to describe the type and frequency of fruits and vegetables consumed by urban, low income, multi-racial/ethnic adolescents and to examine their attitudes and beliefs concerning fruits and vegetables. Furthermore, the study seeks to explore the barriers and facilitators of increased fruit and vegetable consumption as identified by adolescents.

3.2 Study Objectives

Objective 1. Determining the frequency of fruit and vegetable intake of adolescents utilizing a culturally adapted fruit and vegetable specific food frequency questionnaire.

Objective 2. Characterizing the types and diversity of fruits and vegetables consumed by adolescents utilizing the study survey and diet diversity score.

Objective 3. Identifying influences on adolescent's fruit and vegetable intake by utilizing the study survey.

3.3 Research Questions

Q1. What are adolescent's attitudes and beliefs towards increased consumption of fruits and vegetables?

Q2. What barriers and facilitators to increasing fruit and vegetable consumption do adolescents identify?

3.4 Significance statement

Much of the research of adolescent fruit and vegetable intake in the US has focused on youth in major cities throughout the nation, with an emphasis on identifying barriers, facilitators and influences of fruit and vegetable intake and assessing interventions or measurement tools. Participants of these studies consisted of mainly Mexican descent Latinos, African Americans or Non-Hispanic White students, and exact ethnicities are often not identified. Intake, attitudes, and beliefs towards fruits and vegetables in non-Mexican Latino/Hispanic, African, and Asian adolescents from smaller urban centers are a population that has not been thoroughly studied. Additionally, very few studies examined in the literature utilized adolescent input on their beliefs and attitudes regarding fruits and vegetables to create an intervention. This study seeks to fill these gaps in the research. Outcomes of this study will help identify constraints and influences on fruit and vegetable intake of adolescents from racially/ethnically diverse low-income families, as well as help guide the development of an intervention aimed at increasing produce consumption of families in a low-income neighborhood of Worcester, MA.

Furthermore, findings from this study can be shared with community partners to assist relevant organizations to better serve their populations. Specifically, findings from this study will be shared with our key partner, WEMS, which could be used to help the school develop strategies to increase acceptability and consumption of fruits and vegetables provided in their school breakfast and lunch programs.

CHAPTER 4

METHODS

4.1 Study Setting and Population

Worcester, Massachusetts is a central Massachusetts urban center with a population of 182,544 (US Census Bureau, 2013). The city has relatively high levels of poverty, with the average income estimated at \$61,520 per household. In 2013, approximately 20% of the population lived below the poverty line and 23% received SNAP benefits. In the same year, families with children 18 years old or younger were believed to be at a higher risk of poverty, with 27.2% of these families living in poverty. Furthermore, the United States Department of Agriculture (USDA) estimates that approximately half of the city of Worcester is characterized as a food desert. Given these estimates, adolescents in our target population are at higher risk of poverty than other adolescents in Worcester, MA, as evidenced by the high proportion of students receiving free or reduced lunch. In addition, Worcester has a diverse population with about 70% non-Hispanic White, 20% Hispanic/Latino, 12% black, 6.1% Asian, and about 4% reporting multiple races/ethnicities. For complete, comparative demographic characteristics, see Appendix B.

Worcester East Middle School (WEMS) was the setting of the current study. The school is located in Grafton Hill, an area categorized as a low-income census tract with a significant number of residents more than 1 mile from the nearest full service supermarket, as well as a community with low vehicle access (USDA, ERS, Food Access Research Atlas, 2015), otherwise known as a food desert.

An existing relationship between WEMS and the University of Massachusetts (UMass) Cooperative Extension Nutrition Education Program (NEP) facilitated the choice of school in Worcester, MA.

WEMS had 332 grade 7 students enrolled in the 2013-2014 school year when data was collected. The catchment area of WEMS is more racially and ethnically diverse than the city as a whole. Within the school 47% of students were Hispanic, 18% were African American or African, 7.6% were Asian, and 3.8% were mixed race in 2013-2014. The majority of students identified English as *not* their first language and about one third were considered English language learners. An overwhelming majority of students attending the school live in low income households, in the 2013-2014 school year 81% received free lunch, and 6% received reduced price lunch (MDESE, 2014, Table 1).

4.2 Study Design

This formative study was carried out in three phases, using both quantitative and qualitative research methodologies to address the purpose of the study.

Phase One. In order to gain a preliminary understanding of the adolescent population in relation to the purpose of the study, key informant interviews were conducted individually with the school Principal, two school nurses, two school food service staff, and the Health Education (HE) teacher (interview guide in Appendix C). Each interview was voice recorded (iPhone 5S, Apple Inc.) and transcribed verbatim by the graduate student. Findings from the key informant interviews were used to influence the design of the next two phases of the study.

Table 1. Comparison of Student Demographics for WEMS, Worcester School District and Massachusetts State Schools*.

Student Demographics	WEMS (% of students)	Worcester School District (% of students)	All of Massachusetts' Schools (% of students)
Race/Ethnicity			
Hispanic	47.4	38	17
White	22.5	35.8	64.9
African American	18.2	14.5	8.7
Asian	7.6	7.7	6.1
Multi-race, non-Hispanic	3.8	3.8	2.9
Native American	0.4	0.2	0.2
Language			
First language not English	51.3	44.4	17.8
English Language Learners	34.4		
Poverty Level			
Low income	87.1	73	38.3
Receive Free Lunch	81.0	67.2	33.6
Receive Reduced Price Lunch	6.0	5.7	4.7
School Status			
High Needs	91.3	81.4	48.8

(Source MDESE, 2014)

*State schools may include schools funded by the state other than public institutions

Phase Two. Participating students completed a self-administered survey consisting of a culturally sensitive fruit and vegetable food frequency questionnaire (FVFFQ) with additional open-ended questions addressing adolescent intake, attitudes, beliefs and self-efficacy with regards to fruit and vegetable consumption (see Appendix D for survey). The survey was pre-tested with approximately 10 students to assess the comprehension, format and wording of the survey, as well as the completeness and cultural appropriateness of the foods included in the FVFFQ.

Phase Three. Focus groups were conducted with the same students who also took the survey. The focus group explored barriers and facilitators to increased intake of produce and adolescent attitudes and beliefs about fruit and vegetable consumption, including issues of access and self-efficacy (see Appendix E for moderator's guide). Lastly, within the focus group forum, students were asked to provide us with ideas that can help shape development of the larger study's intervention focused on promoting fruit and vegetable consumption within the community.

4.3 Sample and Recruitment

A convenience sample of 7th grade students from the health education class at WEMS were recruited to participate in the study. The HE teacher agreed for the research team to recruit study participants from her classes. All grade 7 students take HE class at some point in the school year. Each quarter, the teacher informed students of the study and provided parent/caregiver consent forms (in English and Spanish) for students to inform their parents of the research project. The HE teacher offered extra credit as an incentive for students to return the parental consent forms (signed or unsigned). Study participants included students who obtained permission from their parent/caregiver and who themselves assented to the study (via a student assent form). All students who completed the survey and were also eligible to participate in the focus groups.

Data collection for both the survey and focus groups occurred in a separate room from the health education classroom, to provide privacy and minimize distractions. Participants were excused from class 2 times to complete the survey and

focus group. The survey was administered first, and on a later date the focus groups were performed.

4.3.1 Study Sample

Of the 332 students enrolled in grade 7 at WEMS in the 2014-2015 school year we had access to 247 students from semester quarters 2, 3, and 4 (missed quarter 1) health classes. Seventy-nine students completed the surveys and 61 students participated in the focus groups. Fewer students participated in the focus groups due to scheduling issues. In total, our participation rate for the survey was 32%, and 24.7% for the focus group.

Twelve students had incomplete food frequency questionnaires (at least one question left blank), but only one survey was missing half of the fruit questions. The one survey missing half of the fruit items was excluded from any analysis including the variable "total fruit intake". The rest of the surveys had 1 to 3 questions for fruits or vegetables missing. Surveys with missing responses in the FVFFQ item were assigned "0" value during analysis. Most other survey questions had only a few or none missing values. The non-FFQ survey questions with missing answers were coded as missing by denoting a "9" or "99" in SPSS and excluded from analysis. Sample size variation in analysis is the result of these aforementioned missing values. All analysis' were performed with list wise exclusions to maximize sample size.

4.4 Design of the Fruit and Vegetable Survey

A self-administered survey was used to collect individual data from students focused on their fruit and vegetable intake, attitudes, and beliefs. The overall format of the survey is based on validated youth-based questionnaires from the literature. For example, formatting of the survey adheres to the recommendation of identifying the purpose of each section of the survey, which has been shown to improve clarity of the survey, while preventing the sense of repetition of information collected (Matt et al., 2006). Consumption was assessed using the FVFFQ with items formatted similar to the validated Youth Adolescent Questionnaire (YAQ). The YAQ is a semi-quantitative food frequency questionnaire developed to obtain a general understanding of what youth eat on a regular basis (Rockett, et al., 1995 & 2012).

The study's FVFFQ asks students to recall fruits and vegetables consumed in the past week. Culturally relevant foods were added to the FVFFQ to enhance representation of a wider range of produce that might be more familiar to our racially and ethnically diverse student population. The culturally relevant fruits and vegetables were sourced from studies by Sharma, Sheehy & Kolonel (2014) and Grigsby-Toussaint, Zenk, Odoms-Yong, Ruggiero & Moise (2010), both of which analyzed fruit and vegetable sources of multiethnic populations including Latino/Hispanic and African Americans. Worldcrops.org (2015), a collaborative project of Rutgers, UMass and Cornell Cooperative Extensions, was also used as a source of culturally relevant produce. In order to make the FVFFQ a manageable length, the FVFFQ groups individual fruits and vegetables together so that all items in a list are interchangeable with one another and are used in a similar manner [for example: sliced tomatoes and tomato soups would not

usually be interchangeable when selecting foods for a meal, therefore they would not be asked in the same question, however tomato soups and other vegetable soups could be grouped together because they may be eaten in place of each other], as Thompspon and colleagues (2002) suggests. Each group of fruit or vegetable had examples of FV to include or exclude listed below the main category.

Questions (3-5) of the survey assess students' attitudes and beliefs towards fruits and vegetables, and were adapted from the Eating and Activity in Teens and Young Adults (EAT)-2010 survey for middle school students in Minnesota (Neumark-Sztainer et al., 2012).

Self-efficacy related to fruit and vegetable consumption was assessed with a combination of previously validated questions used in similar populations. The self-efficacy answer options were adapted from a reliable self-efficacy questionnaire scale used with adolescents with an average age of 13 years (Hagler, Norman, Radick, Calfas & Sallis, 2005; Bandura, 2006). Questions 1, 2, 4, 5, and 9 are adapted from Bannink and van der Bijl (2011) who found acceptable reliability and validity of their instrument with adolescents, ages 11-19 years, in the Netherlands. Questions 3, 6, 7, and 8 are adapted from Sharma and colleagues' (2014) validated vegetable self-efficacy questionnaire, used with African American and Latino children aged 8-11 years.

Lastly, questions on student's beliefs of their family's attitudes towards fruits and vegetables, availability within the home and at school, consumption and participation practices were assessed with questions developed by the graduate student

(see 'Fruits and Vegetables with your Family and at School' section of the survey in appendix D).

Each major section of the survey was introduced through oral instruction by the graduate student as well as with written instructions in boxed text on the survey. Appendix D provides full details of the student survey, including the oral instructions.

4.5 Design of Student Focus Group Moderator's Guide

The thesis chair trained the graduate student on conducting focus groups and carried out the initial focus group as part of the training process. The remaining focus groups were moderated by the graduate student with the thesis chair in the role of observer/note taker (recording observations for data triangulation purposes). Each focus group was voice recorded using the iPhone 5 (Apple, Inc.) and lasted up to 45 minutes in duration. Tables and chairs in the conference room were arranged in a semi-circle to facilitate conversation and group interaction.

Focus groups were conducted using a moderator's guide comprised of semi-structured questions using Halcomb and colleagues (2007) guidelines. The groups included both male and female students from the same health class. Topics areas covered were designed to solicit students' attitudes and beliefs towards fruits and vegetables as well as their access to FV, purchasing behaviors, motivation for consumption, social influence and self-efficacy as it related to fruit and vegetable intake.

A unique aspect of the student focus groups is the use of a combination of interactive individual and group activities. The group activities maintained student engagement throughout the focus group, fostering collaboration in smaller groups and

facilitating free expression of the student's thoughts and ideas. Additionally, a variety of question types were used in the moderator's guide, and included finishing the sentence type questions (Stok et al., 2012), making lists, filling in the blanks, and developing campaigns (Krueger, 2002). Probes were created to elicit further detail for some questions. More probes were used during the focus group as relevant.

Overall, the variety of activities facilitated discussion, allowing all students the opportunity to share their opinions in the setting which they were most comfortable, and provided additional sources of data in the form of the paper activities. See Appendix E for full details of the moderator's guide.

4.6 Qualitative Analysis

The focus groups were transcribed verbatim by the graduate student, and N-Vivo 10 (QSR International Pty Ltd. Version 10, 2012) was used to aid analysis.

Thematic analysis was chosen for our qualitative analysis due to the formative nature of the study. The six steps for Braun and Clarke's thematic analysis method and how we incorporated them into our analysis is outlined below in Table 2.

Table 2. Qualitative Data Analysis Process Following Braun & Clarke’s guide (2006)

<p>1) Familiarization with data</p>	<ul style="list-style-type: none"> • Listened and transcribed all focus groups verbatim. • Reviewed all focus group transcripts again for gaps/grammar.
<p>2) Coding</p>	<ul style="list-style-type: none"> • Broad brush coding was implemented for focus group questions which at least 4 of the focus groups answered.
<p>3) Searching for themes (identifying possible themes)</p>	<ul style="list-style-type: none"> • The preliminary themes for each question were reviewed and combined with other similar themes to create the first subset of overall themes. • These combined themes were reviewed and organized by importance (breadth of coverage by focus groups and number of references) into major themes, having more breadth and greater amount of conversation, and minor themes, having less breadth/ conversation. • Themes were not used if they had neither enough breadth/coverage.
<p>4) Reviewing themes (combine, split, or discard themes and making sure they answer your research questions)</p>	<p>Thematic analysis in response to the three research questions reviewed for themes including:</p> <ul style="list-style-type: none"> • Q1 themes related to attitudes and beliefs in relation to fruit and vegetable consumption. • Q2 themes related to barriers and facilitators to increasing adolescent fruit and vegetable consumption. For both Q1 & Q2 themes cultural, social, and environmental, influences were sought. • Q3 themes related to the role adolescents could play in increasing

	family and peer fruit and vegetable intake.
5) Defining and naming themes (detailed analysis of each theme)	<ul style="list-style-type: none"> • The importance of the theme in relation to the project and theoretical framework were identified. • Examples of each theme and quotes that represented the overall message of the theme or sub-groups of the theme were chosen.
6) Writing up the results	<ul style="list-style-type: none"> • The social cognitive and socio-ecological theories are used to interpret our findings, given that these theoretical models provided a framework for our study.

(Braun & Clarke, 2006)

Coding of the focus group discussions occurred in many revisions outlined above.

First pass of coding included reading the full focus groups individually as they were being entered into NVivo and noting themes that stuck out. Auto-coding was used to create nodes for each FG guide question. Second pass of coding occurred by reading all quotes in each FG guide question node. Themes for each question were identified and made into a node. As the quotes for each FG guide question were analyzed they were put into already existing nodes or new nodes were created under the parent FG question node. After all questions that were asked in at least 4 focus groups were coded, each theme from each FG question node was re-read and major themes from all questions were drafted in a second file set. These overarching themes combined quotes from any previously coded node, irrespective of FG question. A few text searches were performed to gather support for nodes from as broad amount of focus group data

as possible. Themes that did not have as much support as others were saved into a separate folder. The majority of the coding and analysis was performed by the graduate student. Major themes from all combined FG guide questions answered by more than 3 FG were reviewed by the graduate advisor.

4.7 Quantitative Analysis

Objective 1. Determine the frequency of fruit and vegetable intake of adolescents using a culturally adapted fruit and vegetable specific food frequency questionnaire.

Descriptive statistics, including means, standard deviations, range, and inter-quartile ranges for combined food frequency items were used to gain an overall picture of the fruit and vegetable intake of adolescents. The variables 'total fruit intake' and 'total vegetable intake' were measured via the FVFFQ in frequency per week. Frequency of consuming fruit was calculated by converting each answer option into times per week; for example, 2 times a day was converted to 14 times per week. For answer options with ranges, the middle number of the frequency was used to code the question. Total fruits consumed per week was calculated by summing the above codes for questions 12-16, 19-20 and 22 from each survey. Fruit juice was not included in this scale; a separate scale including fruit juice was constructed in a similar fashion for use in additional analysis. The same coding procedure was used for questions 1-8, 17-18, and 21 to calculate total vegetables consumed per week. The vegetable scale did not include french fries as they are not a recommended form of vegetable according to the DGA-2015 (USDA & HHS, 2015). Both the total fruits per week scale (with and without fruit

juice) and the total vegetables per week scale (without french fries) were tested for internal-reliability. Cronbach's alpha for total vegetables scale was 0.731 (11 items, n=70), no items had a negative item-total correlation, meaning all items were measuring the same construct. Similar results were found for the total fruits scales (Including juice: Cronbach's alpha, 0.794; No juice: Cronbach's alpha, 0.753), with 8 and 7 items correspondingly, and n=67.

Since 15% of our population was excluded from the total fruit and vegetable consumption scales because of incomplete data, missing data analysis were performed. No patterns of missing data were noticed except most students who missed food frequency questions were female. Only one student missed half of the fruit items, therefore they were excluded from all fruit intake analysis'. In order to maintain adequate power for regression and other statistical analysis the remainder of missing values were assumed to be 0 intake per week. A common procedure with food frequency questionnaires, which assumes if a person did not answer the question they may not eat that food.

Objective 2. To characterize the types and diversity of fruits and vegetable consumed utilizing the study survey and diet diversity score.

Type. Types of fruits and vegetables eaten were assessed by ranking categories of fruits and vegetables consumed: the mean answer of each FVFFQ question was ranked from most to least. For example, the mean of all FVFFQ answers for question 1 (How often do you eat vegetable Salads-any type?) was calculated, then the mean of all answers for question 2 (How often do you eat canned or frozen vegetables?). This

procedure was carried out for all questions to identify produce categories consumed most to least.

Answers to the open-ended survey questions regarding what fruits and vegetables are eaten more in the summer and identification of favorite fruits and vegetables were coded into the same categories used in the FVFFQ. For each question the participant's list of fruits and vegetables were coded by the type of fruit or vegetable mentioned most frequently, corresponding to the FVFFQ groups. For example; if a student lists apples, bananas, mango, pineapple, grapes. Hand fruit would be chosen as the code for this answer since there were 3 hand fruits listed and 2 tropical. If there is a tie between categories, then the code of the first fruit or vegetable listed was used. For example; if a student lists strawberries, oranges, bananas, apples, blueberries, the code would be Berries. Because of the difficulty determining which category some vegetables were meant to be in (ie. cooked/frozen or raw) a rubric was created that determined which vegetables went into each category. Vegetables you might commonly eat "cooked" or from "frozen" were considered carrots, broccoli, beans (green), peas, asparagus, corn, and cabbage. Vegetables which you might think about putting in a salad such as peppers, onions, cucumbers, tomato, and celery were categorized as "Raw" vegetables. Many of these vegetables could have fallen into either category, but we were not able to deduce which from the student's responses. The other categories of vegetables and fruit were more clearly defined in the FVFFQ. Each category of fruit or vegetable was assigned a number; tropical=1, hand fruit=2, berries=3. The frequencies of each category across all study participants was tallied for

each question and ranked from most to least. These rankings were compared to the FVFFQ ranked data.

To understand if differences in intake of types of fruits and vegetables exist between races, the data in SPSS was split by race and means were computed for each FVFFQ item (as described above) and rankings were compared.

Diet Diversity Score. The Diet Diversity score is based on the 2015 Dietary Guidelines for Americans Adherence Index (DGAI-2015). Each component of the Diet Diversity score (DD score) provides the intake habits of a population in relation to national recommendations. For the purposes of this scale it is assumed one serving of the food is eaten every time a person eats the food. For example, a student who indicates they consume potatoes 3-4 times a week was assumed to have consumed 3-4 servings (cups) of starchy vegetables that week. Each food group category was coded so the highest score (1) indicates when a student met or exceeded intake recommendations for that type of food. A mid-level score (0.5) was given to students who consumed some, but not enough to meet the goal. Students were given a score of 0 if they consumed very little or none of that type of food (see Appendix F for scoring/coding details). The goals/recommendations are based on the USDA, DGA-2015 fruit and vegetable sub-group intake recommendations for moderately active 12-year-old females and males (see Appendix F for recommendations). Components of the DD score are described next.

Food Groups to Increase. *Fruit and 100% Juice.* Fruits provide soluble fiber, vitamin C and many other nutrients needed to maintain health and prevent disease in adolescents. Frequencies were added together for all fruit items in the FVFFQ.

Dark Green Vegetables. Dark green vegetables are a good source of Vitamin K, needed for blood clotting; folic acid, needed for healthy reproductive systems; and potassium, carotenoids, and omega-3 fatty acids. Frequencies were added together for FVFFQ items for salads and cooked greens.

Red, Orange, and Other Vegetables. Red and orange vegetables are a good source of carotenoids such as lycopene (in red), and beta-carotene (in orange), which are antioxidants and help maintain eye health and support the immune system. Other benefits of red, orange, and other vegetables include high amounts of Vitamin C, folate, insoluble and soluble fiber, and other phytochemicals which help prevent diseases, including cancers. Frequencies were added together for cooked and raw vegetables, squashes and avocado FVFFQ items.

Legumes. Legumes are a good source of fiber. Fiber intake of adolescents is much below recommendations. While the many benefits of fiber include longer satiety, promotion of regular bowel movements, cancer prevention, cholesterol lowering and many other preventative benefits. Frequencies were added together for FVFFQ items of vegetable based soups/chili and beans/legume items.

Starchy Vegetables. Starchy vegetables are a good source of potassium and fiber; both are needed to help maintain healthy blood pressure. Frequencies were added together for plantains and potatoes/tuber FVFFQ items. French fries were not included

in the starchy vegetable calculations per dietary guideline recommendation to decrease such forms of fried vegetables.

Fruit and Vegetable Variety score. Eating a variety of fruits and vegetables is important to ensure all the nutrients our body needs are consumed on a regular basis. The Fruit and Vegetable Variety Score is composed by summing the scores from each fruit and vegetable sub-category and divided by the number of items (5) for each student. Higher scores indicate consumption from more sub-categories. These scores were used in analysis after being coded as 1 (consuming more than half of the FV subgroup) or 0 (consuming less than half of the FV subgroups).

Fruit Quality Score. The DGA-2015 encourages most fruits eaten to be whole fruits because of higher fiber and healthful substances and lower energy density than fruit juice. Therefore, fruit quality is measured here as the proportion of fruits eaten that are whole versus fruits eaten including 100% juice (total whole fruit consumed/total fruit plus 100% juice consumed). The goal of consuming at least 3/4ths of total fruit as whole fruit is used as the goal in our fruit quality score, based on the DGAI-2015.

Food Groups to Limit. Foods containing added sugar and solid fats often have low nutrient density and contribute to a high percentage of calories to American's diets. Solid fat contributes to increased risk of heart disease. Therefore, these foods are recommended to be reduced in the American diet (HHS & USDA 2015). Foods to be limited that were measured by our survey include sugar sweetened beverages and french fries. Acceptable limits of consumption were based on the recommended limits

set by the USDA for calories from added sugar and solid (saturated) fat (referred to as empty calories), the USDA recommendation for saturated fat intake, as well as USDA limits for the number of sweets/added sugar items to consume per week for our students age group and calorie level. Scores ranges from 1 to 0 from students who consumed the sugar sweetened beverages or french fries well within the limits ($< \frac{1}{4}$ of the added sugar and saturated fat calorie limits combined), to those who consumed over $\frac{1}{2}$ of the added sugar and saturated fat Calorie limits (with the three items combined) respectively, see Appendix F for more details on the scoring mechanism and development.

There are several food groups from the Dietary Guidelines for Americans Adherence Index-2015 that were not included in this study. These groups included grains; milk; protein; other added sugar foods; total fat, saturated fat, *trans*-fat, cholesterol; sodium; fiber; alcohol; and measures associated with these food groups or nutrients. Since the study's diet diversity score was implemented after the development and use of the food frequency questionnaire data were not collected on the items, but also do not correspond with the purpose of the current study.

The overall DD Score is calculated as shown in Appendix F (as Total Score), by summing all scores together and dividing by the maximum points possible. The total DD Score was then converted to a percentage for ease of interpretation.

Justification for Limits on Sweetened beverages and French Fries. According to the USDA nutrient databank, sports and energy drinks sugar content range from 16 grams of sugar for an 8 ounce serving to 40 grams of sugar for a whole container

(National Nutrient Database for Standard Reference Release 28). Using these two numbers, the average number of grams of sugar that may be in a sports or energy drink would be about 28 grams. Twenty-two grams of sugar equals 112 Calories of added sugar per drink. Having up to 2 energy/sports drinks per week would equal consuming about 224 added sugar Calories.

The average sugar content of other sweetened beverages according to the USDA nutrient databank was about 18.5 grams per serving (National Nutrient Database for Standard Reference Release 28), meaning about 74 added sugar Calories would be consumed for each sweetened beverage. If sweetened beverages were consumed up to 2 times per week, this would be a total of 148 Calories in added sugars.

Therefore, consuming sweetened beverages and sports/energy drinks 1-2 times per week each as a target keeps the adolescent within the DGA-2015 recommendation of <5 sweets/added sugar beverages per week. This limit assumes these beverages were the only sugar sweetened items consumed that week. Additionally, if an adolescent consumed both two sweetened beverages and two sports/energy drinks per week they would be consuming about half of the calorie limit for added sugars for the week, leaving room for other items not measured.

The energy, sports, and sweetened drink (sugar sweetened beverages) targets comply with the maximum added sugar calorie limit and the french fries are within the saturated fat calories limits, for the respective dietary patterns. If a student consumed two servings of french fries in a week, 6 grams of saturated fat would be consumed (based on a small cooked from frozen item or a medium fast food version) (National

Nutrient Database for Standard Reference Release 28), well under the 10% of calories allowed daily from saturated fat. If a person consumed two of each sugar sweetened beverages, sports/energy drinks, and french fries combined about 426 Calories from added sugar and saturated fat would be consumed, only one quarter of the limit for the week. These limits provide room for other foods not measured such as candy, baked goods, higher fat protein options and preparation methods.

Objective 3. To identify influences on adolescent's fruit and vegetable intake by utilizing the study survey.

Prior to inferential statistics, missing data for the food frequency questionnaire were coded as 0 and tests were performed to detect outliers. No extreme outliers existed for the data. Moderate outliers were found for several variables, but were not perceived to be mistakes in data and therefore were kept in the analysis.

Multiple linear regression was performed to predict the outcomes fruit intake and vegetable intake in times per week. Predictors in the model included race/ethnicity, self-efficacy score, preference for fruits and vegetables, family importance, availability, cooking, grocery shopping and eating fruits and vegetables at school (see definition for variable below). Stepwise regression was used to identify variables to predicted total fruit intake (excluding juice) and total vegetable intake (excluding French fries). In addition, several combinations of the above variables were tested with an input only regression method. Variables were obtained from the survey as described in the next section. Relationships between ordinal variables on the survey were assessed by Spearman's rank correlations. Differences in means between groups

of participants, such as between different ethnicities, were assessed by ANOVA or Kruskal-Wallis tests depending on the distribution of the dependent variable. The responses for dependent variables were assessed for normality with histograms using a normal curve for comparison, as well as with skewness and kurtosis statistics. Non-parametrically distributed dependent variable means were compared with Kruskal-Wallis tests, instead of ANOVA. T-tests/Mann Whitney U Tests were also used to compare groups with only two categories. Table 3 details exact relationships examined with Spearman’s rank correlation, ANOVA/Kruskal-Wallis, and T-tests/U-tests. Homogeneity of variance were checked using Levine’s statistic for both T-tests/U-tests and ANOVAs/Kruskal-Wallis tests. If Levine’s statistic was significant, the Welch statistic was used in place of the ANOVA statistic, and the results were interpreted in terms of means instead of medians for Kruskal-Wallis and Mann Whitney U-Tests.

Table 3: Data Analysis Schematic

Independent Variable	Dependent Variable	Data analysis Technique
Race, Eating FV at school, SES score, Cooking, Grocery shopping	FV frequency	Kruskal-Wallis
Race, eating FV at school, cooking, grocery shopping	Self-Efficacy	
Race, eating FV at school, SES score, Cooking, grocery shopping	Diet Diversity Score	ANOVA (close to normally distributed)
Preference (both FV)		
Family Importance (both FV)		
Availability at home (both FV)		

Availability at school (both FV)	Against each one	Spearman's rank correlation
Confidence (of eating enough FV)		
Eating FV at school		
Cooking		
Grocery Shopping		
Individual Self-Efficacy Qs		
Race	Eating FV at school	Kruskal-Wallis
	Cook/grocery shop	
	FV availability at home and school	
	Confidence (eat enough FV)	
	FV Intake	
	Self-Efficacy (SE) Score	
Gender	Cooking, grocery shopping, FV intake, family importance (both F and V), eat F/V at school, SEScore	Mann Whiney U test
	DD score	T-test

*FV=Fruit and Vegetable scores, analyzed separately for all analysis.

Definitions of Variables. Race groups were created by observing what race/s were checked off on the survey. Options included Asian, Black or African American, Hispanic, Latino/a, White, Multi-ethnic/racial, Other (fill in blank) and I don't know. If 'I don't know' was checked off or the question was left blank, a race was determined by what was written in the separate ethnicity question. If "other" was filled in and it was an ethnicity, rather than a race category, the ethnicity was categorized into the corresponding race categories from the survey (Asian, Black/African American, Hispanic/Latino, White, Multi-racial). If a student marked either Latino/a or Hispanic or

both Latino/a and Hispanic they were placed into a group called Latino/Hispanic. If students marked off more than one race they were placed into the multi-racial category.

Self-efficacy was defined as a composite score from the questionnaire section called “Fruits and Vegetables in Everyday Life.” All questions in this section were assigned the same coding matrix (Definitely I can=5, I think I can=4...), and the answers for each question were be added together and divided by the number of questions to obtain a Self-Efficacy Score (SE score). The SE score was tested for internal reliability. Cronbach’s alpha was 0.806, with 9 items (n=79). No item significantly decreased the scale reliability.

Confidence in consuming enough fruits and vegetables was assessed by Q1 and Q2 of section 1 of the survey. Preference for fruits and vegetables was measured by Q4 and Q5 from section 1 of the survey.

Family importance of eating fruits and vegetables were defined from Q1 and Q2 of the 4th section of the questionnaire called, “Fruits and Vegetables with Your Family and at School.” Home availability of preferred fruits and vegetables were assessed by Q3 and Q5 of the same section.

School availability of preferred fruits and vegetables was defined from Q4 and Q6 from “Fruits and Vegetables with Your Family and at School” portion of the questionnaire.

4.8 Ethics

The University of Massachusetts Amherst Institutional Review Board approved the research project. The Worcester school Principal and school board have also

approved the project. The graduate student obtained CITI (Collaborative Institutional Training Initiative) Human Subjects Research training and CORI (Criminal Offender Record Information) approval to work in the school and with the students.

CHAPTER 5

RESULTS

5.1 Demographics

We had more females than male participants (68.4 % vs 31.6%), despite an even gender distribution in the school population. The majority of student participants were Hispanic/Latino (31.5%), with Black/African American participants being the next highest racial representation in the study. These demographics are reflective of the WEMS student population racial distribution (Table 4). When students were asked to write out how they identified themselves we received a wide range of ethnic backgrounds that demonstrates the multicultural nature of the student body at WEMS (Table 5).

No demographic information was collected during the focus groups. Since only those who participated in the survey were eligible to participate in the focus groups there is a possibility the demographic distributions may be differ in the focus groups due to less student participation.

Table 4. Study Participant Characteristics in Comparison to WEMS Student Population

Demographic Characteristic	Study Sample	Middle School¹
	Mean (SD)	
Age	12.5 (0.596)	n/a ²
Gender	Percentage, %	Percentage, %
Female	68.4	50.6
Male	31.6	49.4
Race	Percentage, %	Percentage, %
Black/African American	27.4	18.2
Hispanic/Latino	31.5	47.5
White	15.1	22.5
Asian	11.0	7.6
Multi-racial/ethnic	15.1	3.8

¹Middle School data from Massachusetts Department of Elementary and Secondary Education (MDESE), 2014

² n/a means data not available on MDESE website.

Table 5. Self-identified ethnicities

Race Group	Ethnicities Indicated by Students
Asian	Vietnamese, Chinese, Korean, Nepal, Indian, Bhutanese, Laos, 'Asian'
Black/African American	Liberian, Ghanaian, Ivorian, Kenyan, Jamaican, 'African American', 'Black'
Hispanic/Latino	Dominican Republic, Puerto Ricans, Honduran, Salvadoran, Mexican, Guatemalan, Ecuadorian, Brazilian, Haitian
White	Danish, Irish, English, Polish, Italian, Greek, German, French, Native American, 'American'
Multi-Racial/ethnic	Anyone who indicated an ethnicity in more than one race category, 'American'
Middle Eastern	Saudi Arabian, Iraqi (included in multi-racial/ethnic)

5.2 Survey Results

5.2.1 Fruit and Vegetable Intake

Total fruit and total vegetable intake (times per week) were calculated from the Fruit and Vegetable Food Frequency Questionnaire (FVFFQ) section of the survey. The total frequencies of intake were intended to provide a variable for analysis rather than indicate a level of consumption due to the semi-quantitative nature of the FVFFQ.

Moderate outliers skewed the distribution of total FV intake frequencies, therefore medians are reported alongside the means and quartiles of intake. The median whole fruit intake was 20.5 times per week (2.9x/day) and the median vegetable intake was 26.5 times per week (3.8/day). One quarter of students consumed vegetables more than 5x/day (39.88 times/week), and less than 2x/day (16.38 times/week). Combined, the median total fruit and vegetable intake was over 6.5x day (46.5 times per week). Table 6 summarizes the frequency of FV consumed by students in times per week.

Table 6. Distribution of Fruit (with and without Juice) and Vegetable Intake ^a of Students

	Sample size (n)	Min.– Max.	Mean (SD)	25 th percentile	50 th percentile (Median)	75 th percentile
Total Fruit and Juice intake	67	1.5 - 119	33.52 (25.63)	13.0	26.0	48.5
Whole Fruit Intake ^b	67	0 - 98	27.90 (21.36)	12.5	20.5	40.0
Vegetable Intake ^c	70	1.5 - 96	31.35 (22.59)	16.38	26.5	39.88
Combined fruit and vegetable intake	62	8 - 157.5	56.94 (36.08)	28.9	46.5	79.1

^a Intake = times per week

^b Whole Fruit Intake excludes 100% Juice.

^c Vegetable intake does not include french fries

5.2.2 Types of FV Consumed

Individual FVFFQ items were ranked by their medians (due to outliers), and were intended to identify FV groups consumed most and least frequently by our students.

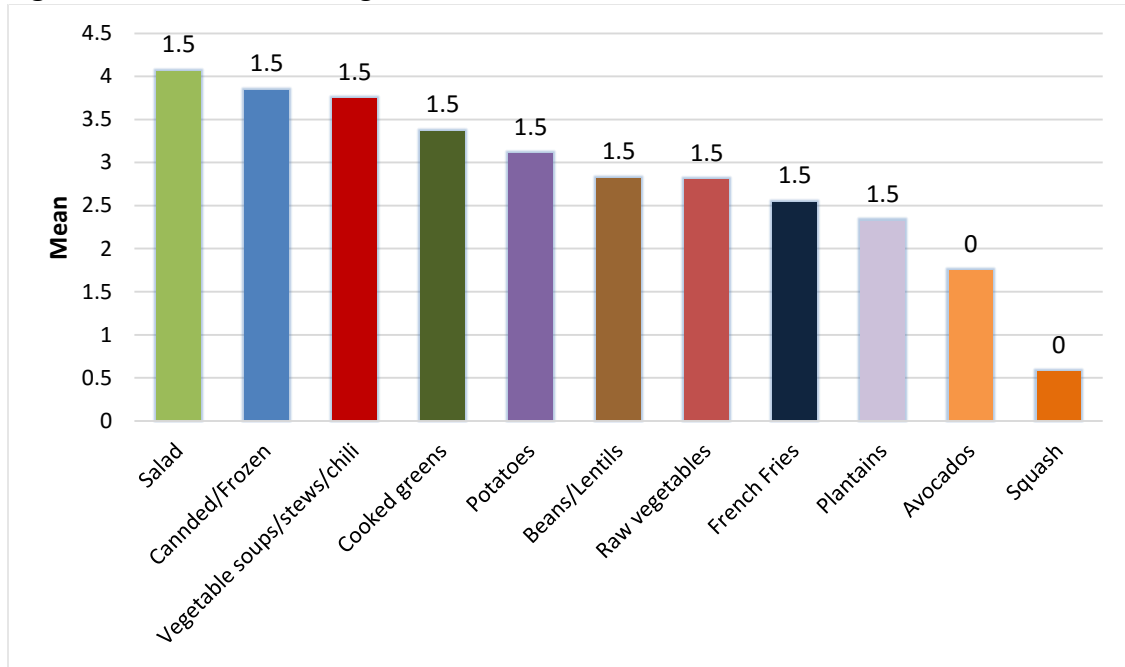
Many of the vegetable FVFFQ item medians were the same, therefore means were used to rank the FVFFQ items for demonstration purposes. The types of vegetables consumed most frequently by students included salad, canned and frozen vegetables, soups (with

beans, peas, veggies and bean chili), cooked greens and potatoes/tubers. The most frequently consumed fruits included hand fruit, 100% fruit juice, citrus, tropical fruit and berries. In addition to the FVFFQ, students indicated in the survey that they consumed more of their favorite FV during the summer months. Table 7 provides examples of 'favorite' and 'summer' FV indicated by students, and categorizes the produce into the FVFFQ groups. Favorite and Summer FV were also tallied and ranked in order to identify student preferences. Top ranking favorite vegetables included cooked/frozen vegetables, raw vegetables, and salad. Most favored fruit included hand fruit, tropical fruit, and berries.

Table 7. Student Examples of Favorite and Summer Fruits and Vegetables

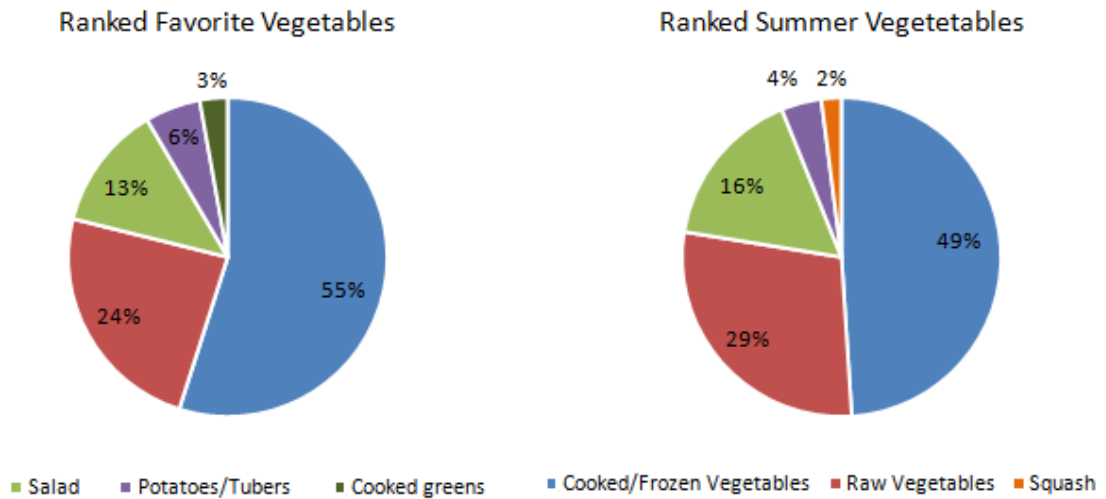
Vegetable Category	Student Examples (except where noted)
Cooked Vegetables	Carrots, broccoli, green beans, peas, asparagus, corn and cabbage, cooked mixed vegetables, wax beans, mushroom, eggplant, cauliflower
Raw Vegetables	Peppers, onions, cucumbers, tomato and celery, raw veggies, carrots, radish, cubanellen
Salads-any type	Spinach, cabbage, Chinese lettuce
Vegetable Soups/Stews/Chilis w/ beans	FFQ Examples (not listed above)-with beans, peas, or vegetables and Chili w/ beans.
Potatoes/Tubers	Cassava, potato, yam
Greens	Kale, potato greens, collard greens, Bok Choi
Squash	Zucchini, squash
Other	Plantain, avocado
Fruit Category	Examples
Hand fruit	Apples, grapes, peaches/nectarines, cherries, pear, banana, plum, apricots, tomato, hand fruit,
Tropical Fruit	Mango, pineapple, plummigrant, coconut, kiwi, pomegranate, starfruit, dragon fruit, lychee, longans, mangosteen, durian, cannepas/cenepas, rambutan, jack fruit, taro, pamello
Melons	Watermelon, melon, cantaloupe, honey dew,
Berries	Strawberries, blueberries, black berries,
Citrus	Oranges, tangerine/mandarin/Clementine, lemon/limes

Figure 3. Ranked FVFFQ Vegetable Items* .



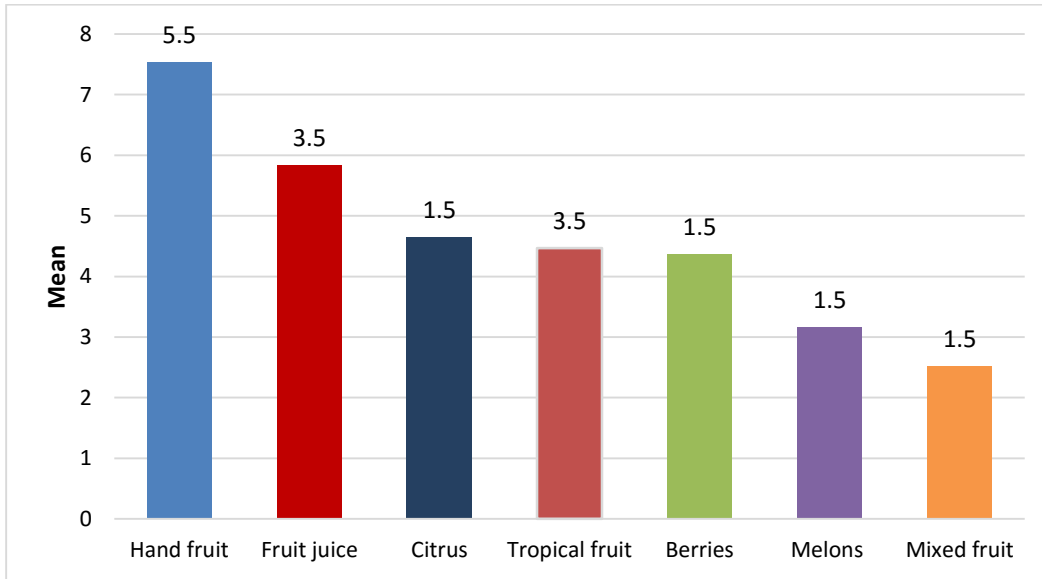
*Bars are labeled by their median intake in times per week, due to the means being skewed by outliers.

Figure 4. Favorite Vegetables and Vegetables Consumed in Summer*



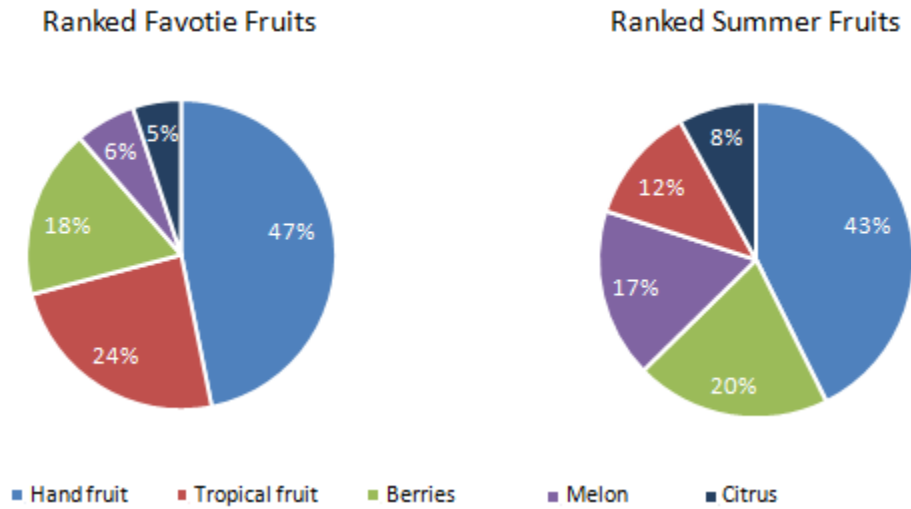
*Percentages represent the frequency each type of vegetable was identified as a favorite or summer vegetable.

Figure 5. Ranked FVFFQ Fruit Items*



*Bars are labeled by their median intake in times per week, due to the means being skewed by outliers.

Figure 6. Favorite Fruits and Fruits Consumed in Summer*



*Percentages represent the frequency each type of fruit was identified as a favorite or summer fruit.

Sugar sweetened beverages (SSB), Sports and Energy Drinks, 100% fruit juice and french fries were also assessed in the FVFFQ in order to determine the frequency of their consumption in relation to more nutrient dense FV. Consumption of french fries was reported as minimal, and therefore ranked as one of the lowest consumed vegetables. Whereas fruit juice was much more frequently consumed with many students indicating they drank 100% fruit juice several times a day (10.1% drink 2xday, and 8.9% drink 3xday) (Table 8).

Table 8. Ranking of Median Sugar Sweetened Beverage Consumption by Students ^a

Drinks	N	Median (Mean)
Sweetened Beverages	79	5.5 (7.79)
100% Fruit Juice	78	3.5 (5.82)
Sports/Energy Drink	78	1.5 (3.69)

^a Frequency per week

Diet Diversity

The Diet Diversity Score (DD Score) was developed based on the FVFFQ items and a scoring mechanism adapted from the Dietary Guidelines Adherence Index-2005/15 (Appendix F), in order to provide more targeted intervention recommendations for our students. Frequencies were assumed to equate to serving sizes for the purpose of interpreting the DD Score and its components (Table 9). More than half our population met recommended intake levels of fruits (67.2%), dark green vegetables (76.6%), and legumes (72%) according to the DD scoring matrix. The vegetable category with the lowest consumption was ‘red, orange, and other vegetables’ (15.6% consume very little/none), followed by starchy vegetables, which excluded french fries (11.7% consumed very little/none).

Table 9. Diet Diversity Scores of Student Food Group Consumption.

Category (score)	Fruits	Dark Green Vegetables (n=77)	Red, Orange, and other vegetables (n=77)	Starchy Vegetables (n=77)	Legumes (n=75)
Meets USDA Recommendation (1)	64.6%	74.7%	34.2%	45.6%	70.9%
Eats some (0.5)	22.8%	15.2%	50.6%	40.5%	21.5%
Consumes very little/None (0)	12.7%	10.1%	15.2%	13.9%	7.6%

Fruit and Vegetable (FV) variety and quality scores were also calculated and included in the DD Score in order to assess adolescent's adherence to these parts of the DGA-2015 recommendations. The mean FV variety score was 0.881 (SD .201, n=79) out of 1. Most (67.1%) student's obtained a FV variety score of 1.0 (Median also equaled 1.0). The quality of fruit intake was assessed by comparing whole fruit intake with intake of fruit including 100% juice, resulting in over 78.5% of students consuming 75% or more of their fruit as whole fruit (meeting DGA-2015 recommendations). Just 6.3% of students consumed less than half of their total fruit intake as whole fruit.

Lastly, calories consumed from added sugars and saturated fats by adolescents were also included in the DD Score, including FVFFQ items for sugar sweetened beverages, sports and energy drinks, and french fries. Added sugar and saturated fat calorie limits were calculated based on age appropriate DGA-2015 guidelines (Appendix F). A score of '1' indicates consumption of added sugar or saturated fat below recommendations and a score of '0' indicates consumption above recommendations.

Students consumed many more sweetened beverages than sports/energy drinks and french fries (Table 10).

Table 10. Students Consumption of Added Sugar and Saturated Fat Calories Compared to Recommendations

Category (score)	Sports and Energy Drinks	Other Sweetened beverages ^a	French Fries
0-2 times per week (1)	58.2%	32.9%	67.1%
3-4 times per week (0.5)	15.2%	16.5%	15.2%
>4 times per week (0)	26.6%	50.6%	17.7%

^a includes sweetened fruit juice

Scores were assigned to all components of the DD Score, added together and divided by the total points possible to create the overall DD Score. The DD Score indicates the degree to which student’s fruit, vegetables, and added sugar/saturated fat intake conform to the recommend dietary pattern set forth by the USDA (DGA-2015) for their age group. This score was converted into a percentage for ease of discussion. Therefore, scores range from 0 – 100, with 100 representing high diet diversity and quality, meeting or exceeding all recommendations. The mean DD score for our population was 72.1%. One quarter of our population received a score below 61%, or above 80%. The median score was 73%.

5.2.3 Associations

In identifying the conditions that would increase student consumption of FV, access to and consumption of FV at school were correlated with self-efficacy questions related to FV intake. Several interesting and significant correlations arose with these variables (Table 11). For example, access to preferred fruit within the school setting (in

cafeteria meal services) and eating fruit at school were significantly associated with students identifying increased confidence in being able to eat FV every day at breakfast ($p=0.008$, $p=0.012$ respectively). Additionally, students who eat vegetables at school were more confident they could eat vegetables 3 times a day ($p=0.014$).

Table 11. Associations Between School FV Survey Items and Student’s Confidence in FV Behaviors

Self Confidence in FV Behaviors	School FV Survey Items (Spearman’s correlation coefficient (p))			
	I eat vegetables at school	I eat fruits at school	The fruits I want to eat are available at school	The vegetables I want to eat are available at school
I am certain I can eat vegetables at least 3 times a day	.275* (.014)	-0.096	0.08	.234* (.042)
Mark how certain you are that you can eat fruit and or vegetables every day at breakfast	0.10	.282* (.012)	.304** (.008)	0.099
Mark how certain you are that you can eat fruit and or vegetables every day at lunch	0.151	.269* (.016)	0.045	0.041

*Significant at < 0.05 **Significant at < 0.01

The home FV environment was also assessed to identify influences on FV consumption behaviors of our students. Students who believed eating vegetables was important to their family held more confidence in their ability to eat FV as a snack ($p=.029$), to prepare a FV to eat ($p=.001$), eat a FV every day at breakfast ($p=.045$) and eat vegetables 3 times a day ($p=.010$). While students who grocery shopped more frequently expressed the fruits ($p=0.011$) and vegetables ($p=0.009$) they want to eat

were available at home more often. Several other significant associations with FV availability at home and high self-efficacy were found (Table 12).

Table 12. Correlations Between Home FV Survey Items and Student Confidence in FV Behaviors

Self Confidence in FV Behavior	Home FV Survey Items			
	Eating vegetables is important to my family	Eating fruits is important to my family	The fruits I want to eat are available at home	The vegetables I want to eat are available at home
Mark how certain you are that you can eat fruit and or vegetables every day at breakfast	0.228* (0.045)	0.191	.232* (.041)	0.142
I am certain I can eat fruits and or vegetables as a snack (instead of chips, candy, etc)	.247* (.029)	0.130	0.159	.237* (.039)
I am certain I can prepare fruit and or vegetables to eat, if needed	.363** (.001)	0.066	0.165	.235* (.041)
I am certain I can eat vegetables at least 3 times a day	.290** (.010)	0.136	0.039	.290* (.011)
I am certain I can eat fruit at least 2 times a day	0.179	0.310** (0.006)	0.166	-

*Significant at < 0.05 **Significant at < 0.01

The amount of importance families place on eating FV at home was assessed from the student perspective through two survey questions. Perceived family value of eating vegetables was significantly correlated with many of the self-efficacy items,

whereas family value of eating fruits appeared less correlated with self-efficacy items.

(Table 13).

Table 13. Correlations Between Self-Efficacy Survey Items and Family Value of Consuming FV

Self Confidence in FV Behaviors	Family Importance of FV Survey Items	
	Eating vegetables is important to my family	Eating fruit is important to my family
Mark how certain you are that you can eat fruit and or vegetables every day at breakfast	.228* (.045)	0.191
I am certain I can eat fruits and or vegetables as a snack (instead of chips, candy, etc)	.247* (.029)	0.130
Mark how certain you are that you can eat fruit and or vegetables every day at lunch	0.106	0.072
I am certain I can eat fruit and or vegetables when I eat out	.250* (.027)	0.109
I am certain I can prepare fruit and or vegetables to eat, if needed	.363** (.001)	0.066
I am certain I can eat vegetables at least 3 times a day	.290** (.010)	0.136
Mark how certain you are that you can eat fruit and or vegetables every day at dinner	.225* (.048)	0.202
I am certain I can eat fruits at least 2 times a day	0.179	.310** (.006)
I am certain I can eat fruit for dessert (instead of ice cream, cookies, or the like)	0.219	0.078

*Significant at < 0.05 **Significant at < 0.01

Preference of FV is a well know influencer of intake of produce. In our study adolescents who preferred the taste of FV were more confident that they ate enough FV (p =0.000 for both FV), and were more likely to eat FV at school (p=0.041, p-0.026, respectively).

Due to the intended use of the Self-Efficacy Scale and its high internal consistency reliability, most self-efficacy items were significantly correlated with one another. Some notable correlations, with at least moderate strength ($r < 0.4$) included students with high confidence in their ability to eat a FV for breakfast every day, were also highly confident they could eat fruits 2x/day ($p=0.000$). Additionally, students who were confident they could eat a FV as a snack instead of chips, candy, etc., were also confident they could eat FV when eating out ($p=0.000$), prepare a FV to eat ($p=0.000$), and eat a FV as a dessert instead of ice cream, cookies ($p=0.000$). Surprisingly, confidence in preparing a FV to eat was not associated with frequency of helping with cooking or grocery shopping. All other significant correlations between self-efficacy items had weaker correlations ($r < 0.4$).

Table 14. Inter-correlations Between Student’s Beliefs, Attitudes, and Behaviors towards Fruits and Vegetables

		1	2	3	4	5	6	7	8	9
1	Eating healthy is important to me.	1								
2	I eat enough fruits	0.006	1							
3	I eat enough vegetables	.274* (.015)	0.034	1						
4	Fruits taste good to me.	0.163	.389** (.000)	-0.019	1					
5	Vegetables taste good to me.	.350** (.002)	-0.017	.514** (.000)	.247* (.028)	1				
6	Eating fruits is important to my family	0.147	0.114	0.173	0.123	0.095	1			
7	Eating vegetables is important to my family	0.189	0.055	.420** (.000)	0.181	0.121	.476** (.000)	1		
8	The vegetables I want to eat are available at home	0.096	-0.107	.357** (.002)	-0.046	0.165	0.079	.245* (.033)	1	
9	I eat vegetables at school	0.195	-0.029	.317** (.005)	0.039	.250* (.026)	0.008	0.059	0.095	1
10	I eat fruits at school	0.129	0.191	0.002	.230* (.041)	0.008	-0.05	-0.166	-0.181	.303** (.007)
*Significant at < 0.05 **Significant at < 0.01										

Differences in Intake Between Racial/Ethnic Groups.

Individual FVFFQ items were ranked by their means for each category of race within our study in order to determine if differences existed in types of FV consumed across racial groups (Table 15). Hispanic/Latino, White, and Multi-ethnic/racial students consumed the most sweetened beverages. Asian students consumed the most tropical fruit, and Black/African American students consumed the most hand fruits. White students had vegetables ranked higher than any other race/ethnicity. Although hand fruits were ranked highest with Black/African American students, they were within the top two most consumed foods for all race/ethnicities, except White students.

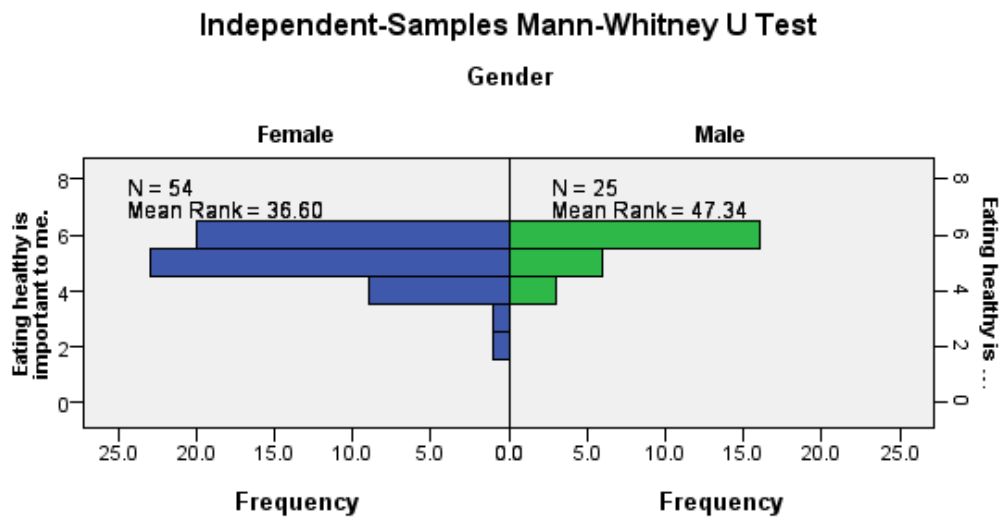
Table 15. Ranked Consumption of FVFFQ Items for Each Race/Ethnicity Group *
*Ranked by mean intake of each FVFFQ item.

	Race/Ethnicity				
Rank	Asian	Black/African American	Hispanic/Latino	White	Multi-ethnic/racial
1	Tropical Fruit	Hand fruit	Sweetened beverages	Sweetened beverages	Sweetened beverages
2	Hand fruit	Fruit Juice	Hand fruit	Canned/Frozen Vegetables	Hand fruit
3	Sweetened beverages	Sweetened Beverages	Fruit juice	Potatoes/Tubers	Berries
4	Fruit juice	Veg./Bean soups/chili	Citrus	Raw vegetables	Salads
5	Citrus	Citrus	Tropical Fruit	Berries	Fruit juice
6	Melons	Tropical fruit	Berries	Salads	Citrus
7	Veg./Bean soups/chili	Cooked greens	Sports/energy drinks	Sports/energy drinks	Tropical fruit
8	Berries	Sports/energy drinks	Melons	Hand fruit	Canned/Frozen Vegetables
9	Raw vegetables	Salads	Salads	Cooked greens	French Fries
10	Salads	Potatoes/Tubers	Veg./Bean soups/chili	Veg./Bean soups/chili	Cooked greens

For more in-depth analysis of demographic differences between our students FV intake and behaviors Kruskal-Wallis tests were performed. In relation to cooking and grocery shopping practices no significant differences were found between racial groups. Availability of FV at home and at school, FV intake (times per week), Self-Efficacy, and DD Score also did not differ between racial groups.

Additionally, Mann-Whitney U Tests were used to assess differences in FV intake and beliefs between male and female students. One significant difference was found with males indicating “eating healthy is important to me” more frequently ($p=0.036$) (Figure 7). No other significant differences were found between gender in our participants, including in regards to Self-Efficacy, total fruit or vegetable intake, or DD Score.

Figure 7. Differences between Genders Attitudes on ‘Importance of Healthy Eating’*

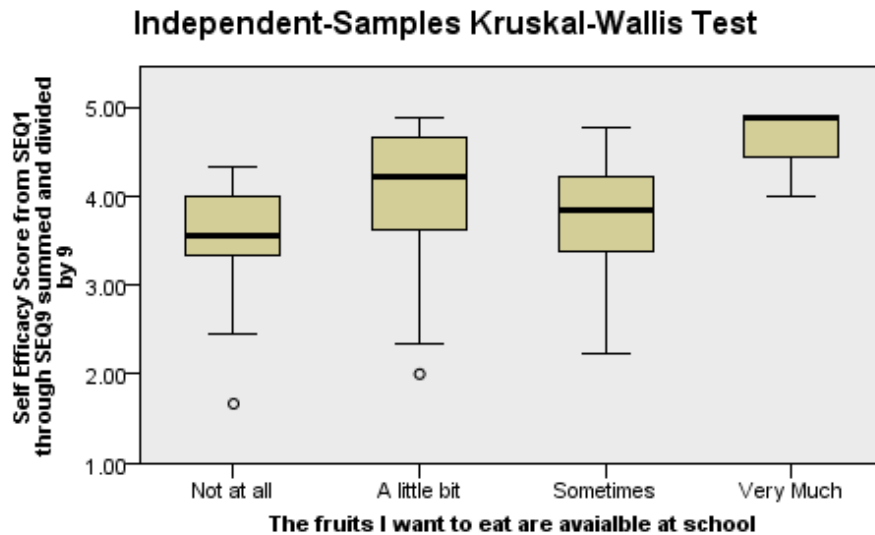


*Eating Healthy is Important to Me answer key: 6=strongly agree, 1=strongly disagree

External Influences on Fruit and Vegetable Intake.

Availability of FV was identified as important to adolescent FV intake and behaviors. Kruskal-Wallis tests (Self-Efficacy Score, and FV Intake) and ANOVA (DD Score) tests revealed that the level of availability of preferred FV at home did not influence DD Score, FV intake or self-efficacy. However, there was a significant difference between availability of preferred fruits at school and self-efficacy scores ($p=0.011$) (Figure 8). Post hoc analysis did not however indicate what levels of availability of fruit at school significantly influenced Self-Efficacy score.

Figure 8. Self-Efficacy Scores by Availability of Preferred Fruits at School



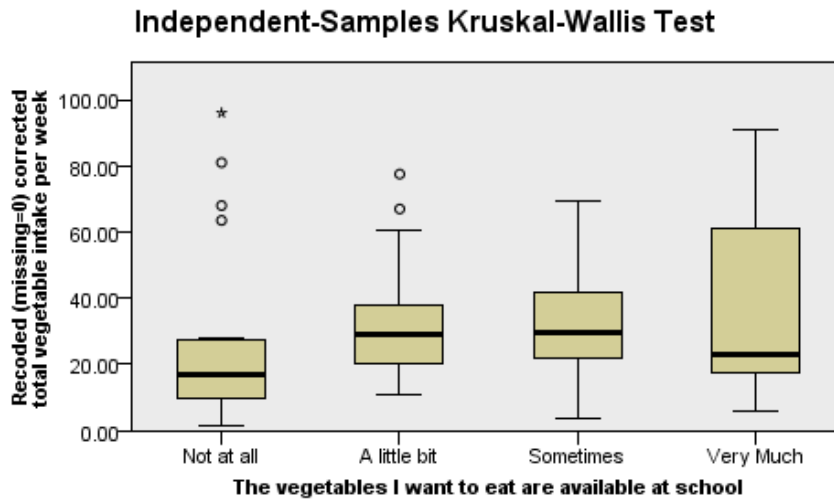
A similar trend was found for the influence of availability of preferred fruits at school on DD Score ($p=0.047$). Students who found their preferred fruits were 'not at all' available at school had slightly lower DD Scores than those whose preferred fruits were 'a little bit' available at school, but a post hoc Tukey test did not indicate a significant

difference (mean diff=-0.10795 (0.4424), $p=0.079$, 95%CI (-0.2243, 0.0084). There was no significant difference in fruit intake by availability of fruit at school.

Availability of preferred vegetables at school did influence DD Scores ($p=0.001$). The post-hoc Tukey test indicated students whose preferred vegetables were “not at all” available at school had significantly lower DD Scores compared to students whose preferred vegetables were available “a little bit” at school (mean difference=-0.15436 (.03760), $p=0.001$), 95%CI (-0.2533, -0.0554).

Intake of total vegetables per week also differed by availability of preferred vegetables at school ($p=0.038$) (Figure 9). Yet a post hoc pairwise comparison did not find any significant differences between levels of availability of vegetables at school and vegetable intake.

Figure 9. Total Vegetable Intake by Availability of Preferred Vegetables at School.



Intrapersonal Influences on Intake.

Neither having a more favorable attitude toward FV, nor having a higher belief of the importance of FV intake on health, influenced FV intake, Self-Efficacy Score or DD Score.

The degree of participation in cooking at home did not influence Self-Efficacy Score, DD Score, or vegetable intake, but did influence total fruit intake ($p=0.02$). A post-hoc pairwise comparison test indicated those who cook 'sometimes' eat significantly more fruit than those who 'never' help with cooking (mean difference=27.054 (9.792), adj. $p=0.017$). The degree of participation in grocery shopping did not influence Self-Efficacy Score, DD Score, total vegetable intake or total fruit intake.

Neither eating fruit nor vegetables at school effected DD Score. Eating fruit at school did not affect overall fruit intake, but students who 'never' eat vegetables at school have a significantly lower vegetable intake than those who 'sometimes' eat vegetables at school (Kruskal-Wallis, $p=0.038$; Pairwise comparison, mean difference=-12.990 (5.366), adj. sig=0.046).

Students beliefs about their consumption of FV and their family's perception of FV were obtained from the survey and assessed for their influence on FV intake. According to Kruskal-Wallis tests, student's perception of eating enough fruits or vegetables did not influence whether they ate more fruits or vegetables nor did it influence DD Score.

Student's belief of their family's attitude on the importance of eating *fruit* was not associated with DD Score or Self-Efficacy Score. But DD Score did significantly differ

in relation to importance families placed on *vegetables* ($f = (3, 73) 4.213, p = 0.008$). A Tukey post hoc test indicated that students who thought eating vegetables was 'not at all' important to their families had significantly lower DD Scores than student's whose families thought eating vegetables was more important, 'sometimes' (difference = -0.313 (0.0998), $p = 0.013$, 95%CI (-0.575, -0.051), and 'very much' (difference = -0.271 (0.0979), $p = 0.035$, 95%CI (-0.528, -0.014)). Perceived family importance of eating vegetables also influenced students Self-Efficacy Scores ($p = 0.019$). Students whose families think eating vegetables is "a little bit" important have significantly lower Self-Efficacy Scores than students whose families think eating vegetables is "very much" important (mean difference = -22.697 (7.199), adj. $p = 0.010$).

Regression

Both stepwise regression analysis' performed for total fruit intake per week and total vegetable intake per week only resulted in leaving Self-Efficacy Score in the model (Table 16). For both models Race, Self-Efficacy Score, Availability of FV at home, Availability of FV at school, and Family importance of FV were added (respectively). Fruit and Vegetable variables were separated for the fruit and vegetable regression models. Outcome predictors were total fruit and total vegetables consumed per week. Residuals were nearly normally distributed for the vegetable regression model (Figure 10) and were less so for the fruit regression model (Figure 11). Therefore, multiple linear regression may not be the best model for the fruit data.

Table 16. Regression Statistics for the best fit Stepwise Regression Models

	Adjusted R ²	Beta Coefficient (s.e) for Self-Efficacy	P-value	ANOVA statistic (Degrees of freedom)	P-value
Vegetable Model	0.195	13.56 (3.22)	0.000	17.68 (1, 68)	0.000
Fruit Model	0.079	9.85 (3.72)	0.010	7.01 (1, 69)	0.010

When the enter method was used to compute regression models the adjusted R² and other indicators of best fit were neither greatly improved nor worsened. Therefore, the most simplistic models chosen by the stepwise method are the only ones described.

Figure 10. Residual Distribution of the Vegetable Regression Model

Normal P-P Plot of Regression Standardized Residual
 Dependent Variable: Recoded (missing=0) corrected total vegetable intake per week

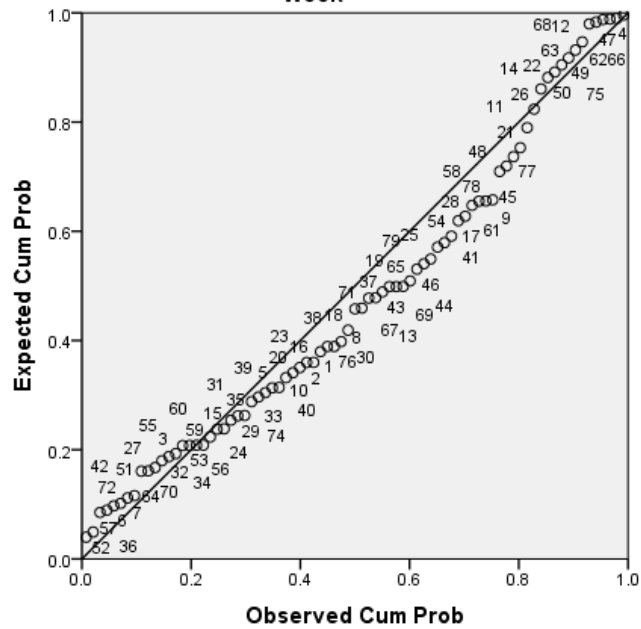
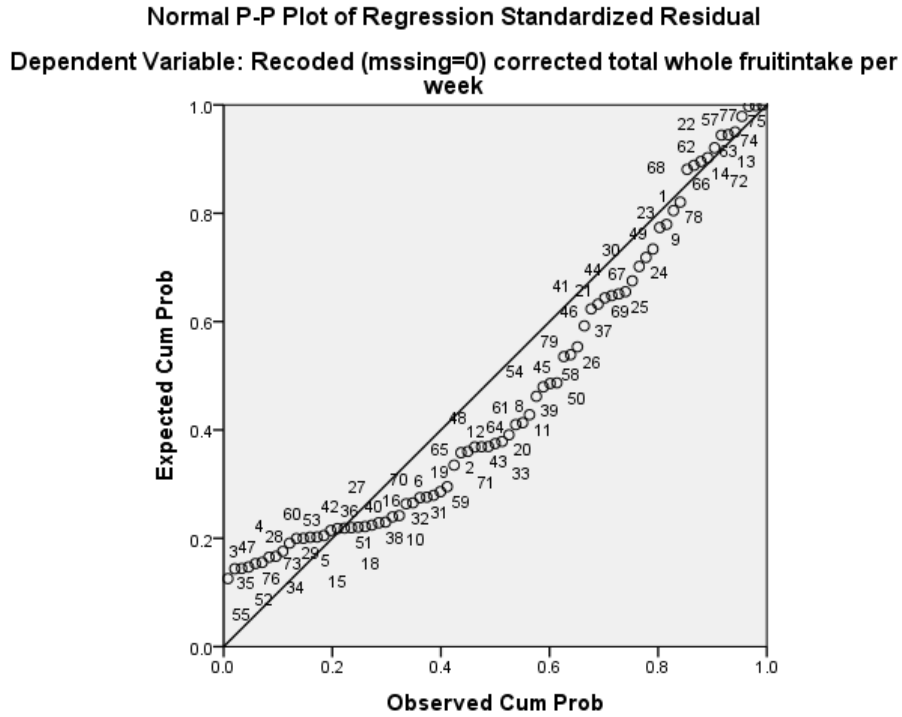


Figure 11. Residual Distribution of the Fruit Regression Model.



Descriptive Survey Results

Self-Efficacy. Self-efficacy (SE) scores were derived using a Likert score, with a score of 5 (definitely I can) indicating the highest level of self-efficacy and 1 (definitely not) the lowest, for each question. Median self-efficacy scores were calculated to indicate level of confidence students perceived they had to carry out behaviors related to preparation and increased consumption of FV. Students were most confident of their ability to consume fruit twice per day and to prepare FV, and least confident about consuming FV at breakfast and to eat vegetables three times per day. The majority of fruit and vegetable related behaviors students perceived as eating practices they could manage (Table 17), as evidence by the high mean SE score.

In assessing differences between students confidence in carrying out FV behaviors, more students identified confidence in being able to consume FV as a snack compared to choosing FV when eating out or selecting FV for a dessert (Figure 12). Although most students were confident they could eat a fruit 2 times a day and had the skills to prepare FV, there were less students confident about eating vegetables 3 times a day (Figure 13). While students were least confident they could eat a FV for breakfast compared to lunch or dinner (Figure 14). Overall, confidence on executing these FV variables was reported at the more possible end of the spectrum than as behaviors that students felt were not feasible (Table 17).

Table 17. Student Self Efficacy for Fruit and Vegetable Consumption Patterns and Preparation

Self-Efficacy	Mean (SD)
Overall Score	3.8 (0.737)
Individual Self Efficacy Items	Median^a
Eat fruit at least 2x/d	5
Prepare fruit and vegetables to eat	5
Confidence to eat f/v as a snack (instead of chips, candy or ...)	4
Eat fruit for dessert	4
Eat f/v every day at dinner	4
Eat f/v every day at lunch	4
Eat f/v when they eat out	4
Eat f/v every day at breakfast	3
Eat vegetables at least 3x/d	3

^a5=Definitely I can, 4=I think I can, 3=Maybe I can, 2=Not sure, 1=Definitely cannot.

Figure 12: Distributions for Self Efficacy Scores on Confidence in Eating a FV: Eating Out, as Snack, or Dessert

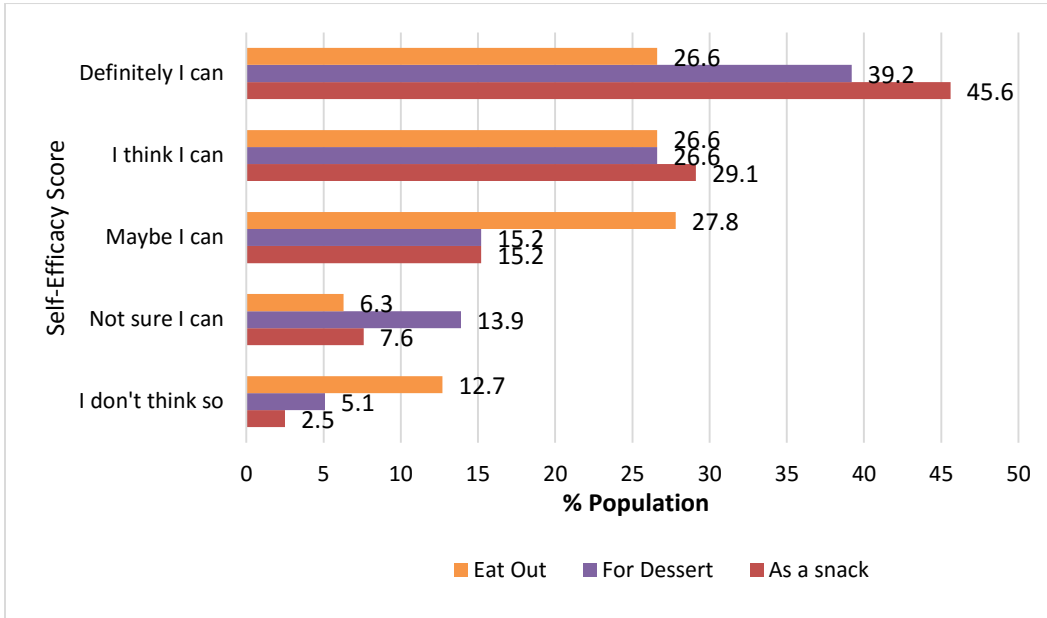


Figure 13: Distributions of Self Efficacy Scores on Confidence in Eating Fruit 2x/day, Eating Vegetables 3x/day, and Preparing FV.

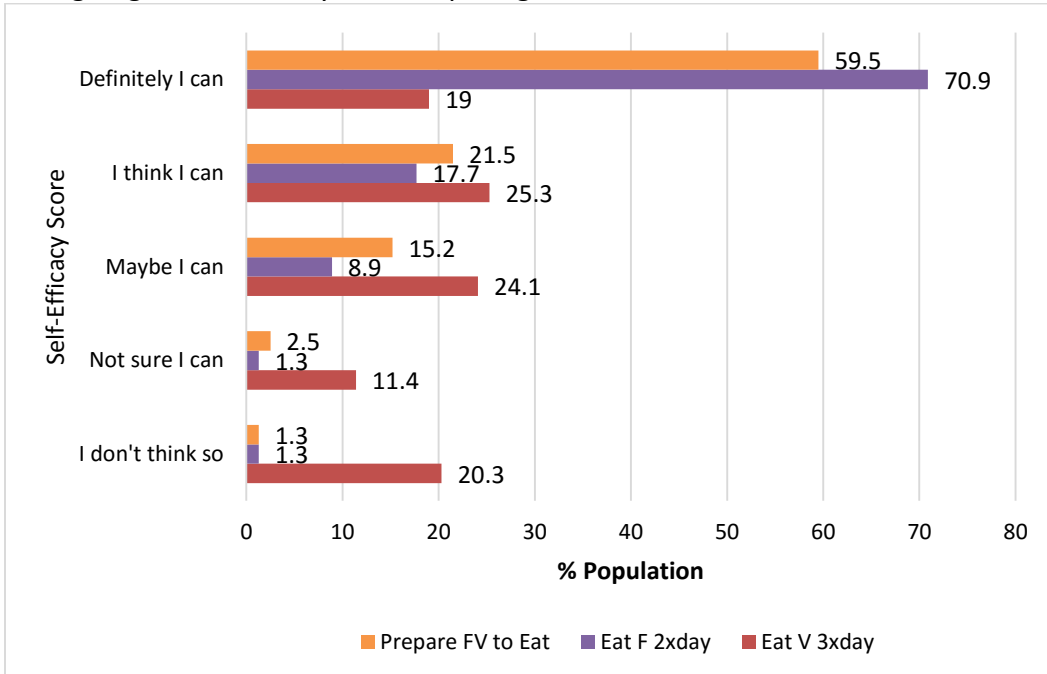
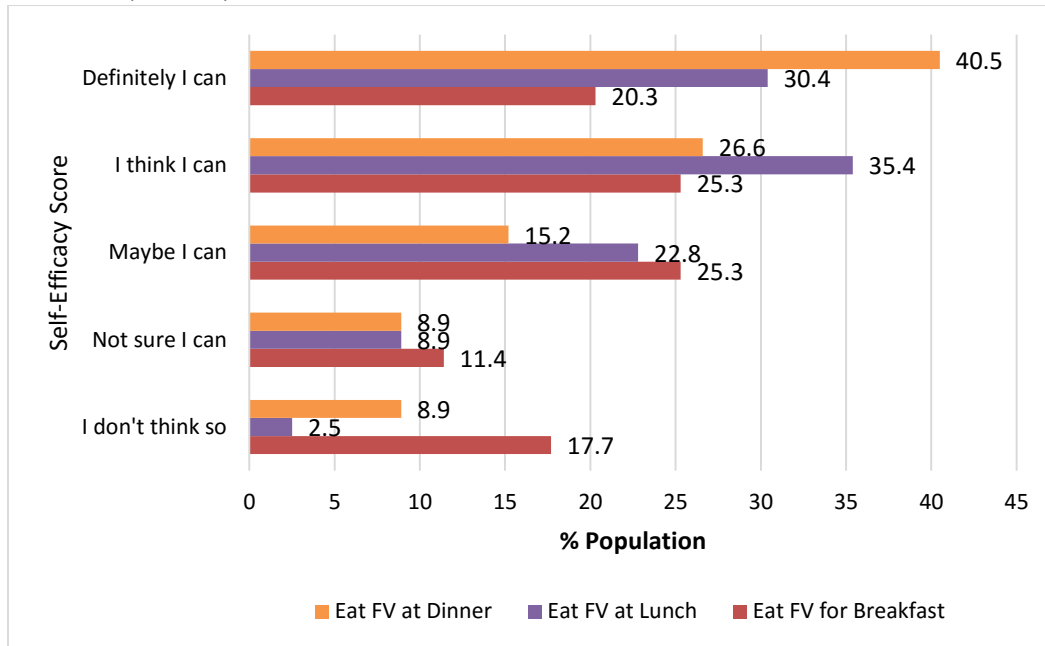


Figure 14: Distribution of Self Efficacy Scores on Confidence in Eating a FV Every Day for Breakfast, Lunch, and Dinner.



Fruit and Vegetable Beliefs, Attitudes and Behaviors.

In our survey assessment differences in student’s beliefs, attitudes, and behaviors related to FV intake, we found that more students believed they consume ‘enough’ fruit compared to vegetables (Figure 15). Concordantly, students preferred the taste of fruits over vegetables. Additionally, many students believed eating healthy was important despite varied opinions of taste preference (Figure 16). While students believed their families valued eating both fruits and vegetables, vegetables were perceived as less important to families than fruits (Figure 17). Consumption of fruits and vegetables at school varied greatly, many more students ate school fruits than school vegetables (Figure 18). Lastly, our students were more likely to help with grocery shopping than with cooking at home (Figure 18).

Figure 15. Distribution of Frequencies in Perceived Intake of FV

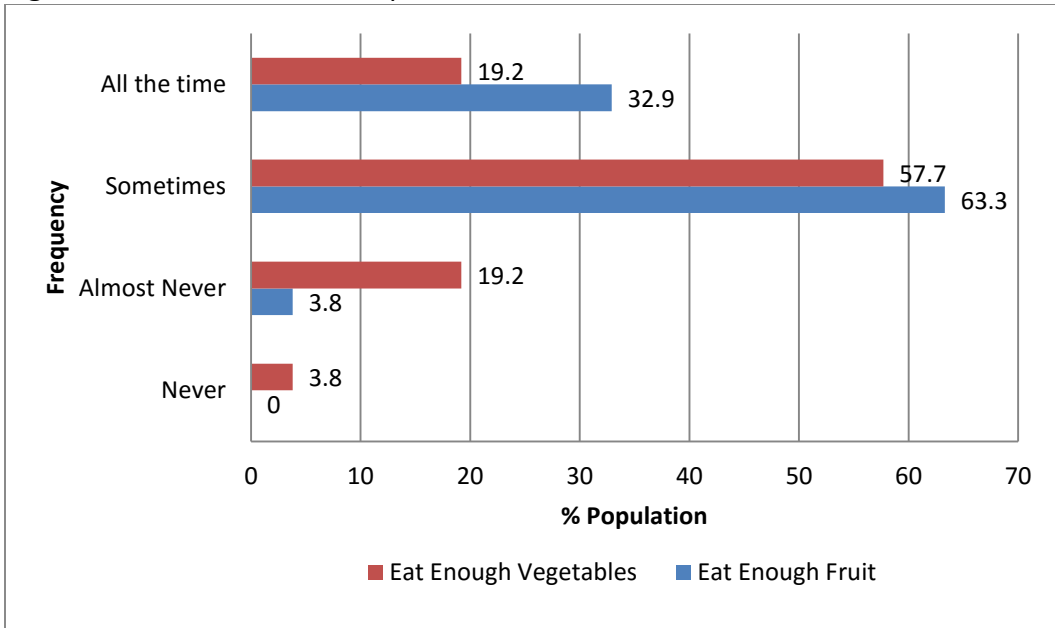


Figure 16. Distribution of Belief Responses on Importance of Being Healthy, Taste Preferences for Fruits and Vegetables

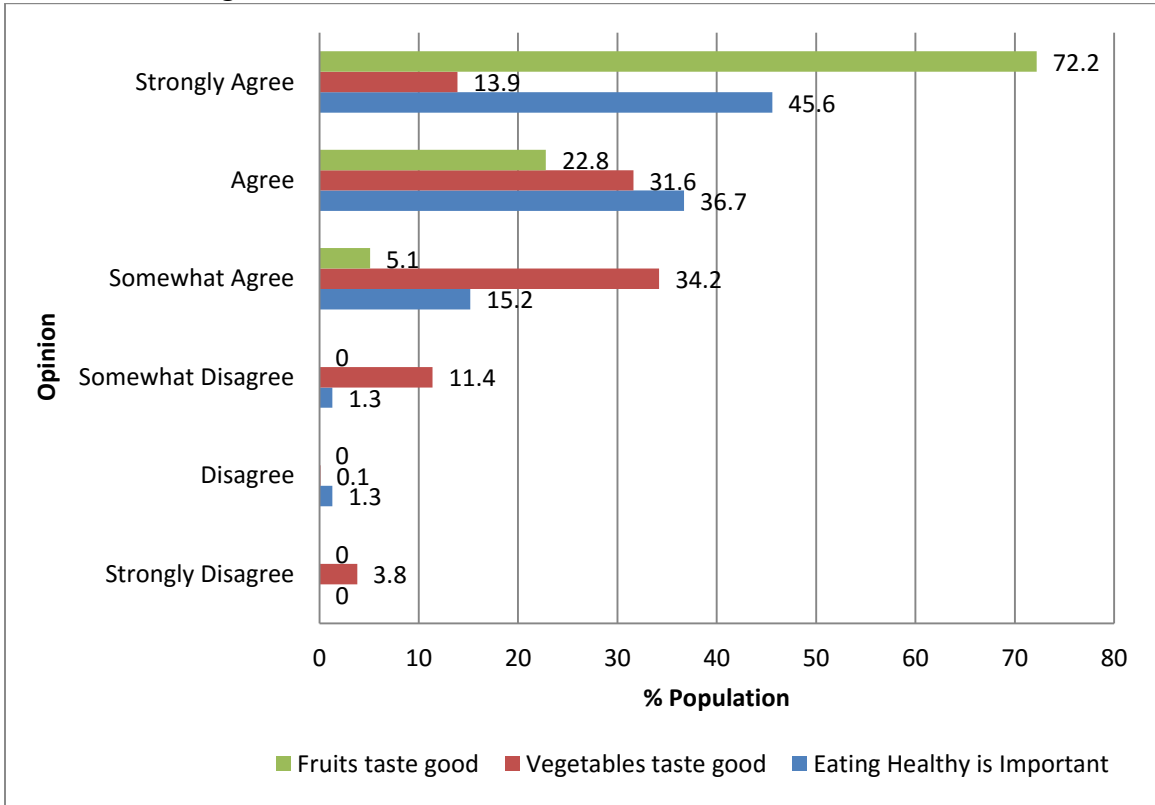


Figure 17. Distribution of Perceived Family Value of Fruits and Vegetables

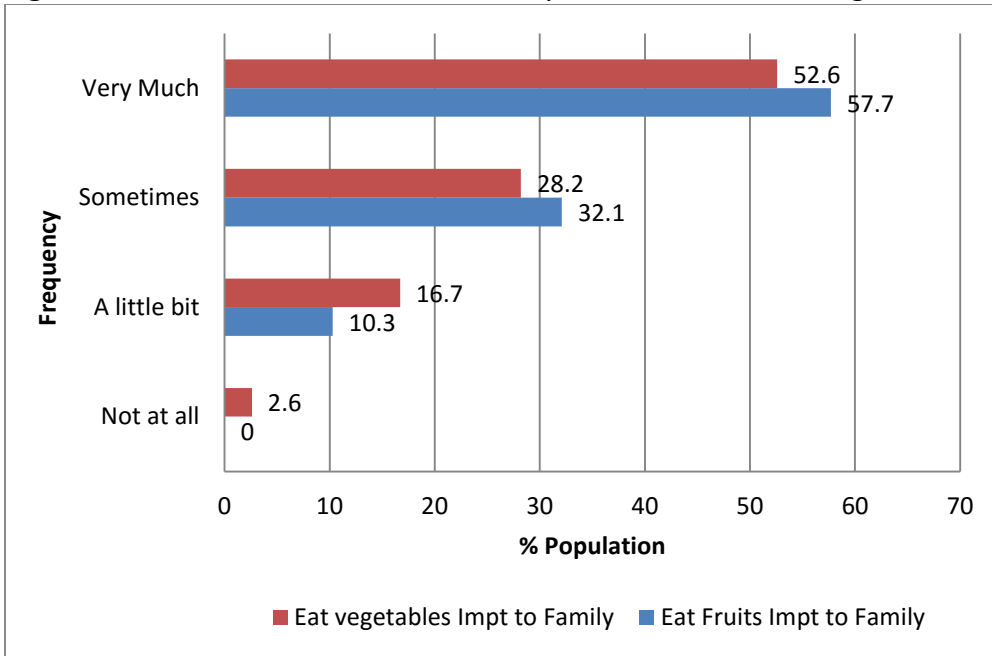
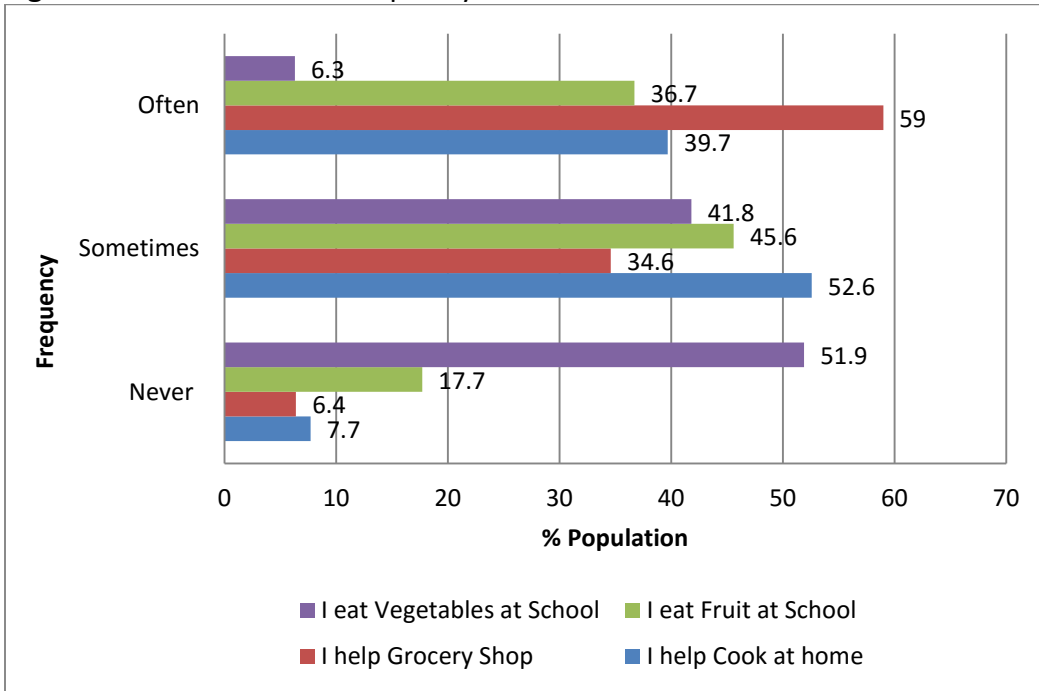
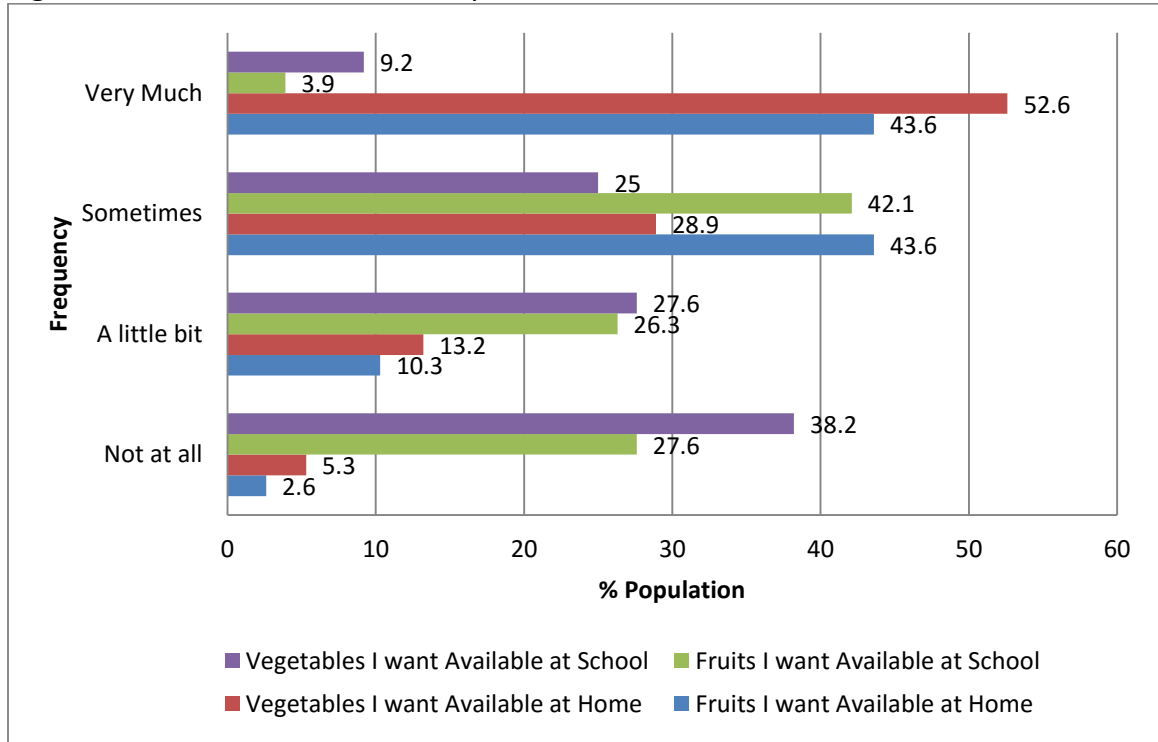


Figure 18. Distribution of Frequency of FV Behaviors at Home and at School



Fruit and Vegetable Availability. About half of our participants indicated their preferred FV were available at home at least ‘sometimes.’ In contrast, approximately half of the students indicated both their preferred FV available ‘a little bit’ or ‘not at all’ (Figure 19).

Figure 19. Distribution of Availability of FV at Home and at School



5.3 Focus Group Findings

The findings of the focus group are discussed under thematic categories that uncover young adolescent’s beliefs, attitudes, barriers, and facilitators that influence their FV intake and related behaviors.

Setting and Receptivity

The general atmosphere of the focus group (FG) was congenial, which seemed to be facilitated by a non-classroom setting, plus our room set up (round tables, well-spaced sitting) was conducive to interaction between participants.

Throughout the FG, students expressed their thoughts and ideas with minimal need for coaxing. Of particular note is the level of comfort and trust that was evident within the group. Students were at ease sharing personal household circumstances, such as being recipients of Women, Infant and Children (WIC) benefits or the Supplemental Nutrition Assistance Program (SNAP-formerly food stamps). The FG moderator (EH) was also able to easily engage students in activities and discussion, with the most notable challenge being one of sometimes having to keep students focused on topic, a common challenge of running focus groups.

5.3.1 Beliefs and Attitudes

The student's attitudes towards FV offered in school meals were overwhelmingly negative, exemplified by the following participant comment: "Like the carrots, they're really long, and like, they don't taste like carrots. And neither do like the green beans" (FG6). In contrast, some students pointed out their preference for FV served at home: "I could get anything I want...at home. But in school, like they don't buy that stuff we want" (FG 6).

When vegetables served at school were discussed in a positive light, comments were qualified with statements of preferences with regards to preparation methods (cooked, canned, frozen, raw served with ranch dressing, etc.). For example, "Usually I

want to get like, fresh broccoli, that that isn't, like, it's gross like they have it here, like I want fresh broccoli that I can have a little thing of ranch and just dip it in" (FG4)

Additionally, students expressed greater preference for fruits than vegetables throughout the focus group. During the FG activity where students were asked to design FV marketing campaigns (discussed below), ideas that included rewards for increased intake provided higher cash prizes for fruit intake (\$200) than vegetable intake (\$100) (FG5).

Cultural Fruit and Vegetable Availability

Students discussed FV served at home more favorably, referring to how FV were incorporated into cultural dishes. For example, one student suggested he would eat more fruit if it were paired with a meat, because at home they often pair something sweet with meat. Another student suggested mixing the vegetables with rice, which was a common dish prepared at home. Addition of legumes was also favored, students mentioned dishes that combined plantains with chicken and beans.

Certain cultural FV appeared to be difficult to obtain in the community, students reported that their parents had to travel to specialty store to obtain their cultural specific produce and other foods. Overall, students showed a strong preference for their cultural specific produce over mainstream FV. Students made specific mention of canapés (quenepes), tamarindo, cashew fruit, 'pear' from Gambia, yam, okra, golden plum, lomgan, guava, and lychee as favorite cultural FV but also as hard to find in their community. One student explained how when she first arrived in the US, she learned about American FV from TV commercials and tried the produce based on that exposure.

She liked some, but she expressed that even FV that were familiar and available in her home country, such as corn, tasted different in her country than in the US (FG5).

Students also spoke of a desire to have their cultural fruits and vegetables represented within the school meals. Specific FV identified as not available at school included plantains, beans (legumes), bamboo shoots, fresh corn, a variety of berries, and watermelon.

Forceful Encouragement

Forceful encouragement was a common suggestion from students when asked what would motivate peers to increase their FV intake. Students expressed that when it came to eating more FV their peers would be more responsive to situations where they thought there was no choice. Students also felt that removing choice would lead to their own increased intake of FV. When requested to write examples of what they meant their responses included comments such as: ‘people to force me’ (FG3), ‘[I should]] Have no [choice]’, (FG4), ‘Take all snacks away’ and ‘Get [rid] of all my junk food’ (FG6). These all constituted examples of forceful actions they thought their parents should take.

Some students explained how their parents were already engaged in behaviors to increase their vegetable intake including ‘hiding’ vegetables in favorite dishes, bribing and setting reward systems associated with eating vegetables, but fruits were not included in these behaviors. Students seemed to accept the behaviors as parental norms. A creative student suggested a national holiday when stores only sold produce as a way to promote increased FV consumption. Table 19 at the end of the section provides additional suggestions offered by students. Overall most students reported

they would rather eat “junk food” than FV when given the choice, therefore taking away the junk food was a frequent suggestion of adolescents.

Health and Appearance

Health benefits and consequences were also identified as potential motivators for increased FV intake. Specifically, students spoke of a need for additional education on the health benefits specific for adolescents derived from consuming FV, in addition to the health consequences of consuming excess ‘junk food’.

Students who specified health benefits as motivators for increased FV intake focused on the benefits to physical health, with comments like “getting in shape because of fruits” (FG3); FV “takes care of your body”, helps you “grow” and “be smart” (FG6). Comments on the health consequences of not consuming FV were centered on “disease” (FG3). Students contrasted not eating FV with eating nutrient poor snacks and specified their concern with suggesting more education on “what junk food does to your body” (FG6).

Students incorporated these themes of health benefits and consequences into their health promotion ideas and suggestions. One group of students suggested creating “an app, showing how good fruits are [beneficial], an app that tells us how healthy the fruits are, [and] show the bad sides [of not eating fruits]” (FG2). Another proposed idea was the use of technology to show visual depictions of physical consequences of a ‘junk food’ diet (FG 2). While digital media suggestions were most popular, some students felt there was a need for a more direct classroom education setting to promote FV intake, on “what junk food does to your body” and “how vegetables help your body” (FG6).

Regardless of whether suggestions were for use of social media and technology or classroom educational settings to promote FV intake, students were consistent in suggesting increased awareness of potential outcomes for adolescents resulting from a high intake of FV.

Despite students admitting it challenging for them to choose FV over “junk food,” most also identified FV as important for their health. “Don’t fruits and vegetables help the...immune system” (FG 3), students talked about FV helping the brain (to be alert and handle stress), and the nutrients and vitamins FV have to help the body and prevent disease. A few students were very concerned about their health due to what they reportedly had learned in health class. A student reported that she started eating more FV because of a nutritional flyer given to her mother at the doctor’s office. When asked to define what the term healthy means to them, there was a range of responses. Students explained there needed to be a balance between healthy and unhealthy food intake: “Like not having too much, or not having too much less” (FG3). Outcome expectation of staying healthy included living for a long time, keeping the body in good shape/able to do normal activities, and preventing disease. “When you are healthy, like you can, you can’t get a disease easily...when you’re healthy...It just like prevents diseases” (FG5). Additionally, student’s agreed living longer was something they were concerned about; an issue that came up in two focus groups.

While there was some agreement on what ‘Healthy’ meant, there was much contention on whether weight and physical appearance are related to health. Some students related health to keeping the body in “good shape and condition” (FG4) and

having enough energy to do daily tasks: “To be healthy you are able to like get up and like exercise...and walk, and stuff. And so like, when [your] eating like, [the right] fruits and veggies, you have like energy to do stuff.” (FG6). Furthermore, other students referred to a healthy appearance in a different manner such as: “healthy is...have your regular skin color” (FG6).

Although esthetic appearance as a motivator for increased FV intake was not mentioned as frequently, when it did come up in the conversation, it seemed to be a more important motivator for girls, with comments related to weight and nicer hair and nails. In this discussions some of the female students alluded to body image issues and the pressure to be ‘thin’. Within this context, there was a strong association between FV consumption and weight control being drawn by the female students, often indicating that someone in their social network was using FV to manage their weight.

Rewards

A reward system from parents was also identified as a motivator for increased FV intake. While only one person mentioned a parent bribing them with cash, students in multiple focus groups stated “chocolate” or “money” would be the most enticing reward for consuming more FV than they currently ate. Two groups of students in separate focus groups came up with ideas for on-line competitions that offered incentives and rewards for eating FV. One idea revolved around an online video recording game, where the more FV they player consumed, the more points they gained. The student explained the game:

Student 1: a video tape that shows how much vegetable you eat per day. Get as many point[s]. That would encourage people to eat vegetables, especially when you eat like 100 vegetables, you get a prize....

Student 2: or, like 10 videos of people eating different fruits, the person who eats the most fruits gets one prize from this mystery box, it could be anything, [like]Nikes, Jordans (sneakers), cash

Student 3: if there was cash in there, I would be the first one to do it (FG5)

Desire to Improve Fruit and Vegetable Skills.

Despite reporting a lack of natural inclination to consuming produce frequently, there was also an overall reported desire to increase self-efficacy related to meal preparation, including FV intake. Students showed an interest in wanting a “recipe book” and “free samples [of FV]” (FG3); as well as a desire to learn how to prepare FV: “different ways of cooking/styles” (FG5). A student expressed that she wanted to learn how to cook because when she “lives by herself...I want to make a living. Not eat only the stuff that I buy” (FG5).

Students also showed an interest in communicating with food service staff, indicating they would like to “Try & talk to the lunch people.” Through communication, students hoped they could make suggestions to food service staff that can bring about modifications to school meals served and result in the incorporation of FV students would actually eat.

Social Events

Students also suggested using social activities to promote FV. For example, one group of students created an advertisement for a “fruit and vegetable buffet” and described the event as a FV party where everyone was eating FV and having fun! The

suggestion of promoting FV in social events may communicate student's beliefs that peers are influential in their eating habits.

Misinformation

Misinformation about FV became apparent as some FG discussion progressed. Despite all students participating in health class with significant nutrition content and student's awareness of the health benefits of FV, they were less clear on recommended intakes. There was an array of opinions on what was considered to be the correct amount of FV to consume for their age group. Responses ranged from: can "never [eat] enough" to need to eat FV "3-5 times a day" to "3 [on] Monday, Tuesday, Wednesday you eat it [FV], and the rest of the week you don't eat it [FV], that's healthy" (FG3). Although most of this conversation occurred in one focus group, students in three focus groups expressed that eating FV on a daily basis was *not* healthy.

Other misinformation mentioned within the FG included the student's perception of being served what they termed "fake" FV at school, and that canned FV are not to be trusted. Yet some student's had no issue with these types of FV:

Student 1: but, I, I gotta point, the vegetable just like that were in a can, cause you don't know when you look at a vegetable and fruit, is it kinda good or that one is good...but when you gonna eat them..they're not good no more, they are like, already way expired to throw in the garbage.

Student 2: I like...beans in a can and corn in a can, and like...peach in a can, they're delicious

Student 1: Yeah, I would just like to see [canned FV] being sealed

Student 3: Yeah, I like [canned FV] [be]cause they are already cooked (FG5)

Adolescent Cooking and Grocery Behaviors.

When students were asked about their involvement with cooking at home many responded positively, even though some students indicated they were limited in their involvement in making meals, this was not the case for all students. For example:

LS: how many of you cook...at home?

P: Oh, mee!

P: sometimes

P: I cook....

LS: That's a lot of hands. So how many of you cook vegetables?
(FG 3)

Students who mentioned helping cook at home cooked various and complex items such as meats, rice, pasta, potatoes, vegetables/salads, warmed up taco shells and cut vegetables. Some students were in charge of preparing foods for younger family members, while others cooked for themselves or when their parents asked for help. Either way, students who participated in cooking expressed a confidence about it: "You know one day my mom was tired of cooking so she told me to like finish cooking that [hand gesture]. It was so good [what the student cooked]... she tried cookin' the same way I did [laughter]." (FG5).

Many students who did not already cook expressed willingness to learn. In addition, most students reported grocery shopping with their family members. While some students seem to be given more responsibility for grocery shopping; "I do, yea, my mom gives me the money, I go to the store and get them" others may still be involved with simpler tasks, "I go every Saturday. I help with the bags." Our findings indicate that

adolescents are already involved with food purchasing and some with preparing meals, and can infer that this role can be strengthened to provide an avenue for promoting FV.

According to students, their family's choice for grocery shopping location was driven by prices, transportation and customer service. Parents would select a grocery store they could get to easily and food prices were considered to be affordable. If transportation was an issue the store would be chosen less frequently. Students also reported that some stores were more accommodating to those receiving benefits from Women, Infants and Children (WIC) and the Supplemental Nutrition Assistance Program (SNAP, formerly food stamps), while some students identified stores that they considered were rude to their families when they used their benefits. Students listed the grocery stores frequented by their families on the survey as well as during the focus groups (Table 18). The list indicates the frequency each store was mentioned. Stores commonly discussed seemed to be the most accessible and affordable for our study population. Students specifically mentioned that Walmart was popular in their families because it was seen as affordable, their parents could make all their purchase in one location, including purchase of affordable groceries.

Table 18. Grocery Stores Students Identified as Utilized by their Families

Method	Store (frequency mentioned*)
Focus Groups (n=6)	Price Rite (8x) Price Chopper(6x) Shaw's(4x) Market Basket (3x) Big Y (2x) Wegman's (3x) Stop & Shop (5x) Sam's club(3x) Wal-Mart (11x) Trader Joes (1x) BJ's (4x) Chinese store (5x) "Dominican store"/Compari (3x) No Name (2x) Monrovia (4x) <u>Mentioned Specifically for Fruits & Vegetables:</u> Price Rite Wal-Mart Wegman's BJ's Compari Monrovia "the Other African store"
Surveys (n=79)-additional stores identified in the survey	Delorico's Vietnam Grocery Target Patel Brothers North East Market Dollar Tree Walgreens Binh anh Mekong H-Mart HaTien Assi Plumly Store

* Some stores generated more conversation than others and were therefore mentioned more frequently (i.e. Wal-Mart).

5.3.2 Barriers and Facilitators to FV Consumption

Barriers.

Since over 87% of this school's population receives free/reduced price lunch, negative attitudes towards FV served at school, especially vegetables, can be a significant barrier to FV consumption. However, students also discussed barriers specific to their home environment.

Temptations

Adolescents reported they struggle to resist temptations such as 'junk food' and sweets readily available at home. When asked to write down what gets in the way of eating more fruits and vegetables, "junk food", candy, sweets, and other less healthful foods were frequently reported. Students pointed out that these snack foods were purchased and frequently brought into the house by their parents, who they perceived as not strongly discouraging such purchases.

The forceful encouragement discussed earlier also indicates a lack of ability for students to resist what they view as temptations. The school has removed many unhealthy options however students have not increased their FV intake due to lack of preference for the FV served. Therefore, the lack of self-regulation (resisting tempting foods) of the adolescents is a barrier to adolescent FV consumption.

Poor Parental Influence

Poor parental influence was a pervasive theme throughout the FG, including mixed signals about what to eat and not eat. Below a conversation between FG

participants demonstrates the mixed signals received from parents while grocery shopping:

Student 1: I like going shopping with my dad because he lets me buy everything I want, but my mom, she like 'no you're not getting that, you're not getting that'. I know no matter how much I bother her, and that's when we get outside, to the car about to go home, that's when she be like, if you wanted that you could have taken it (laughter)

Student 2: I know, that what my mother too. She like telling me not to take stuff, and then when we go out and I'm like why didn't you buy me that cookie over there? She like 'why didn't you take it?' (laughter)

Student 3: My dad, always let me take it, what I want, always (FG5)

Students also expressed parents do not eat or buy the healthy foods they ask their children to eat. Additionally, parents may set strict rules about cooking at home, rules that discourage students from participating in meal preparation. Combined, these parental barriers may create an environment where adolescents not only receive mixed messages about FV consumption but that may impede translation of healthy behaviors they learn at school into their home life.

Affordability and Access

Students discussed lack of access to quality produce and funds for obtaining produce as barriers to FV intake. When asked who goes grocery shopping several students' responses focused on access to money rather than individuals in the family, making statements such as "Um, you asked who buys food. Anyone who has money" (FG4). Money was identified as key for both what would help increase FV intake as well as what is a barrier to eating more produce. Wasting food appeared to be a major

concern, students postulated that certain foods are not bought by family because they go bad too quickly.

Students talked about there often being a lack of availability within their household of preferred FV, focusing most on fruit. The reason offered by students for low availability of their preferred FV was that their preferred FV were eaten too quickly and did not stretch out over a longer time period and so they were not bought by parents. One student expressed even when fruits do get bought there were not enough to go around: “So I ask my dad to buy fruit it’s either too expensive or my brother will eat it all...I never have snack when I get home ‘cause he’s always eating it...” (FG4). These statements reflect poor access to not only preferred FV at home, but may also refer to a general lack of access to items like fruit due to budgetary restraints. For economic reasons families may choose quantity over higher quality or preferred FV or not be able to have a continual supply of produce within the household.

The idea of needing more time to eat produce came up several times in two focus groups. Students mentioned school and homework get in the way of eating FV, which usually require time to prepare, especially vegetables. Another reason presented by students was that their parents do not have enough time to cook vegetables.

Facilitators.

Fruit and Vegetable Campaigns

In order to gather ideas to promote FV among adolescents we asked groups of students to create FV campaigns aimed at their peers. Students suggested that one way

to catch their peers' attention was the use of celebrities in promotional materials via various media; Examples included creating a campaign promoting "Veggie World" featuring [Michael] Jordan promoting FV (FG2); TV commercials or songs with celebrities such as "Beyonce, Nicki Minag, or Jason Derulo" describing how FV taste good and help them get in shape. One group of students created a new pop star, "Carrot Superstar," with a corresponding hashtag and social media page "#Veggies who could promote FV through social media messaging and a Facebook page dedicated to teen celebrities promoting FV:Facebook.com.kpop veges star" (FG3).

Adolescents also suggested running a competition. They indicated their peers would eat more FV if they were competing; "make it into a race" (FG2). One competition suggestion included on-line videos that show people eating FV, whoever eats the most FV receives "Nikes, Jordans [referring to the sneakers], cash" (FG5). Additionally, several groups of students created promotions pin pointing health benefits of eating FV, such as: "Eat more vegetables: you will grow, you will be smart, [you will be] healthy". Ideas including negative health consequences of consuming junk food included:

"This is what you want (pictures of banana, apple, broccoli, and carrot)

But you actually [eat] this (pictures of meat, chicken, candy, junk food)

Which will do this to you (picture of an unfit person)

Final Message: "Eat vegetables to stop disease for life"
(FG3)

Collectively students provided several distinct ways to catch the attention of adolescents through FV promotional campaigns. The suggestions covered a large

spectrum of adolescent developmental stages and personal tastes, which indicates a need for a diverse approach in FV promotion interventions.

In regards to adolescent's attitudes towards changing FV intake behaviors only a couple students verbalized there was no way of motivating their peer to consume more FV "I don't think they can, if there is junk food in the way" (FG6), another agreed "I can't" (FG6). Two other students in other FG expressed less negativity but still were not optimistic about increased FV intake among adolescents. One student suggested to only "eat vegetables/fruit when necessary" (FG3) while another student expressed she does not force people to do what she, herself, does not want to do (FG5). Aside from these few, all other students willingly brainstormed campaign ideas.

Better Flavor

Bad taste and flavor were the most commonly addressed barriers to consuming more FV. Adolescents often commented that vegetables should have more flavor. There seemed to be a consensus that vegetables were not as good "when it's by itself" (FG3). Suggestions for improved flavor included "mixing it with things they like" (FG2). Accompaniments suggested for vegetables included salsa, meat/fish, chili, eggs, rice, cereal, yogurt, whipped cream, chocolate.

Parental Role

Students identified a need for their parents to help them eat more FV, illustrating the important role parents still play in young adolescent's food choices. Students reiterated their parents eating habits and expressed the control parents have

over the food that comes into the house throughout FG discussions. One student described how she started liking FV because of her parent:

Student 1: I used to think it was like, so like waste of time, of energy.

Student 2: [CT] what! How is that a waste of time?

Student 1: ...but like one day, I was like reading that book and read about it. Then I started tasting some fruits. The only vegetable that I eat was broccoli, then my mom make me eat lettuce and spinach...and different types...red beans, all of those things. Then I started liking them, and eat a lot of fruit

E: What book was that?

P: Like, it was about a nutrition book. They give it to my mom when she goes to a doctor appointment

Summary

Overall, adolescents expressed a lack of self-regulation and self-efficacy related to FV intake behaviors (which does not align with survey findings), yet indicated the importance of observational learning (with peers, family and icons) in regards to increasing their consumption of fruits and vegetables (FV). A variety of theoretical constructs from the SEM and SCT were identified by each emergent theme (Table 19), indicating these theoretical constructs are well suited to guide interventions of middle school student's healthful eating.

Table 19. Student’s Beliefs, Attitudes, Identified Barriers and Facilitators Towards Fruits and Vegetables by Theoretical Constructs.

Theme	Student’s Voices	Theoretical** Construct
BELIEFS AND ATTITUDES		
Preferences and Dislikes	<p>“Like the carrots, they’re really long, and like, they don’t taste like carrots. And neither do like the green beans”</p> <p><i>“But in school, like they don’t buy that stuff we want....[like] strawberries...grapes...watermelon”</i></p> <p><i>“I like cooked vegetables, not like raw”, “I don’t like hot broccoli, they taste soft and weird (laughter)”</i></p>	<p>Interpersonal Influence</p> <p>Negative Institutional influence</p> <p>Poor Outcome Expectations</p>
Motivators	<p>Forceful Encouragement: Parents have to ‘force me’, and present ‘no choice’,</p> <p>Parents ‘get rid of all my junk food’</p> <p>Rewards: Parents reward with “Jordans”, “money”, “chocolate”,</p> <p>School hold FV eating “competitions”</p> <p>Health Benefits and Consequences: health messaging highlighting “what junk food does to your body” and “how vegetables help your body”</p>	<p>Lack of Self-Regulation</p> <p>Positive Interpersonal Influences</p> <p>Outcome expectations</p>
Skills	<p>Desire for FV “recipe books”, “free samples”; “to learn to prepare them”;</p> <p>Need to influence school meal preparation by “talk to the lunch people”</p>	<p>Self-Efficacy</p>
Health and Appearance	<p>Identified Health attributes: “help the immune system”, “handle stress”, “nutrients”, “like prevents diseases”, “live longer” “getting in shape because of fruits”</p>	<p>Positive Outcome Expectations</p>
Misinformation	<p>Lack of serving size knowledge: “3 [fruits and vegetables] Monday, Tuesday, Wednesday¹¹² you eat it, and the rest of the week you don’t</p>	<p>Negative Outcome Expectations</p> <p>Negative Interpersonal</p>

	<p><i>eat it, that's healthy"</i></p> <p><i>'Fake Vegetables': "My parents don't like canned food because they don't know how many times, those things, those foods had been in there."</i></p> <p><i>"At school, we have like, fake vegetables, like from like the freezer, or can or something. They aren't real."</i></p>	Influence
Cooking and Grocery Behaviors	<p>Help parents with: <i>"I usually help my mom with the vegetables and chicken and sometimes I'll do the rice for her", "</i></p> <p>Help parents with groceries: <i>"I do, yea, my mom gives me the money, I go to the store and get food", "I go every, Sun, every Saturday. I help with the bags"</i></p>	<p>Self-Efficacy</p> <p>Observational Learning</p> <p>Interpersonal Influence (familial)</p>
BARRIERS		
Temptations	<i>Preferred snack: "junk food"</i>	Lack of Self-Regulations
Parental Influence	<i>Lack of parental modeling: "My dad, always lets me take it, -what I want, always"</i>	Negative Intrapersonal Influence
Affordability and Access	<p>Lack of access to preferred FV: <i>"We don't really have [tomatoes] cause my sisters does not like it. "</i></p> <p><i>"My mom thinks that like it's gonna go bad[FV] 'cause we won't be able to finish it [FV] ..."</i></p>	<p>Observational Learning</p> <p>Interpersonal Influence</p> <p>Community Influence</p>
Cultural FV Availability	<p><i>"Yea, they have them in Puerto Rico, I don't know where else they have them. They are like, brownish, they are like ?(celery)? or ?(soury)?...yeah"</i></p> <p><i>"Well at home, um, my favorite fruits, they send them to me from Puerto Rico, like in a box"</i></p>	<p>Intrapersonal Influence</p> <p>Interpersonal Influence</p> <p>Cultural Influences</p> <p>Community Influence</p>
FACILITATORS		
FV Campaigns	<i>"make it into a race"</i>	Social Influence
	<i>Pictures of: "celebs ...eating"</i>	Observational Learning

	veggies". Use Facebook: "Facebook.com.kpop veges star" to promote - "Beyonce, Nicki Minag, or Jason Derulo", songs, magazines,...	
Better Flavor	- "mixing it [vegetables] with things they like"	Self-Efficacy
Parental Role	"I ask my mom if she can get cereal, then she gets healthy cereal"	Interpersonal Influence(familial) Self-Efficacy Observational Learning

*FV=Fruits and Vegetables, CT=Cross Talk ** Theoretical models include the Social Cognitive Model and Socio-Ecologic Model of behavior change.

CHAPTER 6

DISCUSSION

The FVFFQ used in this study is not a validated measure, but its development was guided by referring to validated instruments and relevant literature. The FVFFQ was developed to provide baseline data on the qualitative nature of the FV intake of a multicultural sample of grade 7 students, from a middle school in a low-income neighborhood, with an 87% free and reduced price lunch student body eligibility. The purpose of the survey was to also help identify other factors related to FV preferences, issues of access, availability and self-efficacy in relation to FV intake.

Our young adolescent student participants represented a racially and ethnically diverse population group, with the majority being of Hispanic/Latino heritage, mostly Puerto Rican and Dominican Republic ethnicities. The second largest racial group being Black and African American, comprised mainly of Ghanaian, Haitian and African American students. Students chose to identify their ethnicities in the survey when asked how they identify themselves as, besides the standard racial categories. Some of the Caucasian students also chose to identify their European heritage. There were very few students of Asian heritage represented in the sample. Overall, our participant demographics were representative of the school's racial/ethnic diversity.

6.1 SURVEY DISCUSSION: quality of FV intake, preferences, availability and self-efficacy

Fruit and Vegetable Intake

Our findings, based on our FVFFQ, indicate that our student participants consumed 2-3 total fruits per day and 3-4 total vegetables daily. An intake level that suggests students in our study are possibly meeting their daily FV requirements. These findings are contrary to the literature and to national surveys. National averages for FV intake for this age group are often measured in cups/day, using a repeated 24 Hour Recall. This makes it difficult to compare against a semi-quantitative food questionnaire. Our FVFFQ is similar to the School Physical activity and Nutrition (SPAN) survey (Buzzard 2001 and Thiagarajah et al., 2008), it does not track portion sizes and only estimates frequency. The FVFFQ is also designed to track nutrition behavior changes, as is the case with the SPAN survey. Given the similarities between the two surveys, we chose to compare our findings with those of the SPAN survey of adolescents. The SPAN found that grade 8 students consumed on average fruits *and* vegetables 4.7 times 'yesterday' (an equivalent of 37 times per week), which is lower than our estimates (5-7 times per day, median= 46.5 times per week). Given these disparate findings, our FVFFQ may be reflective of measurement bias and therefore systematically overestimates our student participant's intake. Additionally, a partial explanation for this large difference in findings could be the difference in the number of questions asked about fruits and vegetables. The SPAN survey only had one question for total fruit intake and a separate question for total vegetable intake, compared to our survey which had over 20 questions combined for fruits and vegetables. The number of questions asked for each category (fruit or vegetable) can be a source of bias (Krebs-Smith, Heimendinger, Subar,

Patterson & Pivonka, 1995). Validation of our survey would provide insight into the accuracy of the FVFFQ and may provide a clearer explanation for the differences in findings.

Multicultural Preference

We found differences by race in students' preferences and intake of FV. White students reported higher intake of frozen/cooked and raw vegetables and also ranked vegetables higher for intake than any other racial group. Asian students indicated the highest intake of tropical fruit followed by their Hispanic/Latino peers, while Black/African American students ate the most hand fruit. Black/African American students identified cooked greens as a top 10 consumed vegetable first compared to other races (see Table 16). Sharma et al. (2014), also found that African Americans consumed the most dark leafy greens, and Caucasians consumed the most potatoes (non-french fries). Although salads did make it onto most of our participants' top 10 consumed vegetable and was a favorite vegetable, it was not as highly ranked as was the case in the findings of Sharma et al. (2014). We also found that similar to Sharma et al. (2014), Black/African American and Latino participants consumed citrus and melons more frequently than other races. Although these findings provide important information on some FV choices the school food service can consider incorporating into the meals they serve, further exploration is warranted to identify other factors including the range of produce and preparation methods students prefer.

Types of Fruits and Vegetables Consumed

Some of our findings with regards to students FV intake seemed contradictory, for instance student indicated their preference for raw vegetables such as peppers, onions, cucumbers, tomato, and celery, however, the same vegetables were also least frequently consumed. One explanation for this incongruous finding is that the categorization of “raw vegetables” in the FVFFQ may have been confusing for students to interpret, since these vegetables may be consumed in cooked form but preferred in raw form. Although our pre-testing of the survey did not identify the categorization of FV as a problem, it is also not clear when students listed their favorite vegetables on the survey, if they had a preference for raw or cooked FV, which may be why these “favorite vegetables” do not correlate with the responses in the FVFFQ.

In contrast, all of the listed favorite fruits on the survey were also the most consumed fruits according to the FVFFQ assessment. Fruits that ranked lower in intake frequency but increased in consumption during the summer months were also highly ranked favorites. One explanation for this trend might be the availability and affordability of these specific fruits (i.e. berries, melons) in the summer, which may not be as readily available within the household year round.

Given the high proportion of Latino participants we were surprised that only a few students listed produce such as avocados and plantains as a favorite fruit or vegetable, and both were ranked very low for frequency of consumption. Yet the FVFFQ may not fairly represent the consumption of these foods since both plantains and avocados were listed as a single food items on the FVFFQ, while all other groups of

vegetables had more than one vegetable per category. If all vegetables were listed separately, rather than grouped they may appear to be ranked higher in intake than other vegetables that are grouped with more commonly consumed vegetables.

Our findings indicate a low intake of french fries by our students, which is contrary to the literature on youth dietary intake (Kimmons, et al. 2009, Bowman et al., 2014; Larson, Melgar-Quinonex & Taylor, 2009). We suspect there may have been social desirability bias at play here given that in the focus group students discussed going to fast food restaurants with their families and that french fries are served at school for the lunch once a week. Yet the same behavior was not observed for the fruit juice intake, which was reported at high intake frequency. It is possible that students are aware that french fries are commonly perceived as an unhealthy food, while they may not perceive the same for fruit juice. Notably, students also did not list fruit juice as their favorite/summer fruit, implying they may think of juice separate from whole fruit or that fruit juice availability is not seasonal.

Overall our students had a high fruit and vegetable diversity score, indicating that many of our students eat from a range of the fruit and vegetable subgroups on a weekly basis. This is consistent with USDA Dietary Guidelines for Americans-2015 recommendations encouraging consumption of a wide variety of nutrients that result from a diverse dietary intake (USDA&HHS 2015).

The majority of our participants met or exceeded the USDA recommended intake of dark green vegetable and legumes. These findings differ from other studies assessing dietary intakes of adolescents. Kimmons et al. (2009) found adolescents (aged

12-19 years) who completed the NHANES 2003-04 survey rarely met dark green or legume recommendations. Dark green vegetable estimates may be high in our study due to this category in the FVFFQ included “Salad-any type”, which can include many non-dark leafy greens, and therefore may lead to an over estimation of dark green vegetables intake. It is important to also note that the school served salads at lunch, which some students identified as appealing in the focus group discussions. The high intake of legumes is reflective of the participant’s cultural diets, with beans and legumes being a significant part of the Latino, Haitian and African cultures, which are subpopulation groups representative of a significant proportion of the study participants.

We found that a majority (67.2%) of our participants were meeting their recommended intake of fruits (14 servings or more per week), estimates that included 100% fruit juice. This finding differs from others, where fruit intake of adolescents is found to be consistently low (Kim et al., 2014, USDA ARS, 2014 Data Tables) and can be as low as only 6.2% of adolescents meeting their needs (Kimmons et al. 2009). About half our student population was meeting or exceeding the recommendation for starchy vegetables (excluding french fry intake). Again this finding is inconsistent to other findings that indicate potatoes are a significant contributor to total vegetable intake in adolescents (Kimmons et al. 2009; Bowman et al., 2014; Larson, Melgar-Quinonex & Taylor, 2009). Our results may differ due to exclusion of french fries from the assessment, but also may be due to a social desirability bias due to our survey being solely about FV.

The vegetable sub group with the lowest reported intake in our study was the 'Red, Orange and Other' produce category ('Red and Orange' and 'Other' subgroups were combined in our study). A possible explanation for the low intake of red, orange, and other vegetables may be due to these types of vegetables being incorporated into mixed dishes like stews, soups and chili, which students identified as being commonly served at home, and therefore more difficult to identify separately. Kimmons et al. (2009) also found the 'orange' vegetable group needed improvement in adolescents (data from NHANES 2003-04).

Overall Diet Diversity

The median and mean overall DD score for our population was 72% indicating a relatively favorable level of diversity in FV intake. Again it is important to keep in mind that our FVFFQ may be reflective of a measurement bias. As well, the survey was administered during the winter months when FV may not have been as readily available and affordable. Overall our DD scores are high in comparison to other similar assessments of adolescent intake. Banfield, Liu, Davis, Chang, and Frazier-Wood (2016) found adolescents scored between 43-52 out of 100 on the Healthy Eating Index (HEI)-2010 scale. Similarly, Santiago-Torres, Adams, Carrel, LaRowe, and Scholler (2014) also found adolescent's average HEI-2010 score of 59 out of 100. An important distinction between our measure and the HEI-2010 is the latter includes all food groups, while our scale focused on FV and some beverages. Additionally, our scale is based on the Dietary Guidelines Adherence Index-2015 rather than the HEI-2010.

Students indicated that there was greater availability of FV they liked within their households than at school. Within the school setting students had a general preference for the fruits served rather than the vegetables. This finding may be due to the high availability of hand fruits served in the school meal service, and that hand fruit was one of the highest ranked fruits for participants in our study population. The low availability of preferred FV at school was reflected in the negative attitude towards FV served in school lunches expressed in the focus group discussions. Hand fruit may have been rated highly in preference due to the ease of their intake.

Self-efficacy has been shown to be a valid predictor of FV intake in youth. Several studies emphasize the importance of self-efficacy and norms (both parental and peer norms) as being an integral part of consumption of FV at home and at school (Thompson, Bachman, Baranowski, and Cullen, 2007; Young et al. 2004; Pedersen et al. 2015 and Fitzgerald et al. 2013). In our study, the self-efficacy score explained about 20% of vegetable intake and about 8% of fruit intake. Overall, in our study, students were least confident about consuming FV when eating out and increasing the frequency of vegetable intake within a day. In contrast, students who perceive that their family value serving vegetables were more confident in their ability to prepare FV at home ($p=0.001$), to eat FV every day at breakfast (0.045) and to consume FV when eating out (0.027). Families who value inclusion of vegetables in family meals may be more adept in modeling vegetable consumption at home and when eating out. Pedersen et al. (2015) points out that what parents do (descriptive norms) is more persuasive than what parents say (injunctive norms) in influencing their children's FV intake. Another

study found that perceived parent modeling and perceived parent support were important predictors of FV intake in adolescents (Younget al., 2004). Clearly parents play an integral part in adolescent FV intake and should be included in FV promotion interventions, as well as made aware of the importance of their role.

Self-efficacy and DD scores were significantly and positively impacted by availability of preferred fruit at school ($p=0.011$, $p=0.047$ respectively). Diet Diversity and vegetable intake were also significantly influenced by preferred vegetable availability at school ($p=0.001$, $p=0.038$ respectively). Our sample size limited our ability to detect significant differences between levels of FV availability at school for most associations. Despite this limitation, our findings do suggest availability of preferred fruits and vegetables at school may play a very important role in the FV intake of adolescents. Krolner et al. (2011) also found availability of *preferred* FV was an important factor in increased consumption of FV in youth. What is unique about our study is that the availability of preferred FV was assessed by students rather than by asking parents.

Unlike Neumark-Sztaiet al (2003a) and Rasmussen et al. (2006), our research did not find *home* availability of FV to be significantly associated with FV intake, but did find both school and home availability of preferred FV, and eating of FV at school to be significantly and positively associated with behaviors indicative of self-efficacy. It would be interesting to further examine in what ways student confidence influences increased intake of FV, both at school and within the home setting.

We found that cooking at home more frequently was significantly associated with a higher fruit intake compared to students who never cooked ($p=0.020$). Additionally, participation in grocery shopping with family was positively associated with availability of preferred fruits at home ($p=0.011$). Larson et al. (2006) also found higher FV intake correlated with more involvement in food preparation, but found a negative association between youth participation in family grocery shopping with fried food intake.

Although most students reported eating more fruits at school than vegetables, the consumption of vegetables at school 'sometimes' was associated with a higher overall intake of vegetables than 'never' eating vegetables at school ($p=0.038$). This finding identifies an opportunity for a school based intervention, particularly if student-preferred vegetables were incorporated into the menu roster. Again, findings in this study can serve as a guide or starting point for school based FV promotional initiatives.

There were no significant relationships associated with home availability of FV, but perceived importance placed on FV by family (parents) did have an influence on other outcomes. The majority of students perceived that their families valued fruits over vegetables, and students who identified vegetables were more valued at home had a more diverse diet ($p=0.008$). Since the DD score is calculated based on adequate intake of all vegetable subcategories, our findings suggest student's whose families are identified as valuing vegetables eat a greater variety of vegetables than those whose families appear to value vegetables less.

Strengths of the Survey

A major advantage of the qualitative FVFFQ was that it provided us with detailed information about student's fruit and vegetable eating habits and offered a platform for us to ask important contextual questions at the individual level. With the additional survey questions, we were able to gain further demographic data, assess self-efficacy, access, availability and other topics related to FV intake, that could not be asked individually within a focus group setting.

An additional strength of the survey was that our participants completed the survey in less than one class period, with no complaints reported regarding the length of the survey, by either student or teachers. Finally, the survey demonstrated that both the total fruit scale and vegetable scale had good internal reliability, meaning all items were measuring the same construct.

Lastly, the survey was developed based on a variety of validated surveys and design guidance detailed in the methods and adolescent dietary intake assessment literature. The DD Score was also developed based on a validated dietary intake index (Fogli-Cawley et al. 2006) and was specifically tailored for use with our participant age group.

Limitations of the Survey

There are limitations to the FVFFQ used in our survey. Firstly, although a pre-test of the survey was performed with 7th grade students, the cognitive testing of the FVFFQ was not as thorough as planned due to unexpected time restrictions and circumstances.

Once the survey was administered it became clear that the number of questions could have been further streamlined to better facilitate analysis. Additionally, students commented while taking the survey that they would answer the self-efficacy questions differently for fruits versus vegetables. If this had been brought up in the pre-test, we simply could have separated the self-efficacy questions accordingly.

Since the DD Score was implemented after surveys had been administered some items in the DD scores were not optimally grouped. For example, the legume score may be higher than actual findings, given the less than optimal grouping of the legume questions on FVFFQ (combined soups with beans or vegetables, and legumes). Sports drinks may have been doubly reported due to two questions referring to sports drinks and sugar sweetened beverages. Inherent in many survey-based studies is respondent bias, in our study this bias was represented by participants being comprised of those who returned parental permission forms within the required time frame. Another inherent bias is that of the analysis of the FVFFQ, where 0 is assigned to missing values.

The main purpose of the FVFFQ was not to quantify the FV intake of adolescents, but rather to gain a deeper understanding of types of FV adolescents were consuming in this multi-racial and ethnic population.

6.2 FOCUS GROUP DISCUSSION: beliefs and attitudes

Focus groups allow insight and understanding of lived experiences that would otherwise not be uncovered from quantitative methods. They also allow student's

voices to be represented in data, thus adding important insight and understanding to participant perspectives and behaviors.

When it came to identifying strategies their parents could use to motivate increased FV intake, particularly vegetables, several students admitted a need for parents to play a central role in making unhealthy choices (ie. Chips) not as readily available at home. They spoke of the difficulty of selecting FV when high calorie, nutrient poor snacks, they termed 'junk food,' were easily accessible. The lack of self-regulation demonstrated in snacking behavior is highlighted in developmental psychology, which posits that adolescents have an underdeveloped frontal lobe, impacting their ability to make logical decisions and instead leads to impulsive decisions and behaviors (Oswalt, 2005).

Students also expressed a desire to be rewarded for increasing their FV intake, with rewards suggestions ranging from money to clothing or candy. An Australian study found that adolescents are drawn to a reward system for completing tasks, and have a preference of receiving 'unhealthful foods' as rewards (O'Dea et al., 2003) as well. This unhealthy reward system demonstrates adolescents' lack of self-regulation and can be a target for FV promotion initiatives at the school and home level.

Student's belief of the importance of FV in the diet was consistently reflected in both the survey and the focus groups discussions. Furthermore, a majority identified positive health outcomes as the most important benefit of FV intake. This belief may have been partly influenced by material covered in health class, which has a significant nutrition component. Interestingly, some students expressed a concern for their own

health indicating they wanted to live longer and prevent disease. This was an interesting finding since much of the adolescent health literature reports that adolescents' nutrition related beliefs and attitudes are not influenced by long term health outcomes (Sylvetsky et al., 2013; Neumark-Sztainer et al., 1999). However, a comprehensive review of the subject by Krolner et al. (2011) found that shorter term health concerns do seem to influence adolescent FV intake. O'Dea and colleagues (2003) also suggest that adolescents in their study self-motivated by reminding "oneself of the many benefits of healthful eating and the undesirable short-term impact of 'junk food'".

Although adolescents reported a lack of self-regulation with regards to FV intake, they also expressed a desire to increase their cooking skills related to FV consumption and for opportunities to participate in taste tests and observe cooking demonstrations of FV. These ideas lead to students expressing their desire to communicate with the school's food services staff, with the intention of discussing some of their ideas. Related to this discussion was the students' suggestion of incorporating a range of FV into lunch meals that reflected the cultural diversity of the student body.

Students also wanted opportunities to sample different recipes with their parents. Exposure to new recipes and building cooking skills seems to be a viable pathway to increased FV intake in young adolescents, since it meets some of their own expressed needs for skills acquisition. At this stage of development adolescents are looking to become more independent (AACA, 2008) and learning at high rates (Oswalt, 2005), implying that adolescence is an opportune time to teach and model healthful skills and foster independence.

Additionally, research indicates adolescents may respond more positively to descriptive norms (observing what others do) rather than injunctive norms (being told what to do), (Stok, de Ridder, de Vet, de Wit, 2014). In Stok's and colleagues (2014) study injunctive norm messages decreased intentions of eating fruit compared to descriptive norm messages which maintained intention, but increased FV intake. Being told what to do may make adolescents more skeptical and evoke their natural response to rebel and exercise independence, rather than encourage change. We observed that students essentially suggested a descriptive norm strategy when suggesting social marketing activities that use celebrities or sports figures to promote FV, with the celebrities pointing out how FV help them excel in their performance.

Influences on Fruit and Vegetable Intake.

Many of the constructs from the Social Ecological Model (SEM), were identified as either barriers or facilitators, or both, to FV intake by our participating students. Interpersonal influences were important for the student's dietary intake, with both positive and poor parental influence on fruit and vegetable intake identified throughout the focus group. While some students explained that their parents sent mixed messages about eating and purchasing FV, others said they would need their parents to help facilitate increased intake of FV. Therefore, it is understandable that the importance of parental influence on adolescent intake is ubiquitous throughout the adolescent dietary intake literature. For example, Pedersen et al (2015) and Young et al. (2004) both conclude parents are still influential in their middle school student's FV intake. DiNoia and Byrd-Bredbenner (2013) found parental support was an important component of

adolescent FV intake. In their study parental support was defined by 16 questions including encouraging students to eat more FV, introducing new FV, and monitoring adolescents FV intake.

The concept of using 'force' to help adolescents eat FV is not common in the literature, and should be interpreted as a choice of expression selected by the participants in our focus group, and interpreted in a broader sense to imply the need for parental support to limit snacking choices and emphasize increased FV consumption. Di Noia & Byrd-Bredbenner (2013) found parental restriction of junk food at home and parental encouragement of eating FV at home was linked to higher adolescent FV intake. Positive interpersonal relationships, such as those with parents and or caregivers, which lead to observational learning and imposed self-regulation, may be useful in adolescent dietary change interventions.

Barriers.

Limited access and availability of adolescent's preferred FV, including culturally preferred FV and high quality FV appeared to be a barrier to FV consumption at home and at school. The lack of preferred and quality FV appeared to be related to parents purchasing FV that were inexpensive and lasted longer in their household, rather than purchasing FV that their children preferred and would eat quickly, or worse not consume prior to spoilage. Urban low-income populations groups often have less access to full service supermarkets where affordable FV can be found (Coleman-Jensen et al., 2014), with poorer diet quality associated with this lack of access (Rose et al.,

2010). Access to *preferred* FV is related to increased intake of FV in adolescents (Krolner et al., 2011), but has not been studied broadly as issues of household access to produce.

Many students expressed a preference for certain cultural foods, especially cultural fruits that were hard to find in their neighborhood, such as canapés. This preference for cultural specific FV was not illustrated in our survey data, but students discussed produce specific to their culture in the focus groups with enthusiasm. Students were often descriptive in their discussion of cultural FV, often not knowing the names of the produce they were describing. Frequently the discussion allowed for students to compare produce between cultures, with students indicating surprise at some of the similarities in produce consumed within each other's homes. For examples a Haitian student described a vegetable a Ghanaian student identified as similar to a food common in her culture. These moments of intercultural sharing were acceptable between students and did not seem to instigate judgment or negative dialogue.

Research indicates that cultural foods are important to help minority populations to maintain traditions and cultural identity. Although stores in predominately minority neighborhoods carry some cultural specific produce, the cost, quality and variety may be limited (Grigsby-Toussaint et al. 2010). Students were also clear about wanting the school to incorporate FV that are culturally familiar into the lunch menu.

Despite a lack of agreement on preference in preparation method of FV, students were in agreement in their generalized dislike of the FV served at school. Given that at the time of this research over 80% of this school's population received free or reduced price lunch FV served through this program can constitute up to half of the

students recommended FV intake for the day. If students dislike the produce served at school, this would mean in general they are not consuming FV served with their school lunch meal, and if their household intakes are limited it would clearly be challenging for these young adolescents to meet their recommended intake of FV. Therefore, low acceptance of school FV constitutes a major barrier to adolescent fruit and vegetable consumption.

Facilitators.

Improved flavor was the key criteria identified by students as a priority change needed compared to current vegetable preparation at school. Their general comments reflected free thought on ways to improve vegetables, including wishing vegetables tasted more like their favorite sweet cereals, that they should be covered in chocolate or paired with foods they already like (yogurt, ice cream, rice). However, as more discussion ensued, most students indicated they were willing to try new recipes of FV, if prepared with increased flavor in mind, if cooked safely and distributed in a cleaner manner than they currently perceived them to be. These comments identified important points of discussion and information to share with the school food service.

Another interesting finding from the focus group was that parents often buy produce that their children do not prefer because of cost and how quickly it is consumed within the family. Adolescents also discussed FV not tasting sweet or a tendency for produce spoiling within a short period of time. Collectively, these comments suggested poorer quality FV may be what is available within the households of the students participating in our study. Combined, the barriers and facilitators

discussed by the students illustrate that adolescents use outcome expectations of eating FV as motivators but may lack the ability to use these expectations as self-regulators in choosing what to eat, especially at snack time at home.

Motivating Increased FV Consumption.

Many students expressed they were involved with cooking or grocery shopping during the focus groups, just as the survey results indicated. What the focus groups added to this knowledge was that cooking may lead to more confidence and independence in adolescents. Both of which are characteristics that adolescents are either usually lacking or naturally exploring. Increased confidence and independence in cooking and buying food may contribute to FV related self-efficacy. Yet, few interventions with adolescents included a simple food preparation component, most cooking interventions deal with slightly younger populations. The Back to Basics after school cooking program in Canada was designed for 9-12 years old and effectively increased the number of participants who ate 1 serving of fruit per day, increased the variety of FV eaten and related SCT constructs (Burrows, Lucuas, Morgan, Bray & Collins, 2015).

Lastly, overall students had positive attitudes about brainstorming ideas to influence their peers' FV intake habits. Only a few students verbalized pessimistic attitudes towards this activity. These findings indicate adolescents seem to be open to change and trying new ideas.

Strengths of the Focus Groups.

A major strength of the study was the comfort level adolescents expressed during the focus groups. The participating adolescents willingly engaged in discussion and in the focus group activities. They also disagreed with one another but also discussed sensitive issues such as being recipients of federal assistance programs, such as WIC. This level of comfort suggests students were in a safe space they could trust and one in which they felt they could communicate their honest opinions.

We purposefully used a variety of strategies to engage students during the focus groups discussions (group discussion, working with a partner, individual written form), with the intention of allowing students with a range of social abilities and comfort levels to communicate their ideas to us in both verbal and written form.

Limitations of the Focus Groups.

The semester of school changed between the time we administered our first survey and the time we performed our first focus groups therefore we were not able to have all the students who participated in the survey also participate in the focus groups. Despite this limitation, we still had the majority of participants (77.2%, n=61) participate in both. Additionally, not all focus groups covered the same amount of questions due to the semi-structured nature of the study design and the time period and school schedule conflict. To facilitate coverage of similar content in all focus groups, only topics that were covered in more than 3 focus groups were interpreted, which did not limit our data since saturation was attained early in the focus groups.

Future Research.

Although adolescents identified cash and expensive prizes as incentives for increasing FV intake, such interventions are unrealistic for obvious reasons. However, it may be interesting to evaluate studies that use incentives with this age group. Baranowski et al. (2003) found an educational computer game, which utilized virtual points, was effective at increasing FV intake with elementary age students, but no other research has documented if virtual points have the same effect on adolescents. Morrill, et al. (2015) did find tangible prizes to be more effective at increasing FV intake than verbal praise with youth.

Although students suggested taste tests and recipe books would motivate them to eat more FV, most research on cooking interventions have been carried out with younger population groups (elementary school aged children) rather than middle school age adolescents. Further research into the effectiveness of taste tests and cooking lessons, accompanied by recipes books for adolescents would be beneficial, as these can become part of a sustainable interventions targeting youth.

More research on the outcome of adolescent's FV intake behaviors in response to descriptive norms may increase the effectiveness of interventions and therefore warrants further research. The descriptive norms can be used in health messaging and development of resource materials, framing advertisements to communicate descriptive vs. injunctive norms.

Future research and development of health promotion initiatives using multimedia that engages youth and motivates behavior change should be explored.

Additionally, further investigations of actual household purchasing and intake behaviors may be useful to understanding FV purchasing practices in low-income urban families.

6.3 Conclusion

Key findings of our study include the importance of the availability of preferred FV at school including culturally representative produce, the importance of parents and caregivers' attitudes towards FV, incorporating vegetables in home meals and encouraging children to participate in grocery shopping in meal preparation. All the aforementioned behaviors seemed to promote increased intake of particularly vegetables in our low-income, multicultural young adolescents. In order to improve acceptability of vegetables at school it may be beneficial for schools to serve one vegetable prepared in multiple ways each day (ie. cooked in a variety of methods or served raw). This approach may help increase FV consumption while keeping costs manageable in a school-based intervention. Tastes tests also seem to be a promising strategy, particularly when food services involve students in the planning process, take into consideration their concrete suggestions. Additionally, it is important to reflect cultural diversity of the school in the FV served. The rankings of FV consumed in this study can be used to help tailor future intervention to align with student's overall FV likes and dislikes. For example, groups of fruits and vegetables can be targeted to increase access and availability in the community, at home and at school. One way this may be accomplished is through sharing this data with the food service staff at the middle school and with community partners involved in increasing access to culturally diverse produce.

Students suggested a range of nutrition education platforms to promote FV, including the use of social media, magazines, apps, computer games, advertisements (on-line and paper) and even classroom activities and school trips. These suggestions cover the social, environmental and personal dimensions of the SEM model, demonstrating the need for interventions to act on multi-levels of influences in order to be effective. Which also, indicates the complexities inherent in motivating sustained behavioral change. A review of nutrition interventions by Delgado-Noguera (2011), found that interventions utilizing computers, television programs, and board games were more effective and less costly than other forms of nutrition interventions.

Based on student's suggestions there is an opportunity for the development of nutrition education initiatives that incorporate cooking demonstrations and taste tests, as well as food preparation skills building delivered in an interactive method. These activities can also include parents and caregiver participation either by sharing recipes, and encouraging students to assist in the recipe preparation at home. The popularity of cooking shows targeted to youth has risen dramatically in recent times, this may be a time when meal preparation interventions are highly acceptable with youth. Education on how to buy FV on a budget may also be useful for addressing lack of available of FV at home. To help increase availability and accessibility of adolescent's preferred FV better communication and working relationships need to be built with parents, school lunch staff and community partners.

The larger part of this study is collaborating with the Department of Agriculture, focusing on urban agriculture in the Worcester area and beyond. They are investigating

ways to grow and distribute cultural fruit and vegetables in city settings in order to improve access and maintain cultural traditions, which was a relevant concern in our study sample.

Helping parents build skills to involve children in grocery shopping and cooking may be helpful as well. Involving adolescents in decision-making may empower adolescents and help them feel more in control of their FV intake.

The use of multi-media for nutrition interventions have proven to be useful and may be able to be adapted from other studies and interventions for facilitating the development of a cost effective intervention. Baranowski et al. (2003) created a video game with an enticing story line that helped increased FV intake of elementary students. While Amaro et al. (2006) developed a board game based on real life decision making which also effectively increased middle school students FV intake. A Manga comic was developed to promote FV intake and compared to a non-health related reading, students who read the Manga comic (average age 10.8) were more likely to choose a healthy snack and had improved self-efficacy related to healthy eating (Leung, Tripicchio, Agaronov & Hou, 2014).

Finding a way to attract adolescents to cooking after school programs or finding ways to incorporate cooking lessons into established after school or in-school programs may be more feasible than a standalone session for adolescents. Grocery shopping lessons or actual tours of the stores can also be incorporated into these activities, along with budgeting and meal planning sessions.

Suggestions from the students to improve school FV selections included serving fruit salad and better salads-with an eggs. Learning fun and tasty snack ideas involving fruits and vegetables, distributing the recipes and having a taste test of the recipes with results that are communicated back to the school kitchen, would appear to be beneficial to these students. Perhaps beliefs about canned/frozen FV could be addressed through an intervention, including taste tests-suggested by students themselves.

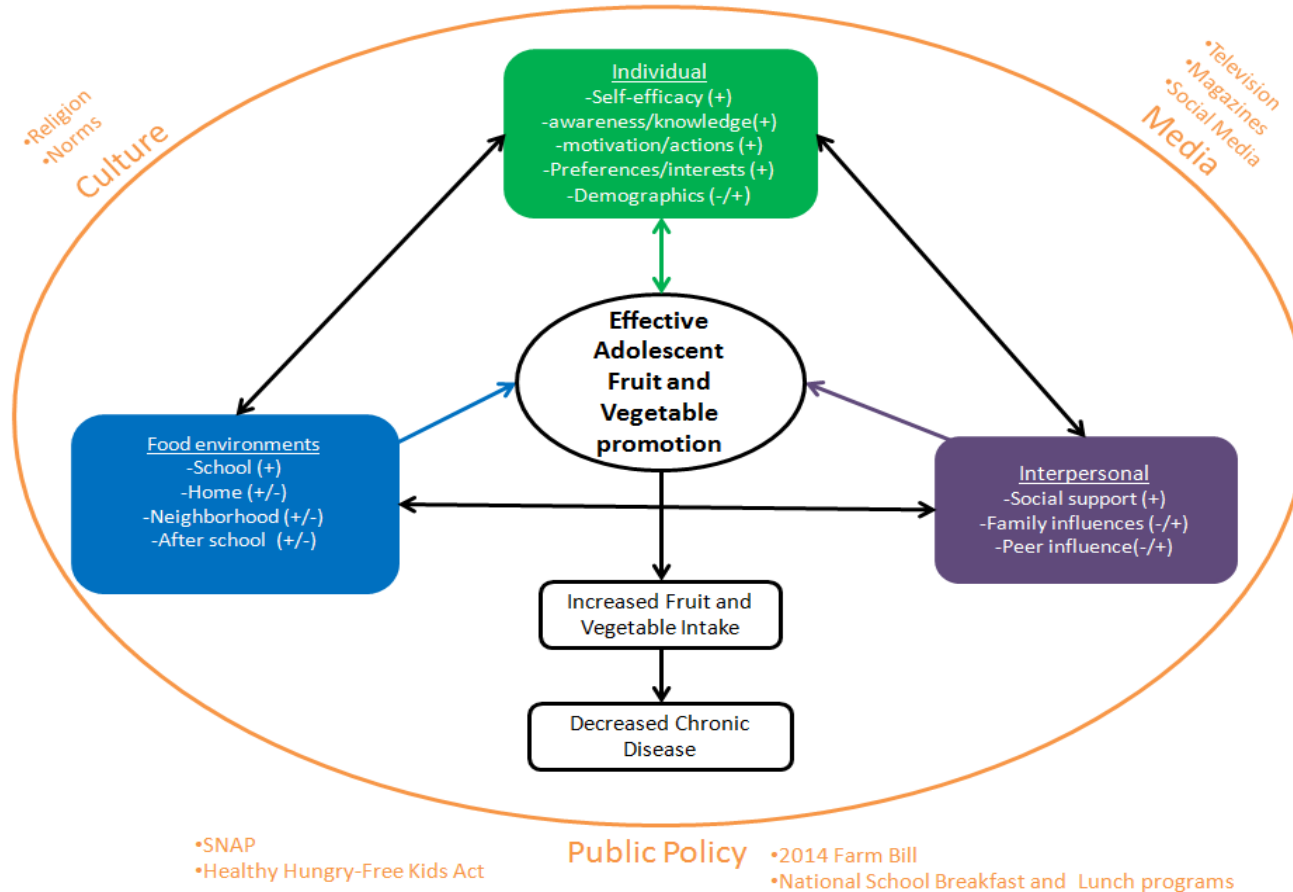
Perhaps, as students had suggested, taste tests and offering the fruit or vegetable of the day in a variety of preparation methods may be tactics to help increase the acceptability of school fruits and vegetables. A multi-faceted intervention involving building self-efficacy of adolescents, education and motivation of parents to improve house hold food environment and education and collaboration with school food service to improve acceptance of school FV are all needed to help increase adolescent FV intake. Recipe ideas that include favorite FV along with less expensive FV may help spread out costs and increase the preference and intake of FV at home. Education and taste tests with students and helping ensure frozen and canned FV are prepared in tasty ways can be ways to help students become more accepting of these types of FV.

Even though some of these ideas seem childish, more grown up ideas could be thought up or found that talk to values adolescents hold rather than moral lessons often found in child shows. Students suggested pairing fruits or vegetable with other items such as salsa, meat/fish, chili, eggs, rice, cereal, yogurt, whip cream, chocolate, etc. to help them eat more.

Lastly our study has indicated how parents influence their children's intake. But adolescents could be influential in their peers and families practice through sharing of skills in choosing and preparing healthy foods. There is also a great opportunity for parent education on ways to involve their children in grocery shopping and cooking, providing students the independence they are craving which may also influence their dietary habits and increase FV intake.

APPENDIX A

CONCEPTUAL FRAMEWORK OF INFLUENCES ON ADOLESCENT FRUIT AND VEGETABLE INTAKE



All (+) and (-) signs denote positive and negative associations and apply to all arrows attached to the corresponding box

APPENDIX B

WORCESTER, MA DEMOGRAPHICS

Table B1: Comparative Demographic Variables for Worcester, MA (2010-2013).

Demographic Data	Worcester, MA	Massachusetts	United States
Population Size (people)	182,544 ^a	6,745,408 ^b	320,610,768 ^c
Mean Household Income (\$)	\$61,520	\$90,877	\$73,487
Household Income Level Below Poverty line (2013)^d	% of Population	% of Population	% of Population
Households w/ any children	17.0	8.1	11.3
Households w/ children 18 years old or younger	27.2	12.8	17.8
Receiving SNAP benefits	21.7	11.7	12.4
Race and Ethnicity (2013)^d	% of Population	% of Population	% of Population
White	73.7	80.5	74.0
Black and African American	12.4	6.9	12.6
Asian	6.1	5.6	4.9
Vietnamese	2.9	0.7	0.5
Chinese	1.0	2.0	1.1
Asian Indian	0.6	1.2	1.0
Korean	0.2	0.4	0.5
Hispanic and Latino	20.4	9.9	16.6
Mexican ¹	0.7	0.6	10.7
Puerto Rican ¹	12.4	4.2	1.6
Cuban ¹	0.1	0.2	0.6
Dominican*	2.3	1.6	0.5
Central American*	2.1	1.5	1.3
Salvadoran	1.3	0.7	0.5
Guatemalan	0.3	0.5	0.3
Costa Rican	0.1	0.0	0.0
Honduran	0.1	0.2	0.2
Panamanian	0.1	0.0	0.1
South American*	1.3	0.8	0.9
Other Hispanic or Latino*	1.4	0.9	1.3
American Indian or Alaskan Native	0.2	0.2	0.8
Multi-race/ethnicity	3.8	2.7	2.8

^a Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2013. Source: U.S. Census Bureau, Population Division Release Dates: For the United States, regions, divisions, states, and Puerto Rico Commonwealth, December 2013. For counties,

municipios, metropolitan statistical areas, micropolitan statistical areas, metropolitan divisions, and combined statistical areas, March 2014. For Cities and Towns (Incorporated Places and Minor Civil Divisions), May 2014.

^b Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014. Source: U.S. Census Bureau, Population Division. Release Dates: For the United States, regions, divisions, states, and Puerto Rico Commonwealth, December 2014. For counties, municipios, metropolitan statistical areas, micropolitan statistical areas, metropolitan divisions, and combined statistical areas, March 2015. For Cities and Towns (Incorporated Places and Minor Civil Divisions), May 2015. Household Income and Race and Ethnicity (2013) from U.S. Census Bureau, 2009-2013 5-year American Community Survey.

^c Monthly Population Estimates for the United States: April 1, 2010 to December 1, 2015. Source: US Census Bureau, Population Division. Release Dates: Monthly, January 2015 to December 2015.

¹only ones specified in 2013 data (5-Year American Community Survey), other Hispanic/Latino races are lumped together (other=7.2%)

*from 2010 Census

APPENDIX C

KEY INFORMANT INTERVIEW GUIDE

Guide for Key Informant interviews.

University of Massachusetts Amherst

Study: Integrating Urban Agriculture and Nutrition Promotion to Increase Consumption of Fruits and Vegetables: A Focus on Worcester, Massachusetts

Introduction

Thank you for taking time out of your busy schedule to meet with me today. My name is _____, I am part of the research team from UMass Amherst. As you know we are working on a project to promote consumption of fruits and vegetables by school children and their families. Before we can develop this program we would like to talk to some of the school staff who can give us their perspective of what foods students tend to eat and where they think fruits and vegetables fit in the whole picture. We know that eating more fruits and vegetables is healthy for people, but we also know that there are many challenges families face in accessing affordable and acceptable fruits and vegetables as well as barriers to consuming more produce. We want to hear what you think some of these challenges are for students and their families in this community.

We will use what you say to help shape development of a program aimed at helping families in the community access and consume more fruits and vegetables.

The interview will be voice recorded so that we can remember exactly what you said. But please remember that everything we discuss is confidential. We take all the information given to us and summarize it together, nobody's identified or their real name linked to specific comments collected for this project.

This interview will take no more than 45 minutes.

Before we begin, I want to go over the consent form with you and answer any questions you may have about the study.

Once consent form is signed, tape recorder is turned on and interview begins.

Interview questions

1. Please tell us a little about your role at WEMS and the type of interaction you have with the students?
2. What do you think are the main food issues for students attending WEMS and for families in the neighborhood?
(probe: if students ever talk about the food they eat at school or home)

3. How do fruits and vegetables fit into the picture?
(Probe: what is your perception of student's attitudes toward fruits and vegetables)?
4. What have you seen happen with the fruits and vegetables that are served in the cafeteria?
(Probe: do students tend to eat fruit/veg or do they mostly end up in the garbage? Are there any popular fruit/veg?)
5. What is your sense about the student's attitude towards the reduced or free meals school lunch program? How about their parent's attitude of the lunch program?
6. What cultural differences, if any, do you see with students in terms of acceptability of food served in the school lunch program?
(probe if differences are observed in relation to fruit and vegetables intake?)
7. Do you think the neighborhood provides access to affordable and quality fruits and vegetables?
(probe: if they feel the locally available fruits and veg are culturally acceptable- do they perceive this to be an issue?).
8. What suggestions do you have for the program we wish to develop aimed at promoting and increasing fruit and vegetable intake among students and their families?
(probes: what do you think we need to address? Has the school tried to promote fruits/veg before? What do you think will be the main barriers and facilitators with this program?)
9. Are there any health promotion activities the school has undertaken in the past, if so what were there and what were your experiences?
10. Do you have anything else to add?

Thank you again for agreeing to be interviewed

APPENDIX D

STUDENT SURVEY AND ORAL INSTRUCTIONS

Oral Instructions

Survey Introduction

Thank you for choosing to help us with our work. I am from UMass Amherst and I am studying Community Nutrition for my graduate degree. As part of my study/project we would like to learn more about fruits and vegetables in your life! This survey will help us understand your viewpoints and situations related to fruits and vegetables. We will use your feedback to figure out what our group can do for you!

Before we get started, you should know your parents have given us permission to talk to you. *But* you also get to tell us if you agree to be in the study. Please read the Assent form, it tells you about our study. If you agree to take part in the study, please sign the form. There are two copies; you get a copy and we keep and copy too. If you have any questions I will be happy to answer them.

Alright, let's get started with the survey!

The most important ground rule for this survey is that there are *no right or wrong answers!* We want you to tell us what you *really* think, not what you think we want to hear. The surveys are confidential, which means your name will not be attached to your answers. We will have your names stored separate from the surveys. So it is important to answer the questions honestly.

The whole survey should take about 25 minutes to fill out.

The way this works is that we will all go through the survey together.

First, I will introduce you to the section of the survey we will do next. I will give you some tips about completing it.

There are four sections [1) tell us about you, 2) fruits and vegetables you eat, 3) fruits and vegetables in everyday life, 4) and fruits and vegetables at home and at school] and each section has instructions in a box. Please read these instructions before completing the questions.

If you are confused about a question or an answer, please raise your hand and I will come help you.

When you have completed the section of the survey, make sure you have answered all the questions then put your pen/pencil down.

We will wait for everyone to be done with the section before we move on.

We will do this for all sections of the survey.

Any questions before we begin??

Okay, thank you for your time, attention, and patience in advance!

Instructions by section

The first part of the survey is called **“Tell us about you.”** Please read the whole question and all the answer options. Make sure to answer each question as specific as possible. For example, for question number 3 on the bottom of the page, there is a difference between somewhat agree and somewhat *disagree*, and for questions 1 and 2 realize there is a difference between never and *almost* never. Pick the one that closest matches your feelings. It is important to give honest answers, because it will help us understand you much better, and your answers are confidential! If you have any questions, please ask!

Okay, the next part is called **“Fruits and Vegetables You Eat.”** This section asks about how much fruits and vegetables you ate *last week*. Answer each question by thinking *specifically about Last Week*, not an average of all weeks, *just Last Week*. Read the instructions on the page before beginning to get your brain thinking about the food you ate last week.

Before you begin, let’s do an example together. The first question reads-How often do you eat vegetable salads-any type?

Make sure to read the examples for what types of food to include in your response, or what to exclude.

To give you an idea about what to include in your answer look at the “Examples” list. You can include anything in your answer that is similar to what is listed under examples-For example- light or dark green lettuce, red or green cabbage, spinach, cilantro, verdolaga/purslane, other salad greens and coleslaw. If you eat something similar to what is listed include that food in your answer. If you do not recognize something in the list, that is OK!

Think about how many times you ate any type of salad like the ones listed below, *last week* and find an answer that best matches your thought.

Some questions will also include examples of food that should *not* be counted. These are labeled as “Do not include.” Make sure you *do not* count those foods in your response.

For example, please look at page 4. The first two questions ask about sweetened drinks and 100% fruit juice. Please look for the type of beverage you drink in the examples and fill in the answer accordingly. For the 100% fruit juice question, please pay attention to the drinks listed in the “do not include” list and *do not* count those in your answer. There should be no drink that counts for both of these questions. 100% fruit juice usually says on the label, 100% or no sugar added. Fruit juice cocktails go in the sweetened beverages question.

Please read all the “examples” and “do not include” foods and answer the questions *honestly*. Remember your answers are confidential and we are not here to judge anyone. Being honest will help us understand if our program is needed or successful later on.

Make sure to answer all questions.

[The last page of this section requires you to write in an answer, please take the time do so.]

Lastly, *if you do not know what a food is*, for example plantains, then *please mark Never*, or if it is in a group of foods, just focus on the other foods.

If you have any questions, please ask! This is the longest section, so please take your time and do not get discouraged!

“Fruits and vegetables in everyday life”

This next section asks you what you think you are able to do *right now*. Please answer these questions honestly, think about if you can do that thing *right now, or today*”. Please read the whole statement and all the answer options. Please fill in the answers that closest fit your feelings. Again, if you have any questions, please ask!

“Fruits and Vegetables with your Family and at School”

Okay, you have made it to the last section! It asks you about what you think about fruits and vegetables at home and at school. You should know the drill by now! Everything is confidential so answer honestly so we can best understand you! Read the whole question and answer options, and answer all the questions. If you have a question, please let me know!

Conclusion

Congratulations we are all done with the survey! Thank you all very much for taking time to complete our survey! We will be combining all these results to help us understand what we can do to best work with your school and community. We hope to see you all around while we work with your school and community soon.

Survey

Survey About Fruits and Vegetables

Thank you for choosing to help us with our work. Before we get started, you should know that your parents have given us permission to talk to you. But you also get to let us know if you agree. Please read the Assent form, it tells you about our study, if you have any questions we are happy to answer. If you agree to take part in the study, please sign the form. You get a copy and we keep a copy too.

Fruits and vegetables are very important for health, because of this we would like to learn more about the fruits and vegetables you eat at school and at home. From the information you give us, we can work on programs that can help make fruits and vegetables more available and more enjoyable for you and your family.

There are no right or wrong answers; we just want you to tell us what you really think. The form will take about 40 minutes to fill out. Thank you again for you time!

Tell us about you:

Please tell us your age and grade: What is your gender? What do you think of yourself as?

Check all that apply.

Age: _____ Grade: _____ Male Female Asian
Black or African American
Latino/Latina

- Hispanic
- White or Caucasian
- Multi-ethnic/racial
- Other, specify _____
- I don't know

What ethnicity do you identify yourself with? _____

(Examples: Puerto Rican, Salvadoran, Dominican, Colombian, African American, Ghanaian, Nigerian, Italian, Polish, Irish, Liberian, Kenyan, El Salvadoran) I do not know:

Tell us what you think about the following:

	Never	Almost Never	Sometimes	All the time
1. Do you think you eat enough Fruits?				
2. Do you think you eat enough Vegetables?				

	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree
3. Eating healthy is very important to me						
4. Vegetables taste good to me						
5. Fruits taste good to me						

Fruits and Vegetables You Eat

Now we want to find out **how much** fruits and vegetables you eat each week.

Tell us about the **Fruits** and **Vegetables** you eat. For each question think about the **Past Week**.

Think about what you eat at home for:

morning/ breakfast afternoon/lunchevening /dinner and snacks

We also want you to think about the **Fruits** and **Vegetables** you ate in other places like:

SchoolRestaurants with Friends and Family

Church/Community eventsand After School programs

Mark how many **Times per Week** you ate each Fruit and Vegetable below.

[Moderators will provide and go over an example before the Survey begins]

<p>1. How often do you eat vegetable Salads-any type?</p> <p>Examples: light or dark lettuce, red or green cabbage, spinach, culantro, verdolaga/purslane, other salad greens, and coleslaw</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>	<p>2. How often do you eat canned or frozen Vegetables?</p> <p>Examples: Jilò/garden eggs, eggplant/berenjena, tomatillos, beets, okra, tomatoes (sauce or stewed), broccoli, cauliflower, green beans, peas, corn or baby corn</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>
<p>3. How often do you eat Cooked Greens-any type?</p> <p>Examples: chard, collard greens, kale, mustard greens, turnip greens, culantro, spinach, verdolaga/purslane, any other cooked greens.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>	<p>4. How often do you eat Potatoes or Tubers-baked, boiled, mashed, roasted?</p> <p>Examples: sweet potatoes/yams, white potatoes, taioba, cassava, jicam</p> <p>Do not include: French fries, potato chips, Pringles.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p>

	<input type="checkbox"/> 3 or more times a day
<p>5. How often do you eat Raw (uncooked) vegetables?</p> <p>Examples: carrots, celery, cucumber/ maxixe, peppers, (chilli pepper, bell pepper, aji dulce, cubanelle, malagueta, or other peppers.</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>	<p>6. How often do you eat Soups and Stews with beans, peas, or vegetables, and Chili with beans?</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>
<p>7. How often do you eat Squash-all kinds?</p> <p>Examples: chayote, acorn, butternut, buttercup, calabaza/auyama, kabocka, ayote tierno, abobora moranga o japonesa., summer squash, zucchini.</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>	<p>8. How often do you eat Beans and Lentils?</p> <p>Examples: black, pinto, red, garbanzo, black eyed peas, kidney, any other beans not listed, green, red and brown lentils.</p> <p>Do not include: bean or lentil soups</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>
<p>9. How often do you eat French Fries?</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>	<p>10. How often do you drink sports or energy Drinks?</p> <p>Examples: Gatorade, Powerade</p> <p> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day </p>

<p>11. How often do you drink Sweetened beverages?</p> <p>Examples: Hi-C, Kool Aid, fruit punch, CapriSun, Sunny D, Tang, Snapple, Arizona drinks, lemonade, sweetened ice tea, Juice cocktail, or any other sweetened drinks?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day 	<p>12. How often do you drink 100% Fruit Juice (no sugar added)?</p> <p>Do not Include: Hi-C, Kool-Aid, Sports Drinks, fruit punch, CapriSun, Sunny D, Snapple, or any other fruit drinks that are not 100% juice.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day
<p>13. How often do you eat Tropical fruit?</p> <p>Examples: Guava, Mangoes, Papaya, Pineapple, coconut, cherimoya.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day 	<p>14. How often do you eat Berries?</p> <p>Examples: strawberries, blueberries, raspberries, blackberries</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day
<p>15. How often do you eat Hand fruits?</p> <p>Examples: Bananas, apples, grapes, pears, peaches, apricots, cherries.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day 	<p>16. How often do you eat Citrus?</p> <p>Examples: Oranges, grapefruit, tangerines, mandarins, clementines.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day
<p>17. How often do you eat Plantains?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day 	<p>18. How often do you eat Avocados or guacamole?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Never <input type="checkbox"/> 1-2 per week <input type="checkbox"/> 3-4 per week <input type="checkbox"/> 5-6 per week <input type="checkbox"/> Once a day <input type="checkbox"/> 2 times a day <input type="checkbox"/> 3 or more times a day

<p>19. How often do you eat Melons?</p> <p>Examples: cantaloupe, watermelon, honeydew</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>		<p>20. How often do you eat Fruit Salad-any combination of fruits ?</p> <p>Include: fresh, canned and from frozen</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>			
<p>21. Any other vegetable not covered above that you ate last week? Please write on line and check off frequency.</p> <p>_____</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>		<p>22. Any other fruit you ate this week not covered above. Please write on line and check off frequency.</p> <p>_____</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> 1-2 per week</p> <p><input type="checkbox"/> 3-4 per week</p> <p><input type="checkbox"/> 5-6 per week</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2 times a day</p> <p><input type="checkbox"/> 3 or more times a day</p>			
	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree
<p>23. The foods I reported above are similar to the fruits and vegetables I usually eat each week.</p>					

24. Do you eat more **Fruits** in the summer? Yes No

Tell us which fruits (**Spelling does not matter**): _____

25. Do you eat more **Vegetables** in the summer? Yes No

Tell us which vegetable (**Spelling does not matter**): _____

26. What are your favorite **Fruits (Spelling does not matter)?**

27. What are you favorite **Vegetables (Spelling does not matter)?**

Fruits and Vegetables in Everyday Life

Now we want to know **what you think** about eating fruits and vegetables.
Please rate how confident you are that you can do the following **right now**.

<p>1. I am certain I can eat fruit and/or vegetables as a snack (instead of chips, candy etc.).</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can	<p>2. I am certain I can eat fruit for dessert (instead of ice cream, cookies, or the like).</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can
<p>3. I am certain I can eat fruit and/or vegetables when I eat out.</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can	<p>4. I am certain I can prepare fruit and/or vegetables to eat if needed.</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can
<p>5. I am certain I can eat vegetables at least three times a day.</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can	<p>6. Mark how certain you are that you can eat fruit and/or vegetables every day at Breakfast.</p> <ul style="list-style-type: none"><input type="checkbox"/> I don't think so<input type="checkbox"/> Not sure I can<input type="checkbox"/> Maybe I can<input type="checkbox"/> I think I can<input type="checkbox"/> Definitely I can
<p>7. Mark how certain you are that you can eat</p>	<p>8. Mark how certain you are that you can eat</p>

<p>fruit and/or vegetables every day at Lunch.</p> <p><input type="checkbox"/> I don't think so</p> <p><input type="checkbox"/> Not sure I can</p> <p><input type="checkbox"/> Maybe I can</p> <p><input type="checkbox"/> I think I can</p> <p><input type="checkbox"/> Definitely I can</p>	<p>fruit and/or vegetables every day at Dinner.</p> <p><input type="checkbox"/> I don't think so</p> <p><input type="checkbox"/> Not sure I can</p> <p><input type="checkbox"/> Maybe I can</p> <p><input type="checkbox"/> I think I can</p> <p><input type="checkbox"/> Definitely I can</p>
<p>9. I am certain I can eat fruits at least two times a day.</p> <p><input type="checkbox"/> I don't think so</p> <p><input type="checkbox"/> Not sure I can</p> <p><input type="checkbox"/> Maybe I can</p> <p><input type="checkbox"/> I think I can</p> <p><input type="checkbox"/> Definitely I can</p>	

Fruits and Vegetables with your Family and at School

Please tell us how much you **agree** with the following statements about fruits and vegetables at home and at school?

<p>1. Eating Fruits is important in my family.</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>	<p>2. Eating vegetables is important in my family.</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>
<p>3. The Fruits I want to eat are available at home.</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>	<p>4. The fruits I want to eat are available at school?</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>
<p>5. The Vegetables I want to eat are available at home.</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>	<p>6. The Vegetables I want to eat are available at school.</p> <p><input type="checkbox"/> Not at All</p> <p><input type="checkbox"/> A Little Bit</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Very Much</p>

<p>7. I help with cooking at home:</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Often</p>	<p>8. I help with grocery shopping with my family:</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Often</p>
<p>9. I eat Fruits at school.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Often</p>	<p>10. I eat Vegetables at school.</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Sometimes</p> <p><input type="checkbox"/> Often</p>

11. Below, please list where do you go food shopping?

You have come to the end of the questions. Thank you very much for being part of this study, it will help the work we want to do with your school.

APPENDIX E

FOCUS GROUP GUIDE

Study: Integrating Urban Agriculture and Nutrition Promotion to Increase Consumption of Fruits and Vegetables: A Focus on Worcester, Massachusetts

Moderator's Guide for Student Focus Groups

Facilitators: Moderator and observer/recorder

Prior to focus group, facilitator will re-organize the desks into a semi-circle format. [all participants can see each other, better arrangement for interaction and discussion].

Introduction (moderator) Welcome all of you and thank you for agreeing to talk to us and share some of your ideas. Please help yourself to the food we brought for you today.

[Moderator and observer introduce themselves and briefly explain the study and purpose of FG as written below]

As you know we are from the department of Nutrition at the University of Massachusetts. We are in your school to learn about what students think about fruits and vegetables. We know that fruits and vegetables are very important for health. But we also know that people have their own likes & dislikes and feelings about eating fruits and vegetables and that sometimes people cannot get the fruits and vegetables they like. We want to hear about all of this and care about what you have to say. This information we collect will help us find ways to make a difference in helping you and your families to enjoy eating more fruits and vegetables. So we really need your ideas. We are excited to learn from you.

Today we will be together for an hour. We will be recording our discussion with a voice recorder and someone is also taking notes. This is so we can remember what you told us. You should know that when we put all the information together, no one will be identified, so your names will not be connected to anything we use from today's chat.

Before we start, it's important for us to go over a few group rules so that everyone who wants to say something can be heard and we can all respect each other.

Let's go over these:

[The rules will be written on flip chart paper and posted up on the wall, where the focus group will take place. Moderator uses the posted rules to go over each point]

1. Please respect each other by putting your hand up if you want to say something.
2. If someone is talking, wait for them to finish before you start talking.
3. What each one of you says is important, we want you to give us your own opinion- tell us what YOU think.

4. You do not have to agree with what other people say in the group. If you do not agree with someone, say so nicely. We are not here to hurt each other's feelings

5. What people say in this room, should stay in this room and should not be talked about after we finish. As the Consent form tells you, the recordings and notes we make will only be seen by our research team. When we write about the information you give us, all the information we gather will be put together so no one will be identified and your names will not be used.

6. There are no right or wrong answers, we want to understand what you like and don't like, what you eat and the way YOU see things ...so there are no right or wrong answers.

Do you have any questions for us before we move on?

Warm-up exercise:

Many of you may already know each other, but we would like to get to know you. So we have a small activity that will help us all get to know each other.

[Pass around pens and paper]

Now, I am going to say something and you write the first thing you think of; Here we go:

Write down your favorite fruit and your favorite vegetable. Don't worry about spelling; chances are if you don't know how to spell it, others don't either. We don't write fruit and vegetable names often so it is okay not to know the spelling of some!

We will go around and hear from everyone, please tell us your name and share with us what your favorite fruit and vegetables are. Let me start.

Now take the paper you wrote on and fold it like this ([moderator demonstrates fold](#)); write your name and put it in front of you on the desk, so we can learn your name.

We are now going to move on to another activity

[Hand out index cards]

Transition Question-Activity: 15 minutes

Using the index cards in front of you, we would like you to write down all the fruits and vegetables you eat, even the ones you do not really like. Write each fruit or vegetable on a separate index card. Write as many down as you can think of in 5 minutes. Again, don't worry about spelling

[5 minutes pass]

Now get into groups of two or three and organize the fruits and vegetables you all came up with into groups that make sense to your group, but do not group them based on whether you like or don't like them. Base the groups on characteristics like cooked or raw or color, whatever you come up with. We are now giving you another index card, for you to write the name of each group and place on top of that group.

[Moderator and observer will circulate to ensure groups understand the activity]

Would a group share with us how they organized their cards?

[Total of 10 minutes for fruit/veg categorizing and volunteer sharing]

[The observer collects each group's stacks of index cards, binds them with a rubber band, ensuring that each category label card is on top of each pile collected.]

Now we are going to ask you some questions and we really want to hear from all of you what you think.

Attitudes

1. Why do you think we are looking at how much fruits and vegetables you eat?
2. Is it important to you to eat fruits and vegetables [every day, week, frequently]? Why? (the moderator asks this question three different times , using one option for each reading)
If not, what is important to you at school or home?

Access /Purchasing behaviors

3. Who buys the food at your home? Where does your family go to buy food? Do they go to a different place to buy fruits and vegetables?
4. Do you think fruits and vegetables are expensive or not too expensive?
5. Are there some fruits or vegetables that you would like to eat, but do not have at home? If you had these fruits and vegetables at home, do you think you would eat them?
6. Are you comfortable asking whoever buys your food at home to buy and cook a certain food?

Motivation/Practices

7. If vegetables are on your plate do you eat them? Which ones do you eat, which ones do you not eat?

8. If there is fruit in your house do you eat it?
9. If you learned how to prepare a vegetable would you make it at home? Why or why not?

Beliefs

10. What do you think when you see someone eating fruits or vegetables at lunch in school? How about at home?
11. Is there anyone you know who likes fruits and vegetables and eats a lot of them?

Activity/Complete the sentences-10 minutes

[On Flip Chart paper will be written the following; additional index cards are handed out]

12. Think of all the ways you could complete these two sentences that are true for you. Write each on the index card provided. You can share what you wrote with the group but only if you want to, you do not have to. We will collect the card afterwards.

A)..... gets in the way of eating more fruits and vegetables.

B) To help me eat more fruits and vegetables I would need

[Index cards are collected by recorder]

Social influence and Self efficacy

13. We have been talking about you most of the time, let's talk about your families, friends and eating fruits/vegetables.

14. Do you think eating vegetables is important in your home? [ask same for fruit]
If not, what is important in your household?

15. Who likes to eat fruits and vegetables in your home? Do you have friends that like to eat fruits and vegetables?

16. Do you think you could do anything to increase the amounts of fruits and vegetables your family eats? Why?

17. What do you think would encourage your family to eat more fruits and vegetables?

18. Situation 1: You are at an event with family or friends. People are lining up to get food, and there are some fruits and vegetables available to eat, but no one in front of you has taken any. Would you put fruits and vegetables on your plate to eat? Why or why not?

19. Situation 2: You sit down at a table with your friends and someone says they do not like the vegetable on your plate. Do you still eat it? Why or why not?

Concluding Activity:

[Hand out index cards]

20. This is our last activity for the group. We have left the most exciting part for the end. In your groups we want you to come up with a great idea to get your friends to eat more fruits and vegetables. It can be a radio or TV commercial, magazine ad, posters in the school or anything else. Write your idea on the index card. Each group will get 3 minutes to tell us their idea.

Thank you/Conclusion: We want to thank all of you for taking the time to help us out with the work we are doing. You have shared with us some valuable and important information, it will really help our work and we hope benefit you. Before we go let's just go over the main things you have told us to see if we have it all right.

[The summary of key points from the focus group will be written on flip chart paper while students are working on their campaign idea. Flip chart will be posted up to provide a visual as moderator summarizes]

Have we missed anything? Do you want to add anything?

Thanks again, you will be seeing us around the school as we work on promoting fruits and vegetables.

APPENDIX F

DIET DIVERSITY SCALE DEVELOPMENT AND SCORING

Table F1: USDA Recommended Food Group and Selected Nutrient Intakes of Student Population

Food Group	Amount for Female (mod activity, age12)	Amount for Male (mod active ity, age 12)
Calories	2,000	2,200
Fruits	2 cups/ day = 14 cups/week	2 cups/day = 14 cups/week
Dark green vegetables	1 ½ cups/wk	2 cups/wk
Red, Orange, and Other Vegetables	9 ½ cups/wk	11 cups/wk
Starchy Vegetables	5 cups/wk	6 cups/wk
Legumes	1 ½ cups/wk	2 cups/wk
Solid Fat and Added Sugar (“Limit on Calories for Other Purposes”)	<280 Calories/ day (<14% of Calories) → 1960 Calories /week	<286 Calories/day (<13% of Calories) → 2002 Calories/wk
Sweets and Added sugar (low in fat, based on 2000 calorie diet, from DGA-2010)	<5 times/wk	<5 times/wk
Saturated fat (<10% of total Calories)	< 22 grams	< 24 grams

Table F2: Coding for Diet Diversity Score.

Food Groups	FFQ Qs	Scoring	
		Value	Score
Fruit	QF1-4, 7-8, 9b	14 times per week or more	1
		7-13 times per week	0.5
		< 7 times a week	0
Dark Green Vegetables	QV1 + 3 (salad and cooked greens)	3-4 times per week or more	1
		1-2 times per week	0.5
		Never	0
Red, Orange and other Vegetables	QV2, 5, 7, QF6 (cooked, raw, squashes, and avocados)	10 times a week or more	1
		9-3 times per week	0.5
		< 3 times per week	0
Legumes	QV6 +8 (veg. soups/chillis and beans/legumes)	2 times per week	1
		Once per week	0.5
		Never	0
Starchy Vegetables	QV4 +QF5 (potatoes/tubers and plantains)	5-6 times per week	1
		1-4 times per week	0.5
		Never	0
Variety	Total scores from above/5	Value	Score
		0.5-1	1
		<0.5	0
Food Quality		Value	Score
Fruit +J	QF1-4, 7-8, 9b + QFx1		
At least 75% of total fruit as whole fruit	Fruit/Fruit+J (see above)	=0.75 or more	1
		>/= 0.50	0.5
		< 0.5	0
Added Sugar and Saturated Fat Calories		Value	Score
Sports and Energy Drinks	QD1	0-2 times per week	1
		3-4 times per week	0.5
		>4 times per week	0
Other Sweetened beverages	QD2	0-2 times per week	1
		3-4 times per week	0.5
		>4 times per week	0
French Fries	QVx1	0-2 times per week	1
		3-4 times per week	0.5
		> 4 times per week	0
Total Score		Value	Score
	(Add all points from above together (except variety score?)/number of items (9-10)) x 100	75-100	High quality
		50-74	Medium quality
		< 50	Low quality

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