CHAPTER ONE
INTRODUCTION

Background

Most Americans, especially low-income individuals, do not consume adequate quantities of fruits and vegetables for disease prevention and health promotion. Use of psychosocial and fruit and vegetable consumption survey data derived from consumers, may be helpful in understanding the barriers and promoters to fruit and vegetable consumption in the low-income population. This information may be beneficial in planning nutrition education interventions for the low-income population and informing policy makers.

According to nationwide nutrition surveys, Americans chronically lack fruits and vegetables in their diet (Krebs-Smith & Kantor, 2001). Fruits and vegetables are vital for good health because they are good sources of essential vitamins and minerals, and fiber. In addition to essential vitamins and minerals, fruits and vegetables provide other phytonutrients with powerful chronic disease risk reduction potential (Steinmetz & Potter, 1991a, 1996).

Lack of good nutrition, more specifically, low intake of fruits and vegetables, is clearly implicated in a number of serious diseases. Based on growing scientific evidence, the incidence of chronic diseases, such as cancer, coronary heart disease, atherosclerosis, and stroke can be reduced through increased fruit and vegetable consumption. Fruit and vegetable consumption may also play a preventive role in birth defects, cataract formation, hypertension, asthma, diverticulosis, obesity, and diabetes (Van Duyn & Pivonka, 2000).

Due to the bulk of scientific evidence linking fruit and vegetable consumption with disease prevention and health promotion, it is important to convey to consumers and policy makers the health benefits of eating more fruits and vegetables, and to make individual and systems level changes to enhance the rate at which these healthy dietary changes occur. People who live in poverty experience worse health than people who are more affluent (Klerman, 1992). The poor also obtain their health services in a less coordinated and comprehensive manner than the affluent. This tends to create a greater financial burden on the government for health care. For these reasons, good nutrition for disease prevention and health promotion is exceedingly important for low-income individuals.

Fruit and Vegetable Consumption data

The 2000 Dietary Guidelines for Americans and the USDA Food Guide Pyramid establish a minimum of 5 servings of fruits and vegetables as a dietary recommendation for good health. The Year 2010 Health Objectives include a nutrition objective to increase fruit and vegetable consumption to 75% of all Americans consuming at least 2 servings of fruits and 3 servings of vegetables by the year 2010 (DHHS, 2000).

In the 1980's, dietary consumption survey data indicated a major deficit in fruit and vegetable intake and underscored a need for a nutrition education program to promote consumption of fruits and vegetables. In 1991, the 5 A Day for Better Health Program was launched as a research initiative of the National Cancer Institute to conduct research on dietary

behavior change in fruit and vegetable consumption. A nationwide nutrition education/media campaign grew out of the initiative (Heimendinger, et al., 1996).

In the fall of 1991, a baseline nationwide survey of fruit and vegetable consumption was completed for the 5 A Day for Better Health Program. Data on a nationally representative sample of 2,837 adults, with an oversampling of African-Americans and Hispanics, were collected by telephone using a food frequency questionnaire. The results indicated that the overall median intake was 3.4 fruit and vegetable servings per day and the mean intake was 3.8 daily servings. Overall, only 23 percent of the population was consuming five or more servings per day. Disparities in fruit and vegetable consumption based upon income were noted. Those respondents with less than 130% of the poverty index ratio, consumed a median intake of 3.1 servings daily. In contrast, those in the higher income category of greater than 300% of the poverty index ratio, consumed a median intake of 3.7 servings daily. Therefore, those in the low-income category ate, an average of 0.6 servings per day less than those in the high-income category (Subar, et al., 1996).

Six years later in the fall of 1997, a follow-up survey was conducted using the same methodology to assess the progress of the 5 A Day for Better Health Program. The results indicated a modest positive, but statistically significant overall mean increase in fruit and vegetable consumption of 0.23 daily servings (Stables, et al., in press). In addition, over the same six-year time frame, there was a small and statistically significant increase in the percent of those who consume at least five or more servings per day to 28% (Stables, et al., in press). As was true with the baseline survey, low-income adults lagged behind in servings of fruits and vegetables consumed.

These modest positive changes are consistent with other nationally representative surveys of fruit and vegetables consumption. The 1989-1991 USDA Continuing Survey of Food Intakes by Individuals (CSFII) shows an average adult intake of 4.1 servings of fruits and vegetables. The 1994-1996 CSFII survey data showed that the average adult intake of fruits and vegetables increased to an estimate of 4.6 servings, when fried potatoes are not included (Krebs-Smith, 1998, Krebs-Smith & Kantor, 2001). While this increase was statistically significant, it still remains shy of the minimum of 5 servings per day. In the 1994-1996 CSFII survey, the low-income population consumed 0.8 servings of fruits and vegetables less than the high-income group (Krebs-Smith & Kantor, 2001).

Even though the data suggest that average intakes of fruits and vegetables are increasing, and on average are approaching 5 servings daily, it should be noted that 5 daily servings represent the minimum dietary guidance recommendation. Mean intakes should be closer to the middle of the 5-9 serving range. Furthermore, there is a wide variation in what is considered a fruit or vegetable for disease reduction purposes. A recent report by the World Cancer Research Fund and the American Institute for Cancer Research (1997) suggested that potatoes prepared in any way should not be considered a vegetable, and bananas and plantains should not be considered fruits, in helping to reduce chronic disease risk, as they do not contribute to disease reduction in epidemiology studies. If potatoes are excluded, the fruit and vegetable intakes averaged 3.2 servings per person per day in 1989-1991; and comparable figures for 1994 would be 3.6 servings (Krebs-Smith, 1998). This would make reported average fruit and vegetable

daily intake much lower, and the picture for decreasing risk much bleaker than currently considered.

Even though there has been a major national initiative in place to increase fruit and vegetable consumption over the past 10 years, the gains in consumption are not adequate for decreasing chronic disease risk in this country. Certainly, further improvements could be made, not only in quantity, but also in quality of fruits and vegetables consumed. Vegetable consumption is dominated by less nutrient dense potato intake. Greater than 50% of the potatoes marketed in this country eventually are eaten as fat laden French fries (Putnam, 1996). Nutrient dense vegetables such as broccoli, other dark green vegetables, and carrots represent only a small fraction of vegetable consumption (Putnam, 1996). No matter how the data is interpreted, the current average fruit and vegetable intake in this country is poor to barely reaching the minimum recommendation, at best, and consumption is considerably lower in the low-income population.

Economics of Fruits and Vegetables

The American food supply provided 5.3 servings, on average, of fruits and vegetables per person per day in 1998 (Krebs-Smith & Kantor, 2001). This data reveals that total produce supplies are adequate in this country to meet the minimum requirements. To meet the dietary guidance requirements of 5-9 servings daily, fruits and vegetables must be uniformly available and affordable to all demographic groups in this country. A recent USDA report reveals that between 1982 and 1997, fruits and vegetables increased in price more than all other food groups. The price increases for fruits and vegetables increased more than double the amount of increases for processed foods (Putman, 1999). Some of this large increase is due to new trade practices between produce shippers and retailers, that adds new fees, such as volume discounts and slotting fees, the cost of which is passed on to the consumer (Calvin, et al., 2001). By and large, the farmers are not experiencing a large increase in dollars received for the fresh product. Rather, retailers tend to gain from the emerging trade practices. In fact, the fresh produce section is currently the most profitable section of grocery stores. This translates into a higher profit margin for retail grocery stores and higher than necessary prices for all consumers.

Health Policy

These issues of cost are particularly relevant for low-income consumers. Accessibility is also a concern. A few studies suggest that low income households in poor central cities and low populated rural areas often have less access to supermarkets and tend to pay more for food (Kaufman, et al., 1997; Kaufman, 1999; Koralek, 1996). Even if costs are the same and fruits and vegetables are accessible, low-income people simply have less disposable income. Data from USDA Consumer Expenditure Surveys show that the low-income apportion their food budget differently from higher income groups. For example, in 1998 the poorest households (annual incomes of $12,367 or less) spent $295 per person on fruits and vegetables compared to $739 spent per person by households in the highest income category (U.S. Department of Labor Statistics, 2000).

Understandably the government is interested in the pursuit of health and the public policies that relate to health. A healthy population is crucial from many perspectives, and the search for health plays an important role in our nation's economy. American's spent more than $1 trillion in the pursuit of health in 1997, and it is estimated that amount could increase to $1.5

trillion by 2002 (Thorpe, 1997). Public policies are authoritative decisions that are made in the legislative, executive, or judicial branches of government. These decisions are intended to direct or influence the actions, behaviors, or decisions of others. Generally, health policies affect or influence groups or classes of individuals, such as the poor, the elderly, or children.

Policy mandated nutrition programs to enhance fruit and vegetable consumption

Only minor policy attention has been paid to nutrition education and price supports to enhance fruit and vegetable consumption within food assistance programs. The Food Stamp Program is an entitlement program available to almost all low-income households, and acts as a social safety net. In 1995, a nutrition education component was added for food stamp participants in some states. It was deemed important to educate low-income participants in the importance of eating healthy diets and on the importance of using their food dollars to improve or maintain health. Education regarding the importance of consuming at least 5 servings of fruits and vegetables is included as part of the healthy diet message in some of the funded participating states.

The USDA school lunch program also underwent great scrutiny in 1995, when it was noted that most school lunches did not meet the U.S. Dietary Guidelines for fat content and fruit and vegetable offerings. The USDA Undersecretary for Food, Nutrition and Consumer Services made it policy to decrease the fat content of the meals and increase offerings of fruits and vegetables in all school breakfast and lunches to meet the Dietary Guidelines for Americans.

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) has had a nutrition education component since it's beginning in 1972 as a pilot program. More recently, WIC Farmers' Market Nutrition Program (FMNP) has been initiated in a few states. With a $12 million appropriation in 1998, the FMNP provided vouchers for fresh fruits and vegetables to low income women and children and boosted income for 9,600 farmers around the nation (Weinberg, 1999). While this program is a contribution to good nutrition for many, it is usually up to $20 per year per participant and only affects those enrolled in WIC in certain states.

The USDA Farm to School Program helps to create a market and provide a distribution system for farmers to sell local grown produce to local schools, in an effort to improve the quality and freshness of fruits and vegetables in schools participating in the National School Lunch Program (USDA, 2000). While this program does not provide additional funding for school lunch or directly to families, it does increase the selection and availability of fruits and vegetables for children in agriculture growing areas of the country.

Statement of the Problem

Most Americans, especially low-income individuals, do not eat enough fruits and vegetables for good health, and this creates an interesting challenge for nutrition educators and policy makers. Since 1991, there has been an increased emphasis on improving the fruit and vegetable consumption of Americans. Even though efforts to educate and motivate all Americans to eat more fruits and vegetables have been put in place, the improvements are very modest and the chronic problem of under consumption continues. Equally troublesome is the disproportionately lower consumption of fruits and vegetables in low-income individuals, and

current consumption patterns have not significantly improved, despite the fact that a major public health nutrition education program has been in place for over 7 years. Public health educators and policy makers need to more fully understand the barriers and promoters to dietary behavior change in the low-income population. The social consequences of the health sequelae related to poor diets in this population are great.

The 5 A Day for Better Health Program 1997 Follow-up Survey includes many questions that may provide insight into the barriers and promoters of fruit and vegetable consumption. This is one of the few nationally representative surveys that captures consumption information and data on demographics and psychosocial factors of fruit and vegetable consumption.

There are currently a few policy-mandated programs in place to improve the availability and accessibility of fruits and vegetables for low-income people. However, these programs usually target only a specific portion of the low-income population in a few states. Therefore, only a few of those who would benefit have access to these programs. A comprehensive nutrition program needs to be enacted whereby all low-income people have affordable healthy foods available to them.

Purpose of the Study

The purpose of the study was to examine a nationally representative nutrition survey to identify psychosocial, educational, and behavioral factors related to fruit and vegetable consumption among adults, particularly low-income adults.

The findings addressed two foci:

1. Issues for behavior change at the individual level.
2. Issues of systems level change

In addition, there was an attempt to identify opportunities for future research to help in identifying further factors related to fruit and vegetable consumption in the low-income population.

Research Questions

The following research questions were addressed in this study:

1. What are the relevant constructs in adult's fruit and vegetable consumption that are being measured in the 1997 nationally representative survey for the National 5 A Day for Better Health program?
2. What differences in consumption and related factors are explained by income level?
3. What profile of characteristics differentiates individuals who a) are aware of the 5 A Day program, b) exhibit high level of self-efficacy, c) have high level of perceived personal benefits of good health-related behaviors, and d) eat high levels of fruits and vegetables?

Significance of the Study

Despite the fact that there has been a large-scale nutrition campaign designed to increase fruit and vegetable consumption in this country for the past 10 years, it is clear that we are not meeting the minimum goals of the nationally mandated nutrition objectives. This is true for all Americans, but it is particularly problematic in the low-income population. Prevention of chronic disease has never been more important because Americans are living longer. Thus, delaying the onset of debilitating diseases not only make good health sense, it makes good economic sense. This is especially poignant for those who live in poverty. The impact of economic conditions on the health of the poor is especially dramatic. Health policies that mitigate the negative influences of socio-cultural and economic environments on health are important aspects of any society's ability to help its members achieve better health.

The science base is strong for a decreased risk of chronic diseases when individuals consume at least 5 daily servings of fruits and vegetables. A recent report estimated that "diets containing substantial and varied amounts of vegetables and fruits will prevent 20% or more of all cases of cancer" (WCRF/AICR, 1997). The authors estimated that "recommended diets, together with maintenance of physical activity and appropriate body mass, can in time reduce cancer incidence by 30-40%" (WCRF/AICR, 1997). This translates globally, to approximately 3-4 million cases of cancer per year that could be prevented by healthy eating and associated lifestyle changes.

Current epidemiological evidence also suggests a strong protective effect of fruits and vegetables on coronary heart disease and stroke. Two recent published reviews have come to that conclusion for heart disease. A report by Klerk, et al. (1998) reviewed findings from 4 ecological, two case-control, and six cohort studies conducted after 1994. From this review, risk reduction for coronary heart disease was estimated to be 20-40%. In the same review by Klerk and colleagues (1998), the risk reduction for high fruit and vegetable intake on stroke may be up to 25%.

These review studies reflect the preventive possibilities of diets high in fruits and vegetables. In the United States, cancer is the second leading cause of death after cardiovascular disease and accounts for one out of four deaths (McGinnis & Foege, 1993). In light of the wide variety of protective substances in fruits and vegetables, the National Cancer Institute's 5 A Day for Better Health Program and the American Cancer Society's 1996 nutrition guidelines advocate eating at least 5 servings of fruits and vegetables daily (Heimendinger, et al., 1996).

The information derived from this survey analysis will be an important addition to the scientific literature base on nutrition education behavior change in adults. It will also be highly informative to the 5 A Day program in the context of overall national nutrition policy. The policy relevant findings from this analysis will inform current and future policy regarding fruit and vegetable nutrition programming at the state and national level. In addition, the findings may inform the NCI and others as to what are the outstanding survey research needs in nutrition surveillance in target populations.

CHAPTER TWO
A REVIEW OF THE LITERATURE

This chapter will review the literature on nutrition education, particularly with respect to increasing fruit and vegetable consumption in the low-income population. The material will be organized around the following categories: 5 A Day Program overview, nutrition education practices and approaches, psychosocial factors related to fruit and vegetable consumption, and nutrition/health education in low-income populations.

5 A Day Program Overview

The National 5 A Day for Better Health Program, initiated in 1991, is a large-scale public-private partnership between the fruit and vegetable industry and the United States' (U.S.) federal government, with the goal of increasing the average consumption of fruits and vegetables in the United States to 5 or more servings every day. The long-range purpose is to reduce the incidence of cancer and other chronic diseases through dietary improvements. The private side of the partnership is coordinated by the Produce for Better Health Foundation, which is a non-profit foundation composed of approximately 1000 members of the fruit and vegetable industry. The National Cancer Institute of the National Institutes of Health in the U.S. Department of Health and Human Services coordinates the public side of the partnership. As the federal government specifically is concerned with populations with health disparities, the low-income population is of special interest to the Program. The goal of the program is one of the national health objectives for the nation and is also consistent with all other national dietary guidance provided by the U.S. Government (USDA & DHHS, 2000; DHHS, 2000; USDA, 1992). The specific program objectives are 1) to increase public awareness of the importance of eating 5 or more servings of fruits and vegetables every day and 2) to provide consumers specific information about how to incorporate more servings of fruits and vegetables into daily eating patterns.

The 5 A Day national program structure is based on the concept of public and private entities working together to positively impact the health of a population. The innovative and highly successful 5 A Day Program structure has been used as an exemplary model of government agencies working effectively with other government agencies and with private industry to promote public health in the United States and abroad. The 5 A Day partnership has a vision for modifying national dietary behaviors by capitalizing on the scientific credibility of the NCI and the ability of the industry to reach the entire U.S. population at the point of sale. Much of the nutrition and behavioral change research targeting increased fruit and vegetable consumption has occurred since the initiation of the 5 A Day research initiative at the NCI.

Nutrition Education for Behavior Change: Philosophies and Approaches

Education Focus of the Dietetic Profession and in Practice

The American Dietetic Association (ADA) was founded in 1917, and established professional, educational, and practice standards. A position paper on nutrition education for the public (ADA, 1996) centered on the importance of behaviorally focused, evidence based, consumer driven, nutrition education using research to guide interventions to improve food

choices, and to prevent disease and promote health. In order for "the public to achieve and maintain optimal nutritional health, nutrition education should be an integral component of all health promotion, disease prevention, and health maintenance programs, through incorporation into all appropriate nutrition communications, promotion, and education systems" (p. 1183).

Evolution of nutrition education philosophy

Nutrition education has become more evidence-based and theory driven since the 1980's. Nutrition education has moved from the provision of knowledge and skills building activities to combining nutrition education, research, and practice, in addition to guiding public nutrition policy and fostering collaborative nutrition education efforts (ADA, 1996).

Early comprehensive reviews of nutrition education research by Whitehead in 1973 and by Johnson and Johnson in 1985 found that nutrition education studies did not usually document theoretical frameworks used in designing interventions. They did, however, report some intermediary or outcome findings in terms of knowledge, attitudes, and dietary intakes. The 1973 review by Whitehead encompassing the previous seventy years found that "nutrition education has been directed more toward the purpose of disseminating nutrition information than toward the purpose of improving dietary habits (p. 99)." In fact, Whitehead notes that only studies that set behavioral change as the goal of nutrition education and used educational strategies to change behavior, actually achieved behavior change. Other nutrition education efforts, which did not use strategies of behavior change, were typically successful only in increasing knowledge.

The review by Johnson and Johnson (1985) used a meta-analysis of 303 studies. The meta-analysis of the nutrition education interventions showed overall improvements of 33% in knowledge, 19% in dietary practices, and 14% in attitudes. Johnson and Johnson concluded that a shortcoming of most of the nutrition education research was that it was not based upon theoretical models, and therefore was hard to determine the theoretical variables to be measured as possible mediating factors to explain how the intervention impacted knowledge, attitudes, and behaviors. It was difficult to determine what makes nutrition education effective, and to guide development of future education efforts.

Achterberg and Clark (1992) reviewed 346 papers and abstracts for the purpose of identifying the frequency of theory-driven nutrition education research and the types of theories used from 1980 to 1990. Only 23.5% cited the use of a theory or model in the research. Of those that utilized a theory driven approach, 57% focused on theories for the learner, such as social learning theory, health belief model, and adult learning theory; and 22% utilized curriculum development or testing theories.

In 1995, Contento, et al reviewed 217 nutrition education intervention research studies for effectiveness and implications for policy, programs, and research. The general conclusion was "the more effective programs are those that are behaviorally focused and based on appropriate theory and prior research. Behaviorally focused nutrition education uses a set of learning experiences to facilitate the voluntary adoption of food and nutrition-related behaviors that are conducive to health and well being (p. 280)." Other elements that contribute to effectiveness of nutrition education interventions were communication and educational strategies

for enhancing awareness and motivation, environmental interventions (changing the eating environment to make healthy choices more available, accessible, and affordable), and community activation and organization. The behavioral change strategies that add to effectiveness included goal setting, tailoring intervention strategies for targeted groups, social support, and enhancing self-efficacy.

This 1995 review found that the most effective and widely used behavioral change theory utilized in nutrition education interventions was the social learning theory. Social learning theory constructs or personal-level variables include self-efficacy (confidence in performing a particular behavior), behavioral expectancies (perceived benefits), behavioral capabilities (knowledge and skills to perform the behavior), and perception of the environment (Contento, et al., 1995).

The public health approach to nutrition education encompasses educational and behavioral change activities designed to move entire population groups to more healthful eating patterns. A new conceptual framework for planning public health-focused nutrition education interventions must address improving access to healthy foods, make it easier to eat healthy foods, and assure greater awareness of nutrition messages (Johnson, et al., 2001). Interventions must be developed that focus on the true determinants of nutrition behaviors and include effective social marketing campaigns and communications (Johnson, et al., 2001).

A review of goal setting as a strategy for dietary behavior change in adults suggests that goal setting is likely to lead to behavior change (Cullen, et al., 2001). Other reviews in nutrition behavior change have revealed that successful programs target one or more personal, behavioral, or environmental factors influencing the behavior of interest (Baranowski, et al., 1997, Baranowski, et al., 1999).

Andragogical Approaches to Nutrition Education

The 1996 ADA position paper on nutrition education centers on adult education (andragogical) approaches to nutrition intervention. People are more likely to make eating behavior changes if they are involved in goal setting, and if their perspectives are incorporated into the educational process.

80 of the 217 studies reviewed by Contento, et al. (1995) were conducted in the general, healthy adult population. The more effective programs were those that were theory-based, in particular, theory of reasoned action using persuasive communication strategies for increasing awareness and motivation, and social cognitive theory. Behavioral change strategies in adults that were likely to be effective were individualized interpersonal education, strategies emphasizing the personal consequences of behaviors, and strategies based on social learning theory and behavioral self-management (Contento, et al., 1995).

A study by Auld (1990) underscores the fact that people process information differently. Even though both males and females seem to possess similar amounts of nutrition information about fat and cholesterol; women tend to have a more complex base of nutrition knowledge, both subjective and epistemological, that takes into account their own experiences and knowledge for

making food decisions. Based upon this research, Auld suggests that nutrition interventions be tailored with gender and other socio-demographic characteristics in mind.

Kent (1988) describes the concept of empowerment through nutrition education. He postulates that malnourished individuals suffer the consequences of those who are more powerful and who may have other agendas than those of nutritional assistance. Kent supports the idea that people should be supported to make their own analysis of their need for change and decide how to make change happen in their own lives. The emphasis should be on creating a dialogue among group members, and helping people uncover the barriers to behavior change, from the sharing of experiences and interpretations.

Abusabha, et al. (1999) also approaches the use of empowerment in nutrition education through facilitated group discussions with low-income adults. "By helping clients make informed decisions about their diet, nutrition educators are empowering them to take control of their eating habits (p. 73)." Rainey and Cason (2001) found these same andragogical theory concepts in their qualitative research in planning nutrition education programs for low-income elderly women. With input from the women regarding barriers (cost, availability, accessibility) and limited understanding the health benefits of eating more fruits and vegetables, the researchers were able to plan interventions that the women considered reasonable, realistic, and achievable.

Other adult education theories in nutrition education

Nutrition education for social change, based on Paulo Freire's empowerment education and principles of participatory research, was examined theoretically by Travers (1997) within the context of the need to address inequities in health. Travers assumed that people make health choices within the realm of available resources, and she proposed that traditional health education strategies may have little impact on those who have limited access to health-supporting resources such as adequate income for nutritious food, and culturally relevant health education. Common strategies, such as dissemination of printed health information and targeting culturally biased education programs to the socially disadvantaged groups, may actually increase the differential between the advantaged and the disadvantaged by increasing the availability of resources to those with literacy skills and income sufficient to enable them to act on recommendations. In this way, the inequities are perpetuated. Simply transferring programs that are inappropriate for low-income populations is what Travers equated to Freire's term cultural invasion. In this way, the educator "seeks to penetrate another cultural-historical situation and impose his system of values on its members" (Freire, 1973, p.113). Travers also made the case for environmental changes, including legislation, as important for health education to be effective for individuals and for social change. She stated that evidence suggests, "that most major improvements in the public's health and their health behaviors have come through movements based on public issues" (p. 345). She cited the antismoking campaigns as examples, whereby education is combined with legislation to create environments more conducive to healthy choices.

Social Cognitive Theory

Social Cognitive Theory (SCT) is based in the field of psychology and is intended as a framework for identifying factors that influence behavior (Glanz, et al., 1997). Bandura (1986) conceptualized this theory as a reciprocal interaction of environmental factors, behavior, and cognitive and other personal factors. This theory proposes that behavior, person factors (such as self-efficacy and perceived benefits), and environmental factors (such as social support), interact to explain and predict changes in behavior, and a change in one component will produce changes in the others. It combines an emphasis on behavioral factors, with the recognition of the importance of cognition. This kind of model is an appropriate framework for examining dietary and health behaviors because it allows for the structuring and ordering of variables known to influence dietary and health behaviors.

Self-efficacy is a major construct in Social Cognitive Theory. Self-efficacy is the confidence a person feels about performing a particular activity, including confidence in overcoming the barriers to performing that behavior (Glanz, et al., 1997). Bandura (1986) proposed that self-efficacy is the most important prerequisite for behavioral change, because it affects how much effort is invested in a given task and what level of performance is gained. Efficacy expectations are influenced or learned from four major sources (Strecher, et al., 1986). The first influence is performance accomplishments, which refers to learning through personal experience and is reinforced by success of accomplishment. The second is learning that occurs through observation of events and/or other people. The third is verbal persuasion, which pertains to asking people to persevere in their behavior change efforts. The fourth influence is one's physiological state, whereby being nervous, for example, can hamper one's success in performing a behavior. Beliefs in personal efficacy can be changed by these different modes of influence. Enhancement of efficacy beliefs leads to motivation for behavioral efforts (Maibach & Murphy, 1995).

Social support, another SCT construct, is defined as aid and assistance exchanged through social relationships and interpersonal transactions. Social support is always intended to be helpful and not an intentional negative interaction. Cassel (1976) suggests that social support serves as a key psychosocial "protective" factor that reduces individuals' vulnerability to the potentially harmful effects of stress on health.

Psychosocial factors and fruit and vegetable consumption

Dittus (1995) conducted a mail survey to examine attitudes toward nutrition and reported fruit and vegetable intake among randomly sampled Washington state residents (n=1069). Results of the regression analysis indicated that 16% of the variance in fruit and vegetable intake was accounted for by attitudinal barrier variables (cost/time to prepare fruits and vegetables, difficulty in changing eating habits, self-efficacy issues, and taste of fruits and vegetables). Results suggested a relationship between attitudes about barriers to fruit and vegetable intake and nutrition behaviors. A limitation of the study was that the sample was heavily skewed toward upper income and education levels. The author concluded that since barriers are related to nutrition behavior more strongly than benefits, nutrition education efforts should also concentrate on identifying the barriers to behavior change for target audiences. Despite a very small sample

size of low-income respondents, Dittus notes that barriers are particularly important components to address in nutrition education interventions for men and low-income/education audiences.

The baseline survey for the 5 A Day for Better Health Program included an analysis of psychosocial factors associated with fruit and vegetable consumption (Krebs-Smith, et al. 1995). Multiple regression analyses were performed to measure the net effect of the various psychosocial factors on the intake of fruits and vegetables. Descriptive analyses were done to determine the percentage of adults whose responses fell in various categories. Results included that only 8% of adults thought five or more servings per day were needed for good health (message awareness/knowledge). Most adults agreed strongly that they liked the taste of fruits (82%) and vegetables (71%). About a third of adults felt strongly that family friends encouraged them to eat fruits and vegetables. Of all the factors studied, the most important in determining fruit and vegetable intake were the number of servings they thought they should have in a day, whether they liked the taste, and whether they had been in the habit of eating many fruits and vegetables since childhood. These few factors accounted for 15% more of the variation in fruit and vegetable consumption than did demographic variables alone. Persons with less than a high school education and those with incomes below 130% of the poverty level were less likely than other groups to think that five or more servings per day of fruits and vegetables were needed. The authors concluded that men, young adults, and persons with low levels of income and education should be targeted in promoting fruits and vegetables.

Laforge and colleagues (1994) looked at the psychosocial factors influencing consumption in a group of adults who are low consumers of fruit and vegetables (<2 servings daily). In this study, males were twice as likely to be aware of the need to consume more fruits and vegetables, as were women. Years of education was a strong predictor of those unaware of the need consume more fruits and vegetables, with those with a high school education or less being three times more likely to be unaware (Laforge, et al., 1994). Those unaware of the health message reported lower fruit and vegetable consumption than those aware. Those unaware need to be targeted with cognitive and experiential strategies when tailoring educational messages to this group.

Two worksite research interventions assessed psychosocial correlates of fruit and vegetable consumption. At the baseline of the Working Well Trial, beliefs/knowledge, perceived benefits, and motivation were strong predictors of current diet (fat, fiber, fruits, and vegetables) and intention to change (Kristal, et al., 1995). Also, at the baseline of the Next Step Trial, beliefs/knowledge, perceived benefits, and motivation showed a stronger association with current diet than did perceived barriers, norms or social support (Glantz, et al.,1998). This suggests that attitudes, knowledge, and motivations may be more important than social factors, in the worksite setting. Self-efficacy was not assessed in these trials. The intervention for the Next Step Trial significantly increased attitude, knowledge, and motivation scales, and changes in these correlates, along with changes in social factors were associated with significant dietary change (Kristal, et al., 2000). In a side-by-side analyses of psychosocial factors from 7 large scale community-based interventions (3 of which were worksite) to increase fruit and vegetable consumption in adults, self-efficacy scores, fruit and vegetable consumption, and knowledge of the 5 A Day message were positively associated with higher levels of stage of change, i.e. being

in the act of trying eat more fruits and vegetables or maintaining a high level of intake (Campbell, et al., 1999).

A random sample telephone survey was completed in the Netherlands to analyze the importance of psychosocial determinants of fruit and vegetable consumption. Self-efficacy and attitudes (perceived benefits of performing a health behavior) were significantly associated with consumption of fruit and vegetables (Brug, et al., 1995). It was concluded from this research that nutrition interventions should focus on enhancing perceived benefits of performing a behavior and self-efficacy expectations.

The relationship of cancer prevention-related nutrition knowledge, beliefs, and attitudes to dietary behavior were assessed in a nationwide survey of over 12,000 adults (Harnack, et al., 1997). After adjusting for covariates in this study, knowledge and awareness of key health messages were predictive of dietary behavior (fat, fiber, fruit, and vegetables). In addition, it was found that knowledge and awareness have less influence on dietary behavior for those with lower educational levels, than for those with higher levels of education.

Qualitative research has been conducted with several groups of low-income women receiving food assistance benefits. Reicks, et al. (1994) conducted focus group discussions with low-income mothers participating in the USDA Expanded Food and Nutrition Education Program (EFNEP), and found that women perceived fresh produce as expensive, and they limited their purchases to sale items, and limited purchases due to lack of storage space. Treiman, et al. (1996) conducted focus group discussions with low-income, primarily African American mothers enrolled in the Supplemental Food Program for Women, Infants, and Children (WIC). These mothers reported that a key motivator of adopting healthy eating patterns (more fruits and vegetables) was being a good role model their children. Barriers included availability of fruits and vegetables, time and effort to prepare, and preference for other foods. Some of these same findings occurred in focus group discussions with Food-Stamp-Eligible Hispanic mothers (Hampl & Sass, 2001). A recurrent theme with this group was that children greatly affected what the women bought at the grocery store. Barriers included cost, and unfamiliarity with the wide variety of fruits and vegetables in the U.S.

Another group described the multiple perspectives on nutrition education needs of low-income Hispanics. (Palmeri, et al., 1998). Nine focus groups were conducted with low-income Hispanics (n=65). Low-income Hispanics' primary concerns were their children's nutritional habits and ways to prepare quick, nutritious meals and snacks. Relative to nutrition education efforts, major barriers included lack of resources (time and money), family customs and preferences, and confusion over conflicting nutrition messages. Consideration was given to the idea of the use of abuelas (Hispanic grandmothers) as lay health advisors or paraprofessionals, due to the great respect in the Hispanic community for elders. While this was ethnically a real plus, the ongoing need for support and education of the abuelas may be prohibitive. The focus group participants emphasized a desire for their families to adopt healthy eating habits, which were described as consuming more fruits, vegetables and milk, and less red meat.

Nutrition Education interventions in low-income populations

Most of the published literature in health promotion strategies for the low-income population describes actual programs and evaluation of such programs to reach the intended audience. Few discuss the formative research, or the determination of barriers and underlying constructs to behavior change in underserved populations. Several articles allude to the proposed barriers to behavior change in low-income participants, but, other than focus group research, little has been published on attempts to characterize salient mediating issues of dietary behavior change from research in low-income individuals.

Several papers describe dietary and other health promotion interventions in low-income populations. Nutrition education for cardiovascular disease prevention among low-income individuals was addressed through the use of a physician-based model called the Food for Heart Program (Ammerman, et al., 1992). Strategies used included low literacy education materials emphasizing regional eating patterns, linking the dietary assessment with educational materials, and organizational elements to facilitate physician counseling. Barriers that were addressed in this low-income population included culturally determined eating practices, competing demands and pressures, low literacy issues, and perceived or real costs of the recommendations. It was noted that access to medical care is limited in low-income populations, physicians have little time and are often lack training in nutrition; therefore physicians may not be the best purveyors of nutrition education. Lay health providers with similar socio-cultural backgrounds may be more appropriate to be able to reach, educate, and motivate the poor to make health promoting behavior changes.

Calderon & Goerence (1998) conducted a short survey to determine Food Center recipient's (n=207) perception of the quality of their own and their family's diet, and to assess nutrition knowledge, in order to plan an appropriate nutrition education program. Approximately 1/3 of the respondents rated their diet as good or excellent while the remaining 2/3 rated the quality of their diet as fair, poor or very poor. Their nutrition knowledge was deemed very poor, with 70% of the respondents answering three or less of the eight questions correctly. While this short survey questionnaire is quite rudimentary, it does point to the fact that lack of nutrition knowledge is a definite problem in those seeking emergency food assistance. Calderon notes in her discussion "those on a limited income need to discern what foods are most cost effective in providing the necessary nutrients for health and well-being" (pg. 463).

Anderson, and colleagues (2001) evaluated the Michigan Farmer's Market Nutrition Program to determine the effect of vouchers and an educational program on fruit and vegetable consumption behavior. The findings of this study showed that vouchers (price supports) directly affected consumption behavior in a positive way, but did not affect attitudes directly or indirectly. In contrast, education indirectly affected consumption behavior by positively affecting attitudinal variables. The authors suggest that education, coupled with vouchers, can achieve the maximum effects on consumption.

A 5 A Day educational demonstration project was done with low-income families (Weaver, 1999). The results showed that cooking events were significantly more effective in increasing awareness and knowledge, than was an advertising campaign. The authors felt that the cooking events called attention to the message through colorful displays, the smell and taste

of food samples, and the opportunity to interact informally with outreach workers. These participatory strategies utilize an andragogical approach and tie in with adult education theory.

Both the Black Churches United for Better Health Project and the Maryland WIC 5 A Day research projects used a lay health advisor model to deliver the educational intervention. The researchers in these projects point out that since the peer educators are selected from the participant pool and share common language, norms, and cultural values, they provide social support to the participants. In addition, they can make valuable contributions to program design, and deliver the interventions effectively (Anliker, et al., 1999; Campbell, et al., 1999).

Summary of Literature Review

Fruit and vegetable consumption data in this country is consistently below recommendations. Fruit and vegetable intake is particularly low in the poor population. Despite a nationwide 5 A Day program to increase fruit and vegetable consumption, the progress is slow with modest positive increases, and the low income population continues to lag behind the rest of the country in consumption.

The scientific evidence that strongly links increased fruit and vegetable consumption with decreases in the risk of the major chronic diseases in the U.S. is staggering. As the science base increases and we begin to understand the biological mechanisms of fruits and vegetables that fight disease, it is imperative that we speed up the rate at which healthy dietary behavior change occurs.

Nutrition education philosophy in adults not only includes andragogical approaches to education, but is becoming more theory-driven. The social cognitive theory seems to be the most commonly used educational and behavioral change theory in the nutrition profession. The public health approach of encouraging entire populations to adopt healthy eating behaviors, encompasses the inclusion of a variety of educational, behavioral, and policy interventions targeted to specific groups.

Although there have been attempts to intervene in low-income groups, we need to know more about the barriers and promoters of healthy eating habits in this population. Health educators continue to grapple with planning effective, culturally appropriate educational interventions in poor populations. Some policy mandated nutrition programs are in place for selected populations, but many low-income persons are without safety nets when it comes to encouraging healthy food consumption.

Survey and intervention research has been conducted in the effort to understand the barriers and promoters of fruit and vegetable consumption. There is a dearth of information examining psychosocial determinants of fruit and vegetable consumption by income group. From the research studies looking at determinants or mediators of fruit and vegetables dietary change, a few common themes emerge. Self-efficacy, awareness/knowledge of key health messages, social factors, taste of fruits and vegetables, and barriers (costs, availability, and accessibility) are the most often measured determinants of dietary behavior. Low income and low educational level is associated with lower fruit and vegetable consumption. Likewise, there

is an inadequate body of knowledge from research efforts to help guide health education in the low-income population.

For these reasons, it is important to better understand the real and perceived barriers, and the factors that promote fruit and vegetable consumption.

CHAPTER THREE
METHOD

The material in this chapter is arranged in the following way: research goals; survey overview; sampling plan, and analysis procedures.

Research Goals

To effectively intervene in populations, it is important to understand the barriers and promoters to eating healthfully. Effective nutrition education programs can help individuals to improve their health and prevent diet-related chronic diseases. This research proposed to learn more about the mediating variables to healthy eating. The information gleaned from this survey may help practitioners to plan effective interventions and to understand the reasons why the low-income population lags behind in fruit and vegetable consumption.

The specific research objectives are:

1. Via a secondary analysis of the 5 A Day for Better Health Program Follow-up survey, characterize the barriers of cost, availability, lack of knowledge, and psychosocial issues to consuming fruits and vegetables.
2. Identify the underlying latent structures of consumption, barriers to consumption, and other constructs present in the survey data.
3. Characterize differences in consumption and related factors that are explained by income level.
4. Based upon the underlying latent structures, determine a conceptual model for influencing fruit and vegetable consumption in Americans.

Survey Overview

The National Cancer Institute (NCI) collected data from a representative sample of American adults from July 9, 1997 through September 21, 1997 for the National 5 A Day for Better Health follow-up Survey. The study was designed to measure six-year trends in fruit and vegetable intakes, as well as in knowledge, attitudes and beliefs about diet and nutrition. Approximately 2,600 interviews were completed using Computer Assisted Telephone Interviewing (CATI) technology. 348 interviews were completed in the low-income category (<130% of Poverty Index), 796 interviews in the 130-<300% Poverty Index Ratio (PIR) range, and 1101 interviews were completed in the >300% PIR range. Over 300 respondents refused to give their income information.

The study consisted of a Screener Survey to determine household eligibility and to sample a respondent for the Extended Survey; and the Extended Survey, which gathered detailed information on health status, fruit and vegetable consumption, and habits and attitudes towards nutrition and health. Both components were conducted in English.

The Screener Survey was a random-digit-dial (RDD) survey of households in the United States, conducted using CATI technology. A contractor called a nationwide sample of 13,521 telephone numbers during the survey. All residential units occupied by related individuals, or up

to six unrelated roommates, were considered eligible for participation in this study. When an eligible household was contacted, the Screener questionnaire was administered to an adult (18 years of older) member of that household. The questionnaire asked the adult household member to identify the household member with the most recent birthday and to answer questions about that person's gender, age, and ethnicity.

The sample was composed of low and high minority strata. The CATI system selected all respondents identified in the low minority stratum without regard to race. An additional question was asked of each household in the high minority stratum to determine if it was a minority household. If so, the respondent was selected with certainty. If not, a subsampling algorithm determined whether to continue with the interview or resolve the household as ineligible.

All interviewers assigned to the survey participated in training sessions and completed a minimum of 12 hours of formal project-specific training. Quality assurance measures included interviewer monitoring, callback procedures, and ongoing examination of the data during the data collection phase. 3, 528 screener questionnaires were completed. Of these, 2,605 extended interviews were completed. The overall response rate for screener and extended interview was 44.5%. Of the 2,605 completed interviews, 65.5% were completed with White respondents, 19.7% with Black respondents, and 10.3% were completed with Hispanic respondents.

Questionnaire Development

Since this was a follow-up survey to the 1991 baseline survey, the questionnaire was very similar to the baseline questionnaire. Many of the questions were the same, with a few new questions added. In order to comply with governmental clearance, the Food Frequency portion of the questionnaire was abbreviated from 33 items to a 7-item frequency questionnaire. In an open-ended response format, individuals reported the number of times per day, week, month, or year they consumed each fruit and vegetable item. No questions were asked about portion sizes. The seven-item fruit and vegetable frequency questionnaire and a similar instrument have been validated in a number of U.S. populations, yielding correlations in the range of 0.47 to 0.56 with longer food frequency questionnaires, multiple 24-hour recalls, and 3-day food records (Thompson, et al., 2000; Campbell, et al., 1999; Hunt, et al., 1998; Serdula, et al., 1993).

Most of the psychosocial questions included a scale of 0-10, with a response of 0 = “don’t agree at all” to 10 = “ strongly agree”. These questions were not assessed for reliability or validity prior to administration of the survey.

Sampling Design

The sample design was a random digit dialing (RDD) telephone sample. A random sample of telephone numbers was drawn from all working banks with all exchanges in all area codes covering the United States. Banks are sets of one hundred telephone numbers with the same area code and five-digit prefix. Exchanges were assigned to one of two strata: a high minority stratum and a low minority stratum. An exchange was assigned to the high minority stratum if 15 percent or more of the telephone households associated with the exchange were

black or Hispanic, according to the Genesys estimates. Otherwise the exchange was assigned to the low minority stratum. A random sample of 12,000 telephone numbers was drawn from the high minority stratum, and a random sample of 4,150 telephone was drawn from the low minority stratum. The original sample included 8,000 telephone numbers respectively in the high minority and low minority strata, but a shortfall in the number of completed interviews by minority persons from expected yields required an increase in the relative sample size of high minority stratum telephone numbers. The telephone numbers were selected using a stratified sampling design: the working banks in the High and Low Minority Stratum were ordered according to geography, metropolitan or non-metropolitan status, and by area code and five digit prefix within the geographic regions. This ordered set of telephone numbers was the frame for each of the two strata. The frame was partitioned into equally sized substrata using this ordering of working banks. An independent equal probability sample of one telephone number was then drawn from each of these substrata.

Analysis Procedure

With the Statistical Package for the Social Sciences (SPSS for Windows, version 9.0; SPSS, Chicago, Illinois), the following analyses were performed: Exploratory Factor Analysis with varimax rotation, one-way analysis of variance (ANOVA) with LSD Post Hoc Test, Chi Square test, and multiple regression analysis. Prior to conducting the analysis, variables were examined for normality. Although several variables were slightly skewed, servings of fruits and vegetables and poverty ratio variables were severely skewed. These variables were transformed using the Log 10 transformation operation in SPSS, version 9.0, resulting in a normally distributed variable for fruit and vegetable consumption. The income variable resulted in a bimodal distribution suggesting there are at least two distinct groups differing by income.

Exploratory factor analysis was used to initially analyze the data. Each measure in the data set is considered to an observed indicator of one or more underlying factors. A single factor is hypothesized to be expressed in a range of measures, and at times an individual item may load on more than one factor. The factor analytical procedure (including varimax rotation and factor scoring) used in SPSS was one of the analytic tools for research question 1, "What are the relevant constructs in adult's fruit and vegetable consumption that are being measured in the 1997 nationally representative survey for the National 5 A Day for Better Health Program?"

Research question 2, "What differences in consumption and related factors are explained by income level?" was partially answered by one way analysis of variance (ANOVA) with an LSD post hoc test which showed differences in awareness, total fruit and vegetable consumption, mean total composite values of self efficacy, weak intent, and cost/quality scales between low income and high income respondents. The question was further answered using multiple regression modeling by income categories showing the percent of variance in total fruit and vegetable consumption explained by demographic covariates, social cognitive factors, and perceived barrier factors.

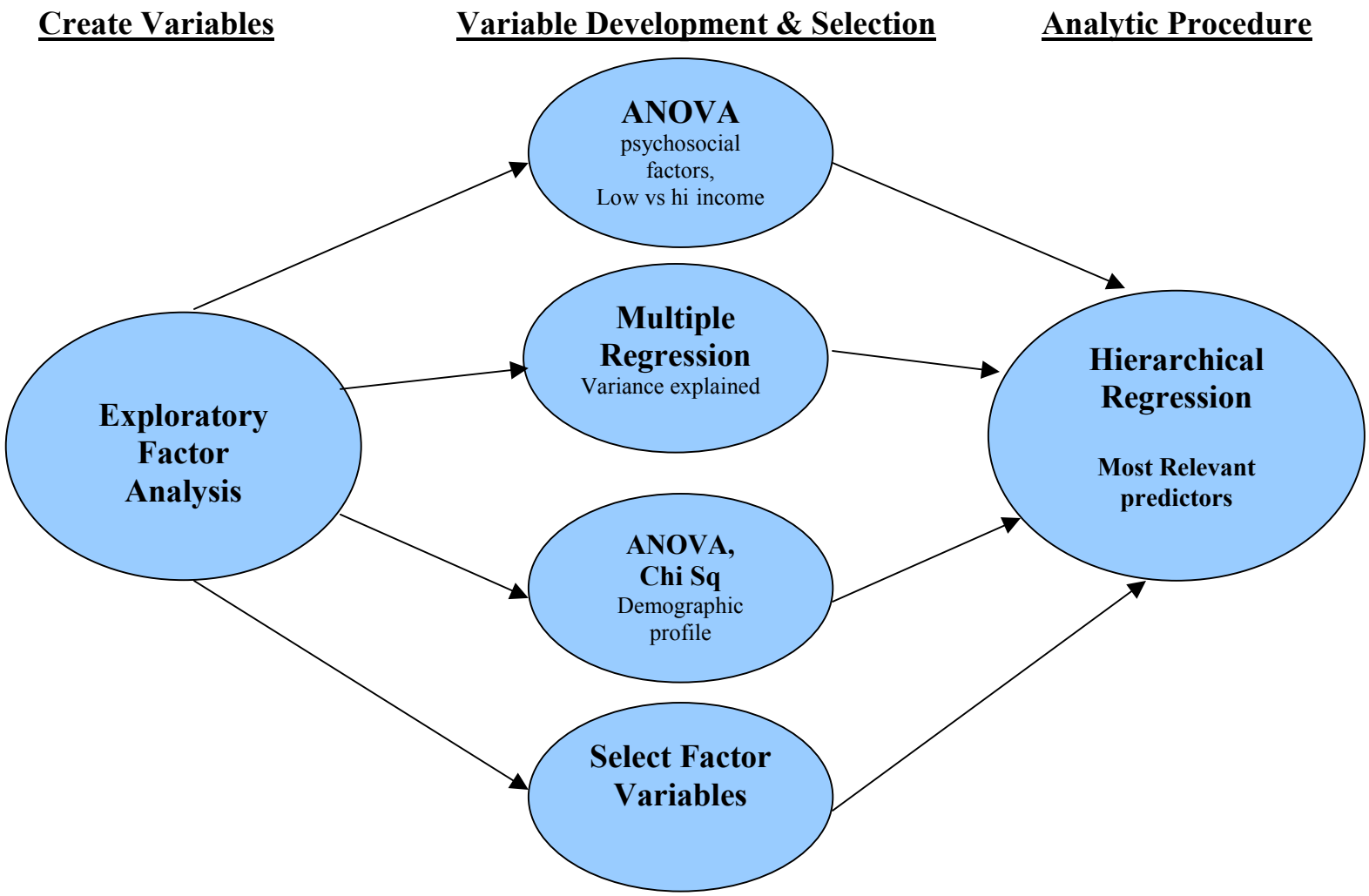
Research question 3, "What profile of demographic characteristics differentiates individuals who a) are aware of the 5 A Day program, b) exhibit high level of self-efficacy, c) have high level of perceived personal benefits of good health-related behaviors, and d) eat high

levels of fruits and vegetables?" was answered by one-way analysis of variance and chi square analyses. This analysis simply provides a demographic profile of those with specific measures of the behaviors listed. The profile is helpful in determining the variables for the hierarchical regression analysis.

Multiple linear regression was done to determine the variance in fruit and vegetable consumption as explained by psychosocial and demographic variables, by income group, eg. Low-income, high income, and all income groups. This analysis contributed to research questions 1 and 3.

Hierarchical linear regression was the final analysis to be completed and adds more information to answer research question 1 on relevant constructs in adult's fruit and vegetable consumption. Psychosocial variables that were found to be significant in the ANOVA, Chi Square, and multiple regression analysis and all the demographic variables were stepped into the hierarchical regression equation, resulting in nine regression models. These promising variables were included in several iterations of the analysis. If they were consistently not significant in the regression, they were removed. For example, marital status, race/ethnicity, and cost/availability variables were removed. In addition, for research question 3, the proportion of variance contributed by the several latent factors was used to determine where further developmental work for future surveys should be done. The factors discovered in this research will need to be strengthened and new issues identified, both of which will lead to specific suggestions for future research. Figure 1 shows the overall analysis scheme.

Figure 1. Analysis Scheme



CHAPTER FOUR
RESULTS

The survey instrument has several methodological shortcomings and therefore the findings need to be interpreted with caution. First, the fruit and vegetable intake findings are based upon self-reported information of a short fruit and vegetable screener. Second, although the survey instrument would have benefited from updating and from cognitive testing, modification of individual questions was minimized in the Follow-up Survey to maintain comparability to the Baseline Survey. Third, the psychosocial questions were not assessed for reliability and validity prior to implementing the survey. Fourth, despite major efforts to maximize the response rate, there was a less than optimal response rate of 44.5%. Even though the Subar, et al. (1995) of the 1991 5 A Day Baseline Survey completed a rigorous nonresponse survey and found that those nonresponsive to the survey did not differ significantly in fruit and vegetable consumption or in responses to the psychosocial questions from those who completed the survey, there remains a question of how representative of the U.S. population are the 1997 results. Nonresponse problems are common in national RDD surveys. The increased use of answering machines and the increased magnitude of telephone solicitation have all increased the survey burden in RDD surveys. In 1996, Massey, et al conducted a study of response rates in large national RDD surveys, and found that 1/3 of the studies had response rates below 60%, even though almost one-half of the surveys used methods that overestimated the response rate. Massey, et al. (1997) concluded that considerable effort is required to obtain a response rate over 60%, that response rates have declined slightly over the past 10 years, calculation of response rates is variable across surveys, and nonresponse in RDD surveys is an ongoing problem.

Analysis of Demographic Data

Table 1 shows the distribution of the sample (N and raw %) according to various demographic characteristics by income group. Of the 2,605 adult participants, 14% are in the low-income category, 31% are in the middle-income category, and 43% are in the higher income category, with 12% not reporting income levels. These proportions by income category are similar to the 1997 U.S. census.

The proportion of Whites increases in the higher income categories, while the proportion of African Americans and Latinos decrease as income categories increase. A large percentage (76%) of those with greater than a high school education are in the higher income category. The proportion of smokers is highest (27%) in the low-income category. The greatest percentage of those in the youngest (18-34 year old) age group and in the oldest (>65 year old) age group is in the low-income category, while those aged 35-65 have the highest percentage in the higher income group.

Table 1. Demographic Characteristics by Income Category

		Low Income[b]		Middle Income[c]		Higher Income[d]		All Income	
Demographics		**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Gender	Males	115	32%	332	41%	521	47%	1068	41%
	Females	249	68%	477	59%	596	53%	1536	59%
Race/Ethnicity	Whites	170	47%	506	63%	800	72%	1700	65%
	African American	114	31%	173	21%	173	16%	510	20%
	Latinos	66	18%	86	11%	92	8%	267	10%
	Other			34	4%	44	4%	105	4%
Smoking Status	Non-Smoker	260	71%	607	75%	923	83%	2043	78%
	Smoker	104	29%	203	25%	194	17%	562	22%
Age Category	18-34	148	41%	280	35%	363	33%	857	34%
	35-49	95	26%	243	30%	451	40%	838	33%
	50-64	40	11%	129	16%	215	19%	428	17%
	>=65	79	22%	152	19%	79	7%	383	15%
Education	<12	104	29%	92	11%	37	3%	285	11%
	12	159	44%	297	37%	221	20%	778	30%
	>12	97	27%	401	50%	843	76%	1497	57%
Martial Status	Married	117	32%	395	49%	654	59%	1326	51%
	Div/Sep/Widowed	151	42%	242	30%	218	20%	697	27%
	Never Married	96	26%	172	21%	244	22%	574	22%
Total Population		364		810		1117		2605	

[a] 314 did not report income

[b] Low income defined as <130% Poverty Index Ratio (food stamp eligibility criteria); takes into account income/size of household

[c] Medium income defined as 130-300% Poverty Index Ratio

[d] Higher income defined as >300% Poverty Index Ratio

Factor Analysis

Exploratory factor analysis was done to address the first research question: What are the relevant constructs in adult's fruit and vegetable consumption, that are being measured by the most recent survey for the National 5 A Day for Better Health program? Exploratory factor analysis was completed with a grouping of variables addressing barriers to consuming fruits and vegetables, and with a grouping of psychosocial variables addressing social/cognitive factors involved in fruit and vegetable consumption.

Seventeen items of a social/cognitive nature were included in a factor analysis completed on the entire sample population (Table 2), on the low-income group (Table 3), middle-income group (Table 4), and higher income group (Table 5). A factor structure was identified that was stable across income groups. Of these seventeen items, five loaded on factor one, and are labeled as a self-efficacy factor since all five variables address the respondent's confidence in being able to do a particular behavior. Four items loaded on factor two and address friends and family support issues, and therefore labeled "social support". Three items addressing health benefits of consuming vegetables and fruit loaded on factor three and were labeled as the "perceived benefit" factor. The factor loading scores and the variance explained were very similar across income levels. A "self efficacy" factor, a "perceived benefit" factor, and a "social support" factor were saved for each of the three income groups and the entire sample.

Five additional variable items were eliminated from the factor analysis due to cross loading or not loading on any particular factor. Items eliminated included questions regarding eating fruits and vegetables by habit, fruits and vegetables make you feel better, how often stores display nutrition information, and two questions about knowledge/awareness of the 5 A Day message and program.

Table 2. Social/Cognitive Factors Related to Fruit and Vegetable Consumption: All Income Levels (n = 1851)[a]

	Factor loadings		
Questionnaire item	Self-efficacy	Social support	Perceived benefits
Can respondent eat 3 servings of fruits and vegetables daily	**.789**	.105	.147
Can respondent eat 5 servings of fruits and vegetables daily	**.780**	.184	.119
Can respondent eat fruits and vegetables for snacks	**.773**	.089	.109
Can respondent eat fruits and vegetables outside the home	**.723**	.144	.060
Can respondent drink fruit juice daily	**.636**	.033	.082
Friends urge respondent to eat fruits and vegetables	.035	**.778**	.095
Friends eat lots of fruits and vegetables	.112	**.714**	.078
Family urges respondent to eat fruits and vegetables	.053	**.660**	.047
Family eats lots of fruits and vegetables	.278	**.644**	.016
Fruits and vegetables prevent heart disease	.110	.092	**.871**
Fruits and vegetables prevent cancer	.119	.129	**.761**
Fruits and vegetables help lose weight	.141	.039	**.748**
Variance explained[b]	24.1%	17.2%	16.4%
Chronbach Alpha	0.79	0.62	0.73

[a]Extraction method: principal component analysis (forced into three factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in five iterations.
[b]Total variance Explained = 57.7%.

Table 3. Social/Cognitive Factors Related to Fruit and Vegetable Consumption: Low Income (n = 231)[a]

	Factor loadings[b]		
Questionnaire item	Self-efficacy	Social support	Perceived benefits
Can respondent eat 5 servings of fruits and vegetables daily	**.792**	.169	.085
Can respondent eat fruits and vegetables for snacks	**.782**	.132	.128
Can respondent eat 3 servings of fruits and vegetables daily	**.731**	.070	.339
Can respondent drink fruit juice daily	**.721**	.093	.053
Can respondent eat fruits and vegetables outside the home	**.650**	.280	.095
Friends urge respondent to eat fruits and vegetables	.065	**.768**	.139
Friends eat lots of fruits and vegetables	.120	**.717**	.187
Family urges respondent to eat fruits and vegetables	.054	**.695**	.057
Family eats lots of fruits and vegetables	.353	**.659**	.102
Fruits and vegetables prevent heart disease	.052	.096	**.853**
Fruits and vegetables prevent cancer	.236	.024	**.681**
Fruits and vegetables help lose weight	.102	.022	**.651**
Variance explained[c]	24.4%	18.0%	15.3%

[a]Only low-income cases (<130% of the Poverty Index Ratio; takes into account the income and size of household; <130% poverty is food stamp eligibility criteria) were used in the analysis.
[b]Extraction method: principal component analysis (forced into three factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in six iterations.
[c]Total variance = 57.7%.

Table 4. Social/Cognitive Factors Related to Fruit and Vegetable Consumption: Medium Income (n = 578)[a]

	Factor loadings[b]		
Questionnaire item	Self-efficacy	Social support	Perceived benefits
Can respondent eat 3 servings of fruits and vegetables daily	**.801**	.160	.138
Can respondent eat 5 servings of fruits and vegetables daily	**.793**	.197	.096
Can respondent eat fruits and vegetables for snacks	**.782**	.078	.117
Can respondent eat fruits and vegetables outside the home	**.721**	.114	.069
Can respondent drink fruit juice daily	**.678**	.089	.104
Friends urge respondent to eat fruits and vegetables	.050	**.752**	.047
Friends eat lots of fruits and vegetables	.073	**.714**	.048
Family urges respondent to eat fruits and vegetables	.050	**.675**	.086
Family eats lots of fruits and vegetables	.260	**.631**	.025
Fruits and vegetables prevent heart disease	.158	.052	**.861**
Fruits and vegetables help lose weight	.142	.014	**.777**
Fruits and vegetables prevent cancer	.081	.117	**.755**
Total variance explained[c]	24.9%	16.9%	16.6%

[a]Only medium-income cases (130–300% of the Poverty Index Ratio; takes into account the income and size of household) were used in the analysis.
[b]Extraction method: principal component analysis (forced into three factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in six iterations.
[c]Total variance = 58.4%.

Table 5. Social/Cognitive Factors Related to Fruit and Vegetable Consumption: Higher Income (n = 869)[a]

	Factor loadings[b]		
Questionnaire item	Self-efficacy	Social support	Perceived benefits
Can respondent eat 3 servings of fruits and vegetables daily	**.784**	.096	.073
Can respondent eat fruits and vegetables for snacks	**.776**	.071	.100
Can respondent eat 5 servings of fruits and vegetables daily	**.772**	.210	.136
Can respondent eat fruits and vegetables outside the home	**.721**	.128	.061
Can respondent drink fruit juice daily	**.581**	.055	.061
Friends urge respondent to eat fruits and vegetables	.024	**.796**	.108
Friends eat lots of fruits and vegetables	.110	**.730**	.099
Family urges respondent to eat fruits and vegetables	.081	**.656**	.037
Family eats lots of fruits and vegetables	.317	**.621**	.086
Fruits and vegetables prevent heart disease	.077	.129	**.866**
Fruits and vegetables prevent cancer	.102	.164	**.775**
Fruits and vegetables help lose weight	.133	.077	**.762**
Variance explained[c]	23.5%	17.5%	16.7%

[a]Only higher income cases (>300% of the Poverty Index Ratio; takes into account the income and size of household) were used in the analysis.
[b]Extraction method: principal component analysis (forced into three factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in five iterations.
[c]Total variance = 57.8%.

Ten barrier items were also included in a factor analysis completed on the entire sample (Table 6), low-income sample (Table 7), middle-income sample (Table 8), and higher income sample (Table 9). A factor structure was identified that was stable across income groups. Of the ten items, four items loaded on factor 1, which is titled a "weak intent" factor because these variables address issues of weak will power and effort. Three items loaded on construct 2, and address expense and quality of fruits and vegetables. Three additional items were removed due to not loading on any factor or cross loading on more than one factor. The items not included were questions regarding confusing advice about healthy eating, needing preparation information, and how often a person eats away from home.

A "weak intent" factor and "expense/cost" factor variable was saved by income groups. Over all the income levels, the "fruits and vegetables not readily available" items did vacillate a bit in the loading pattern. In the low-income group, this item firmly loaded with the "weak intent" factor, and in the high-income group, this item loaded more strongly with "weak intent". Therefore, "fruits and vegetables not readily available" was important to include within the "weak intent" factor. The factors were saved by income group to create factor variables specific to those income levels. The income specific factor variables were used in the regression equations.

Cronbach alpha (range of 0.62-0.79) was computed to evaluate the internal consistency of the self-efficacy, weak intent, perceived benefits, cost/quality, and social support scales, and are included in Table 2 and 6. The five factors (self-efficacy, social support, perceived benefits, weak intent, and expense/cost) derived from the factor analysis represent underlying psychosocial constructs related to fruit and vegetable consumption behavior and will be used in further analysis to determine how they may predict these behaviors.

Table 6. Perceived Barriers to Eating Fruits and Vegetables: All Income Levels (n = 2389)

	Factor loadings[a]	
Questionnaire item	Weak intent	Cost/quality
Preparing fruits and vegetables takes too much planning	**.886**	.143
Preparing fruits and vegetables takes too much time	**.873**	.133
Daily consumption takes willpower	**.659**	.210
Fresh fruits and vegetables are too expensive	.125	**.820**
Frozen and canned fruits and vegetables are too expensive	.078	**.818**
Fruits and vegetables are poor quality	.289	**.604**
Fruits and vegetables are not readily available	.443	**.461**
Variance explained[b]	32.6%	28.6%
Chronbach Alpha	0.73	0.63

[a]Extraction method: principal component analysis (forced into two factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in three iterations.
[b]Total variance = 61.2%.

Table 7. Perceived Barriers to Eating Fruits and Vegetables: Low Income (n = 338)[a]

	Factor loadings[b]	
Questionnaire item	Weak intent	Cost/quality
Preparing fruits and vegetables takes too much planning	**.860**	.137
Preparing fruits and vegetables takes too much time	**.831**	.102
Daily consumption takes willpower	**.674**	.247
Fruits and vegetables are not readily available	**.565**	.300
Fresh fruits and vegetables are too expensive	.157	**.834**
Frozen and canned fruits and vegetables are too expensive	.139	**.826**
Fruits and vegetables are poor quality	.347	**.462**
Variance explained[c]	33.8%	25.3%

[a]Only low-income cases (<130% of the Poverty Index Ratio; takes into account the income and size of household;<130% poverty is food stamp eligibility criteria) were used in the analysis.
[b]Extraction method: principal component analysis (forced into two factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in three iterations.
[c]Total variance = 59.1%.

Table 8. Perceived Barriers to Eating Fruits and Vegetables: Medium Income (n = 748)[a]

	Factor loadings[b]	
Questionnaire item	Weak intent	Cost/quality
Preparing fruits and vegetables takes too much planning	**.888**	.196
Preparing fruits and vegetables takes too much time	**.873**	.181
Daily consumption takes willpower	**.705**	.233
Fresh fruits and vegetables are too expensive	.115	**.822**
Frozen and canned fruits and vegetables are too expensive	.117	**.788**
Fruits and vegetables are poor quality	.369	**.571**
Fruits and vegetables are not readily available	.343	**.520**
Variance explained[c]	33.3%	28.8%

[a]Only medium-income cases (130–300% of the Poverty Index Ratio; takes into account the income and size of household) were used in the analysis.
[b]Extraction method: principal component analysis (forced into two factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in three iterations.
[c]Total variance = 62.1%.

Table 9. Perceived Barriers to Eating Fruits and Vegetables: Higher Income (n = 1028)[a]

	Factor loadings[b]	
Questionnaire item	Weak intent	Cost/quality
Preparing fruits and vegetables takes too much planning	**.901**	.105
Preparing fruits and vegetables takes too much time	**.891**	.085
Daily consumption takes willpower	**.600**	.149
Fruits and vegetables are not readily available	**.447**	.415
Fresh fruits and vegetables are too expensive	.010	**.839**
Frozen and canned fruits and vegetables are too expensive	.127	**.807**
Fruits and vegetables are poor quality	.247	**.657**
Variance explained[c]	32.0%	28.6%

[a]Only higher income cases (>300% of Poverty Index Ratio; takes into account the income and size of household) were used in the analysis.
[b]Extraction method: principal component analysis (forced into two factors). Rotation method: Varimax with Kaiser normalization. In the rotated component matrix, the rotation converged in three iterations.
[c]Total variance = 60.6%.

Psychosocial, Educational, and Behavioral Response Differences by Income

The five factors derived from factor analysis, plus the two knowledge/awareness variables are examined by income group in Table 10 and 11. This analysis will partially answer the second research question: What differences in consumption and related factors are explained by income level? In general, care was taken in the interpretation of the significance (p value) of differences found in the analysis to address how meaningful the differences are from a public health perspective. Given the large sample size, even very small differences between income levels were found to be significant or highly significant, but may not be meaningful.

One way analysis of variance (ANOVA) with an LSD post hoc test showed there are significant differences in mean total composite values of self efficacy ($p<.05$), weak intent ($p<.001$), and cost/quality ($p<.001$) scales between low income and high income respondents. Higher income respondents have significantly higher scores in self-efficacy and lower scores regarding perceptions of cost/quality barriers. Using a likert scale (1-10), the efficacy scores were relatively low for all incomes, with no differences between income levels, for the very important question, "How sure are you that you can eat at least 5 servings of fruits and vegetables each day?" No significant differences were found between income groups in composite social support factors or composite perceived benefits scales.

LSD post hoc tests revealed there are significant differences between low and higher income respondents in two of the individual self-efficacy items and all of the cost/quality items. Low-income respondents were significantly more likely to agree that vegetables and fruit (canned, frozen, or fresh) were too expensive and that vegetables and fruit are of poor quality where they shop. There was also a significant difference between income categories in the mean weak intent composite score, with low-income respondents being significantly more likely to report that vegetables and fruit are not readily available and that daily consumption takes will power. There are significant, but small differences between low and higher income respondents regarding knowledge of the 5 a day message and awareness of the 5 a Day Program, with high-income respondents have higher knowledge/awareness than low income respondents. Even though there are differences in awareness by income level, it is important to note that both low and higher income respondents have overall low awareness of the 5 A Day message.

Table 10. Psychosocial Response Differences between Low Income[a] Respondents and Higher Income[b] Respondents: Social/Cognitive Factors

FACTORS		Mean Score (SD)		
Scales Items	F Value	Low income[a] n=310-364	higher income[b] n=993-1116	P value[c]
SOCIAL/COGNITIVE FACTORS				
Self Efficacy[d,e]	5.90	32.63 (12.5)	34.06 (10.7)	**0.041**
Can eat 5 servings Fruit/Veg daily	1.60	4.88 (3.4)	5.18 (3.1)	0.119
Can eat 3 servings Fruit/Veg daily	5.39	6.99 (3.3)	7.36 (2.9)	**0.047**
Can drink juice daily	4.85	7.23 (3.4)	7.46 (3.1)	0.240
Can eat Fruit/Veg for snacks	2.62	7.38 (3.2)	7.40 (2.7)	0.909
Can eat Fruit/Veg outside home	49.08	6.10 (3.5)	6.61 (2.8)	**0.005**
Social Suppor[cd,f]	1.54	22.06 (10.4)	21.03 (8.6)	0.086
Family urges to eat Fruit/Veg.	0.59	5.79 (3.9)	5.63 (3.6)	0.497
Friends urge to eat Fruit/Veg.	0.82	3.59 (3.8)	3.42 (3.2)	0.401
Family eats lots of Fruit/Veg.	2.88	6.96 (3.3)	6.55 (2.7)	**0.021**
Friends eat lots of Fruit/Veg.	0.21	5.27 (3.3)	5.37 (2.4)	0.553
Perceived Benefits[d,g]	0.94	23.60 (6.0)	23.73 (5.2)	0.744
Fruit/Veg. Prevent Heart Disease	0.76	7.69 (2.6)	7.86 (2.1)	0.258
Fruit/Veg. Prevent Cancer	0.97	7.47 (2.9)	7.49 (2.3)	0.946
Fruit/Veg. Help Lose Weight	1.65	8.32 (2.4)	8.24 (2.2)	0.558
Awareness/Knowledge				
Servings Fruit/Veg. a person should eat[h]	14.97	2.83 (1.5)	3.29 (1.8)	**0.001**
Aware of 5 A Day Program	8.12	1.19 (0.4)	1.28 (0.4)	**0.001**

Items are paraphrased

[a] Low Income defined as <130% Poverty Index Ratio; takes into account the income and size of household; <130% poverty is food stamp eligibility criteria; medium income analyzed, but not reported

[b] Higher Income defined as >300% Poverty Index Ratio

[c] LSD Post Hoc Test

[d] Response 0 = don't agree at all to 10=strongly agree

[e] Composite score of 5 self efficacy items

[f] Composite score of 4 social support items

[g] Composite score of 3 perceived benefit items

[h] Knowledge: number of servings fruits and vegetables respondent thinks are needed for good health

Table 11. Psychosocial Response Differences between Low Income[a] Respondents and Higher Income[b] Respondents: Perceived Barrier Factors

FACTORS *Scales* Items	F Value	Mean Score (SD) Low income[a] n=310-364	higher income[b] n=993-1116	P value[c]
PERCEIVED BARRIER FACTORS				
Weak Intent[d,e]	7.63	10.35 (10.6)	8.25 (8.1)	**0.001**
Preparation takes too much planning	0.55	2.34 (3.3)	2.17 (2.6)	0.322
Preparation takes too much time	1.74	2.78 (3.4)	2.44 (2.9)	0.065
Daily Consumption takes will power	2.40	2.69 (3.6)	2.29 (2.9)	**0.033**
Fruits vegetables not readily available	22.55	2.55 (3.7)	1.39 (2.5)	**0.001**
Cost/Quality[d,f]	35.15	11.91 (8.6)	8.18 (7.0)	**0.001**
Fresh Fruits/Veg. too expensive	30.49	4.52 (3.8)	3.09 (3.0)	**0.001**
Frozen/Canned Fruits/Veg. too expensive	29.23	4.20 (3.9)	2.81 (3.0)	**0.001**
Fruits/Veg. poor quality	16.48	3.23 (3.7)	2.17 (2.8)	**0.001**

Items are paraphrased

[a] Low Income defined as <130% Poverty Index Ratio; takes into account the income and size of household; <130% poverty is food stamp eligibility criteria; medium income analyzed, but not reported

[b] Higher Income defined as >300% Poverty Index Ratio

[c] LSD Post Hoc Test

[d] Response 0 = don't agree at all to 10=strongly agree

[e] Composite score of 4 weak intent items

[f] Composite score of 3 cost/quality items

Examination of Relationships between Total Fruit and Vegetable Consumption, Psychosocial Factors, and Demographic Characteristics

The goal of these analyses was to address research question #3, which was to determine the profile of demographic characteristics that identifies those who a) have a high fruit and vegetable consumption pattern, b) exhibit high level of self-efficacy, c) have high level of perceived personal benefits from consuming more fruits and vegetables, and d) are aware of the 5 A Day Program and message. These analyses do not adjust for multicollinearity, therefore their significance is limited to beginning to determine a profile of demographic characteristics with respect to fruit and vegetable consumption, self-efficacy, perceived benefits, and awareness/knowledge.

Total Fruit and Vegetable Consumption by Demographic Characteristics (Table 12)

There are significant differences ($p<.001$) in total fruit and vegetable consumption by gender, smoking status, and education level, and significant differences by income category ($p<.01$) and age group ($p<.05$). Non-smokers consume almost a full serving of fruits and vegetables more than smokers ($p<.001$), and females consume almost 0.8 servings more than males ($p<.001$). Those with greater than a High School education consume 0.5 servings more fruits and vegetables than those with a High School education or less ($p<.001$). The respondents >= 65 years of age consumed slightly more fruits and vegetables than those in the lower age categories <50 years of age ($p<.05$). Increasing income level is also correlated with higher fruit and vegetable consumption. Generally as income increases in the total sample, mean total fruit and vegetable intake increases, from 3.83 total daily servings in the low income group to 3.90 total daily servings in the middle income group, to 4.20 total daily servings in the higher income group. This pattern of increasing intake among increasing income categories is generally true even when broken down by gender and race/ethnicity groups (data not shown).

Self-Efficacy: Differences by Demographic Characteristics (Table 13)

Significant differences ($p<.001$) in mean self-efficacy scores were found by gender, smoking status, and educational level; with females, nonsmokers, and more highly educated respondents with higher self-efficacy scores. The F scores were particularly high by gender and smoking status, which signifies an important significant difference between males and females in self-efficacy scores, and between non-smokers and smokers, with females and non-smokers having a higher self-efficacy score. Significant differences ($p<.01$) were also seen by income level and race/ethnicity. Those respondents in the higher income level had a significantly higher self-efficacy score than those in the low and middle incomes. African Americans have a self-efficacy score significantly higher than all other race/ethnicity groups.

Table 12. Total Fruit and Vegetable Consumption[a]: Differences by Demographic Characteristics

Characteristic	Mean (SE) servings	F Value	P value
Gender		60.35	.000
Male	3.63 (.08)		
Female	4.36 (.06)		
Race/ethnicity		5.62	.001[b]
White	4.10 (.06)		
African-American	3.89 (.12)		
Latino	4.04 (.18)		
Other	4.33 (.29)		
Smoking status		102.18	.000
Nonsmoker	4.27 (.06)		
Smoker	3.29 (.10)		
Age group (yr)		7.08	.000[c]
18–34	3.91 (.09)		
35–49	3.99 (.08)		
50–64	4.21 (.12)		
≥65	4.34 (.11)		
Education (yr)		23.131	.000[d]
<12	3.67 (.14)		
12	3.78 (.09)		
>12	4.25 (.06)		
Marital status		7.331	.001[e]
Married	4.12 (.07)		
Divorced/widowed/separated	4.07 (.01)		
Never married	3.91 (.11)		
Poverty Income Ratio		13.00	.000[f]
<130%	3.83 (.14)		
130%–300%	3.90 (.09)		
>300%	4.20 (.08)		

[a]Servings per day estimated from fruit and vegetable frequency questions, including fruit, vegetables (no fried potatoes), and 100% juice. Total fruit and vegetable consumption variable was log transformed for analysis.

[b] LSD post hoc test reveals significant differences between whites and blacks (p=.000), and whites and Latinos (p=.017).

[c] LSD post hoc test reveals significant differences between the 18–34 and 50–64 age groups (p = .014), between the 18–34 and ≥65 age groups (p = .000), and between the 35–49 and ≥65 age groups (p = 003).

[d] LSD post hoc test reveals significant differences between <12 and >12 years of education (p = .000) and between 12 and >12 years of education (p = .000).

[e] LSD post hoc test reveals significant differences between married and never married (p=.000).

[f] LSD post hoc test reveals significant differences between <130% and 130%-300% Poverty Income Ratio (p = .022) and <130% and >300% (p=.000), between 130%–300% and >300% Poverty Income Ratio (p = .001).

Table 13. Self-Efficacy[a]: Differences by Demographic Characteristics

Characteristic	Self-efficacy mean (SE)	F value	Unadjusted P value
Gender		58.83	.001
Male	31.13 (.36)		
Female	34.69 (.30)		
Race/ethnicity		3.99	.008[b]
White	32.90 (.28)		
African-American	34.81 (.55)		
Latino	32.74 (.70)		
Other	32.15 (1.18)		
Smoking status		56.66	.001
Nonsmoker	34.13 (.25)		
Smoker	29.96 (.54)		
Age group (yr)		1.78	.149
18–34	32.63 (.39)		
35–49	33.20 (.40)		
50–64	34.21 (.57)		
≥65	33.31 (.65)		
Education (yr)		9.45	.001[c]
<12	32.30 (.77)		
12	31.92 (.45)		
>12	34.06 (.29)		
Marital status		3.24	.039[d]
Married	33.52 (.31)		
Divorced/widowed/separated	33.53 (.47)		
Never married	32.11 (.50)		
Poverty Income Ratio		5.90	.003[e]
<130%	32.62 (.67)		
130%–300%	32.31 (.43)		
>300%	34.06 (.32)		

[a] The self-efficacy scores were derived by summing the scores of five self-efficacy questions.
[b] LSD post hoc test: significant difference between Whites and African-Americans ($p < .001$) and between African-Americans and Latinos/Others ($p < .05$).
[c] LSD post hoc test: significant differences between <12 and >12 years of education ($p = .023$) and between 12 and >12 years of education ($p < .001$).
[d] LSD post hoc test: significant differences between Married and Never married ($p < .05$) and between Married and Divorced/widowed/separated ($p < .05$).
[e] LSD post hoc test: significant differences between <130% and >300% Poverty Income Ratio ($p < .05$) and between 130%–300% and >300% Poverty Income Ratio ($p < .05$).

Perceived Benefits by Demographic Characteristics (Table 14)

Significant differences in perceived benefits of eating 5 servings of fruits and vegetables were found by gender (p<. 001), with females perceiving a higher level of health benefits from eating vegetables and fruit, and by smoking status (p<.01), with non-smokers having a significantly higher perceived benefit score. No significant differences were noted by race/ethnicity, income category, or other demographic characteristics.

Table 14. Perceived Benefits of Eating 5 A Day[a]: Differences by Demographic Characteristics

Category	Perceived benefits[a] mean (SE)	F value	P value
Gender		56.85	.001
Male	22.45 (.20)		
Female	24.34 (.15)		
Race/ethnicity		2.36	.070[b]
White	23.40 (.15)		
African-American	23.62 (.31)		
Latino	24.48 (.40)		
Other	23.40 (.55)		
Smoking status		9.98	.002
Nonsmoker	23.78 (.14)		
Smoker	22.83 (.29)		
Age group (yr)		1.09	.350
18–34	23.36 (.20)		
35–49	23.68 (.20)		
50–64	23.93 (.34)		
≥65	23.22 (.43)		
Education (yr)		.419	.657
<12	23.47 (.51)		
12	23.39 (.24)		
>12	23.64 (.15)		
Marital status		2.32	.099
Married	23.84 (.17)		
Divorced/widowed/separated	23.28 (.28)		
Never married	23.32 (.24)		
Poverty Income Ratio		.943	.390
<130%	23.60 (.36)		
130%–300%	23.34 (.23)		
>300%	23.73 (.17)		

[a]The perceived-benefits scores were derived by summing the scores of three perceived-benefits questions.
[b] LSD post hoc test: significant difference between Whites and Latinos (p = .008).

Knowledge/Awareness of the 5 A Day Message by Demographic Characteristics

Females, whites, non-smokers, those with greater than a high school education and in the higher income categories were significantly more aware of the 5 A Day message than males, non-whites, smokers, high school education or less, and lower incomes (Table 15). Those respondents with more than a high school education were twice as likely to have knowledge of the need to consume at least 5 servings of vegetables and fruit for good health, than those with less than a high school education. Income level is correlated with knowledge of the 5 A Day message. Those in the high-income group were more than twice as likely to know the 5 A Day message as those in the low-income group.

Table 15. Knowledge/Awareness of the 5 A Day Message[a] by Demographic Characteristics

	%				
Characteristic	Aware	Unaware	DF	Chi-square statistic	P value
Gender			1	83.995	.001
Male	11.4	88.6			
Female	26.0	74.0			
Race/ethnicity			3	55.241	.001
White	24.1	75.9			
African-American	12.6	87.4			
Latino	9.4	90.6			
Other	16.2	83.8			
Smoking status			1	39.200	.001
Nonsmoker	22.6	77.4			
Smoker	10.7	89.3			
Age group (yr)			3	8.948	.030
18–34	18.3	81.7			
35–49	23.1	76.9			
50–64	20.1	79.9			
≥65	16.9	83.1			
Education (yr)			2	52.582	.001
<12	10.5	89.5			
12	14.4	85.6			
>12	24.8	75.2			
Marital status			2	2.270	.321
Married	21.2	78.8			
Div/wid/sep[b]	19.2	80.8			
Never married	18.5	81.5			
Poverty Income Ratio			2	35.440	.001
<130%	11.3	88.7			
130%–300%	17.2	82.8			
>300%	24.4	75.6			

[a] Awareness/Knowledge that 5 or more servings of fruits and vegetables are needed for good health.
[b] divorced/widowed/separated.

Awareness of the 5 A Day Program by Demographic Characteristics

Non-smokers, whites, more educated, higher income, and those in the younger age categories were more likely to be aware of the 5 A Day program (Table 16). Again, those respondents with more than a high school education were more than twice a likely to have heard of the 5 A Day for Better Health Program than those with less than a high school education. In addition, the high-income respondents were much more likely (27.8% vs. 19.2%) to have heard of the 5 A Day Program than those in the low-income group.

Table 16. Awareness of the 5 A Day Program by Demographic Characteristics

Characteristic	%		DF	Chi-square statistic	P value
	Aware	Unaware			
Gender			1	5.887	.015
Male	21.1	78.9			
Female	25.2	74.8			
Race/ethnicity			3	11.017	.040
White	25.3	74.7			
African-American	21.8	78.2			
Latino	18.4	81.6			
Other	15.3	83.8			
Smoking status			1	14.740	.001
Nonsmoker	25.2	74.8			
Smoker	17.4	82.6			
Age group (yr)			3	45.442	.001
18–34	28.8	71.2			
35–49	25.1	74.9			
50–64	20.9	79.1			
≥65	12.0	88.0			
Education (yr)			2	31.912	.001
<12	12.7	87.3			
12	21.0	79.0			
>12	27.1	72.9			
Marital status			2	26.619	.001
Married	24.7	75.3			
Div/wid/sep[a]	17.0	83.0			
Never married	28.9	71.1			
Poverty Income Ratio			2	16.151	.001
<130%	19.2	80.8			
130%–300%	21.4	78.6			
>300%	27.8	72.2			

[a] divorced/widowed/separated

Variance in Fruit and Vegetable Consumption Explained by Various Factors

A multiple regression model was used to examine associations between demographic characteristics/psychosocial constructs and fruit and vegetable consumption. Tables 17 and 18 give results of multiple regression analysis by income categories showing the percent of variance in total fruit and vegetable consumption explained by demographic covariates, social cognitive factors, and perceived barrier factors, and further addresses the second research question, "What differences in consumption and related factors are explained by income level?"

Multiple regression analysis was used to calculate the unique variance explained by psychosocial factors and demographics. Table 17 shows the variance in total fruit and vegetable consumption explained by these factors in the total sample population was 35%. Of the 35%, 8% was explained by demographic characteristics, 25% was explained by social cognitive factors, and 2% was explained by perceived barrier factors. Self-efficacy was by far the strongest single variable contributor to the total variance, explaining 17% of the variance. Other single variables which contribute substantial variance include knowledge/awareness of the 5 A Day message (5%) and smoking status (4%).

Table 18 shows some interesting differences by income category in variance explained by independent variables. Combined, the demographics, social cognitive factors, and perceived barrier factors explained 37% of the variance in total fruit and vegetable consumption in the low-income group, and 34% in the higher income group. Self-efficacy factors explained 11% of the variance in the low-income group and 14% of the variance in the higher income group. This factor measure of self-efficacy is very strongly associated with fruit and vegetable intake. Combined, the demographic characteristics explained 13% of the variance in the low-income group and 9% of the variance in the higher income group. Knowledge of the 5 A Day message alone accounted for 7% of the variance in the low-income group, and 5% of the variance in fruit and vegetable consumption in the higher income group, indicating that knowledge/awareness of the need to consume at least 5 servings of fruits and vegetables is strongly predictive of fruit and vegetable consumption.

Individually, perceived barrier factors were significant predictors in both the low and higher income groups, but explained only 2% of the variance. Cost/quality was not a significant predictor in the low income, but was in the higher income group. Program awareness was not a significant predictor in the higher income group, but was significant in the low-income group.

Table 17. Variance in Total Fruit and Vegetable Consumption[a] (R^2) Explained by Psychosocial Factors and Demographic Characteristics: All Income levels

	Fruit and vegetable intakes[a] (servings/day)		
	All income (n=1,463)		
Independent variables	$R^2\Delta$	Cumulative R^2	P value
Demographic characteristics[b]	.081	.081	.000
Income Level[c]	.014		.000
Smoking Status	.042		.000
Educational Level	.011		.000
Gender	.020		.000
Age	.003		.006
Race/Ethnicity	.001		.175
Marital Status	.003		.012
Social cognitive factors[d]	.249	.330	.000
Self-efficacy	.166		.000
Social support	.024		.000
Perceived benefits	.005		.001
Knowledge/awareness of message	.051		.000
Program awareness	.003		.020
Perceived barrier factors[e]	.015	.345	.001
Weak intent	.015		.000
Cost/quality of fruits and vegetables	.000		.464
Full model		.345	

[a] Servings per day estimated from fruit and vegetable frequency questions, including fruit, vegetables (no fried potatoes), and 100% juice. Total fruit and vegetable variable was log transformed.
[b] Demographics listed do not add up to total variance of .081, due to missing values when total model is analyzed.
[c] Income variable was log transformed.
[d] Factor analysis scores from tables 3 and 5 for self-efficacy, social support, and perceived benefits all income categories used in regression models.
[e] Factor analysis scores from tables 7 and 9 for weak intent and cost/quality of fruits and vegetables all income category used in regression models.

Table 18. Variance in Total Fruit and Vegetable Consumption[a] (R^2) Explained by Psychosocial Factors and Demographic Characteristics: Low vs. High Income Levels

	Fruit and vegetable intakes[a] (servings/day)					
	Low income[b] (n=203)			Higher income[c] (n=761)		
Independent variables	$R^2\Delta$	Cumulative R^2	P value	$R^2\Delta$	Cumulative R^2	P value
Demographic characteristics[d]	.126	.126	.000	.087	.087	.000
Income Level[c]	.003		.318	.010		.001
Smoking Status	.071		.000	.051		.000
Educational Level	.002		.396	.009		.002
Gender	.008		.094	.024		.000
Age	.000		.706	.003		.051
Race/Ethnicity	.001		.562	.001		.346
Marital Status	.015		.023	.002		.180
Social cognitive factors[e]	.250	.346	.000	.227	.314	.000
Self-efficacy	.110		.000	.144		.000
Social support	.028		.007	.015		.000
Perceived benefits	.001		.709	.014		.000
Knowledge/awareness of message	.068		.000	.054		.000
Program awareness	.012		.064	.001		.395
Perceived barrier factors[f]	.023	.369	.036	.024	.338	.000
Weak intent	.023		.010	.021		.000
Cost/quality of fruits and vegetables	.000		.811	.003		.062
Full model		.369			.338	

[a] Servings per day estimated from fruit and vegetable frequency questions, including fruit, vegetables (no fried potatoes), and 100% juice. Total fruit and vegetable consumption variable was log transformed.
[b]Low-income population defined as <130% Poverty Income Ratio. [c]Higher income population defined as >300% Poverty Income Ratio.

[d] Demographics listed do not add up to total variance of .126 and .087, due to missing values when full model is analyzed.
[e] Factor analysis scores from tables 3 and 5 for self-efficacy, social support, and perceived benefits by low and high income category used in regression models.
[f] Factor analysis scores from tables 7 and 9 for weak intent and cost/quality of fruits and vegetables by low and high-income category used in regression models.

Most Relevant Predictors of Fruit and Vegetable Consumption

To further examine the set of demographic and psychological variable main effects as predictors of fruit and vegetable consumption, a hierarchical regression analysis was done to determine the most relevant predictors of adult's fruit and vegetable intake (Table 19). Beginning with those psychological variables that were shown to be highly significant predictors in the regression analysis of the full model (Table 17); awareness, self-efficacy, social support, then income along with the rest of the demographic variables were stepped into the model, one at a time until nine models were analyzed. Race/Ethnicity was not included because it does not contribute to the variance as shown in Table 17. After rigorously adjusting for shared variance, the variables that remained highly significant in the ninth model included awareness, self-efficacy, perceived benefit, educational level, smoking status, age, and weak intent. These data show that the standardized beta coefficients for awareness/knowledge, self-efficacy, social support, smoking status, and weak intent remain robust even after adjusting for the other demographic variables.

Awareness/Knowledge of the 5 A Day message accounted for 14.4% of the variance, self-efficacy accounted for 13.2%, social support accounted for 3.1%, smoking status accounted for 0.7%, and weak intent accounted for 1.4% of the variance in fruit and vegetable consumption. Although not shown, several iterations with variables stepped in a rotated manner were completed to approximate interaction terms. These iterations revealed that awareness/knowledge, self-efficacy, social support, weak intent and smoking status maintained their significance and the change in the beta coefficient remained roughly similar regardless of order entered. This suggests that these variables are not related in any meaningful way to the other variables. These psychosocial variables are an interesting set of main effects, that may have policy-related interpretations.

Income status was a borderline significant predictor after adjusting for all variables, suggesting that income is important. The beta coefficient dropped from model #5 (when income level was stepped in) to model #9 in Table 19, suggesting that income shares variance with other variables. Future research should include examining these interactions.

Table 19. Most Relevant Predictors in Adult's Fruit and Vegetable Consumption[a]: Hierarchical Regression in All Income Levels

Model		R^2 Change	Standardized Coefficients Beta	T value	P value
1	Awareness/knowledge of 5 A Day message	.144	.380	15.71	.000
2	Awareness/knowledge of 5 A Day message		.283	12.29	.000
	Self Efficacy	.132	.376	16.34	.000
3	Awareness/knowledge of 5 A Day message		.280	12.46	.000
	Self Efficacy		.374	16.63	.000
	Social Support	.031	.177	8.16	.000
4	Awareness/knowledge of 5 A Day message		.274	12.10	.000
	Self Efficacy		.377	16.75	.000
	Social Support		.178	8.20	.000
	Perceived Benefit	.003	.055	2.53	.012
5	Awareness/knowledge of 5 A Day message		.265	11.66	.000
	Self Efficacy		.376	16.79	.000
	Social Support		.180	8.32	.000
	Perceived Benefit		.056	2.58	.010
	Income Level[b]	.005	.072	3.28	.001
6	Awareness/knowledge of 5 A Day message		.257	11.34	.000
	Self Efficacy factor		.370	16.57	.000
	Social Support		.167	7.63	.000
	Perceived Benefit		.053	2.45	.014
	Income Level[b]		.062	2.84	.005
	Smoking Status	.007	-.085	-3.83	.000
7	Awareness/knowledge of 5 A Day message		.253	11.04	.000
	Self Efficacy		.370	16.53	.000
	Social Support		.166	7.62	.000
	Perceived Benefit		.054	2.51	.012
	Income Level[b]		.048	2.01	.045
	Smoking Status		-.080	-3.58	.000
	Educational Level	.001	.034	1.38	.167
8	Awareness/knowledge of 5 A Day message		.249	10.62	.000
	Self Efficacy		.364	16.30	.000
	Social Support		.160	7.31	.000
	Perceived Benefit		.052	2.39	.017
	Income Level[b]		.043	1.75	.080
	Smoking Status		-.074	-3.31	.001
	Educational Level		.044	1.77	.077
	Age		.064	2.91	.004
	Gender	.005	.024	1.06	.291

Table 19 con't. Most Relevant Predictors in Adult's Fruit and Vegetable Consumption[a]: Hierarchical Regression in All Income Levels

Model		R^2 Change	Standardized Coefficients Beta	T value	P value
9	Awareness/knowledge of 5 A Day message		.244	10.53	.000
	Self Efficacy		.341	15.17	.000
	Social Support		.161	7.43	.000
	Perceived Benefit		.052	2.42	.016
	Income Level[b]		.039	1.63	.103
	Smoking Status		-.075	-3.36	.001
	Educational Level		.045	1.83	.068
	Age		.073	3.32	.001
	Gender		.021	0.94	.345
	Weak Intent	.014	-.123	-5.65	000

[a] Total fruit and vegetable consumption variable analyzed as a log transformed variable.
[b] Income level analyzed as a log transformed variable.

CHAPTER FIVE
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The evidence that vegetable and fruit consumption may contribute to the prevention of cancer and heart disease is drawn from hundreds of epidemiological and biological studies (Block, 1992, Steinmetz & Potter, 1991a, 1991b, 1996, van't Veer, 2000). The overall weight of the evidence has led to a major focus on vegetable and fruit consumption in U.S. federal nutrition policy, with Dietary Guidelines for Americans 2000 and Healthy People 2010 identifying vegetables and fruit for increased attention and monitoring.

The 5 A Day for Better Health Program was established in 1991 as a nutrition education campaign designed to increase awareness of the need to consume more vegetables and fruit, and to increase vegetable and fruit consumption in the United States to an average of 5 or more daily servings. In the first seven years of the program, fruit and vegetable intake increased on average by about ¼ of a serving in the total adult population, and increased even less in the low-income population (Stables, et al., in press). At this rate, it will take decades to move the U.S. population to the minimum recommendations of 5 servings daily. Awareness of the 5 A Day message increased significantly from 8% to 20% (1991 to 1997) in the adult population.

Given the lower fruit and vegetable consumption in the low-income population and the health disparities among this population, it is important to investigate the barriers and promoters to fruit and vegetable consumption among the low-income. Some research has been done to investigate underlying psychosocial constructs to fruit and vegetable consumption in the total population, however, less has been investigated by income status, and may help to inform targeted nutrition education interventions in particular income groups and by race and ethnicity. More data may also help to inform policy decisions in the low-income population.

The limitations of the survey instrument included a low response rate, and other issues. The survey used is a follow-up survey to the 1991 5 A Day Baseline Survey, with a nationally representative sample of U.S. adults' (Subar, et al, 1995). Due to a lower than optimal response rate (43.8%) in 1991, an additional Non-respondent Survey was conducted. This survey provided data showing that non-respondents did not differ significantly from respondents in their consumption of fruits and vegetables or in the number of servings they believed they should consume. Due to the low overall response rate in the Baseline Survey, several strategies were employed to improve response rates for the Follow-up Survey. These methods included a minimum of 20 attempts (vs. four attempts in the 1991 survey) to screen a randomly selected household and identify multiple telephone lines, at least 12 additional attempts to reach a respondent at a working telephone number, and two attempts at refusal conversion. A computer algorithm scheduled calls over different days and included day, evening, and weekend attempts over a minimum of four weeks. In addition, the National Cancer Institute's name (vs. the research contractor's name in the Baseline Survey) was used in the introduction of the Follow-up Survey to evoke a credible health authority. The survey length was decreased from 30 minutes to 15 minutes. Oversampling in high minority strata added to the nonresponse problem, as it was noted that the screener response rate in the high minority strata was about 10% lower than in the low minority strata.

Another major weakness is the small amount of variance in fruit and vegetable consumption (30-35%) accounted for in the survey instrument. The instrument is not capturing the vast majority of factors that account for consumption. Even though the findings should be interpreted with caution, the analysis is valuable in that it reveals provocative findings that point towards further research needs.

Summary

The objective of this study was to investigate the underlying psychosocial determinants of fruit and vegetable consumption by income via secondary analysis of a nationally representative RDD survey of adults. First, a factor analysis was done to analyze the interrelationships among a large number of items, and for data reduction purposes. Certain variables correlated highly among themselves, therefore measuring the same general construct. Select question items were reduced via exploratory factor analysis to 5 factors or underlying latent constructs, which were then used in multiple regression models, along with awareness/knowledge variables and demographic characteristics, to determine the variance in fruit and vegetable consumption explained by these covariates. In addition, chi square analysis and analysis of variance was done to determine a demographic profile of respondents by income category in consumption, self-efficacy, perceived benefits, and awareness/knowledge.

The research questions that the study was designed to address were:

1. What are the relevant constructs in adult's fruit and vegetable consumption that are being measured by the 1997 nationally representative survey for the National 5 A Day for Better Health program?
2. What differences in consumption and related factors are explained by income level?
3. What profile of characteristics differentiates individuals who a) are aware of the 5 A Day program and message, b) exhibit high level of self-efficacy, c) have high level of perceived personal benefits of good health-related behaviors, and d) eat high levels of fruits and vegetables?

The relevant psychosocial constructs found via exploratory factor analysis that were measured by the 5 A Day for Better Health Survey are self-efficacy, perceived benefit, social support, weak intent, and cost/availability of fruits and vegetables. Other constructs are awareness/knowledge of the 5 A Day health message. These underlying constructs are consistent with constructs found in similar research. De Vries, et al found that attitude (perceived benefits), social influences, and self-efficacy were predictors of behavioral intentions (De Vries, et al., 1995). Attitudinal variables, including perceived benefits, barriers (cost, availability, social support, etc) were assessed in a state-wide survey addressing fruit and vegetable behaviors (Dittus, et al., 1995). A group in the Netherlands used focus groups to study psychosocial factors in determining increased fruit and vegetable consumption and found these same underlying constructs (Brug, et al., 1995). Two large worksite studies used predisposing factors (perceived benefits, beliefs, and motivation) and enabling factors (barriers including weak intent, norms including availability, and social support) as conceptual constructs of their dietary worksite interventions (Kristal, et al., 1995; Glanz, et al., 1998; Kristal, et al., 2000).

Awareness and knowledge of the health message to eat at least 5 servings of fruits and vegetables for good health is associated with increased consumption of fruits and vegetables and is considered an underlying construct in several studies (Krebs-Smith, et al., 1995; Stables, et al., in press, Harnack, et al., 1997; Patterson, et al., 1997; Neill, et al., 2000). Lack of knowledge and awareness of key health messages has communication and educational implications. Educational interventions, including media interventions, designed to increased knowledge and awareness of the importance of consuming at least 5 servings of fruits and vegetables, may have an impact on the process of dietary change.

Income level differences

What differences in consumption and related factors are explained by income level? This research question was answered by using analysis of variance with LSD post hoc tests to determine psychosocial, education, and behavioral response differences between low income and high-income respondents. Very little research has been published on the psychosocial, education, and behavioral factors regarding fruit and vegetable intake by income level.

In an unadjusted analysis, a significant but small difference was found between low and higher income respondents in the composite self-efficacy scale and two of the individual items, with the higher income respondents having greater self-efficacy scores. There was a significant modest difference with respect to eating at least 3 servings daily, however no difference between income status with respect to eating at least 5 servings daily. Even though eating at least 5 servings daily is a stated health objective, the self-efficacy scores for this behavior were lower than all other social cognitive, social support, or perceived benefit items, suggesting that this a behavior perceived to be difficult to master. The scores for confidence in being able to eat fruits and vegetables outside the home were highly significantly different between low and high income, with high-income respondents being more confident. It can be speculated that higher income respondents may frequent family style or white table cloth restaurants where menus include more variety, including more fruits and vegetables, versus lower cost fast food-type restaurants where fruits and vegetables are scarce.

Scores for Social Support and Perceived Benefit Scales and items were not significantly different between low and high income, with the exception that low income respondents were more likely to agree that family members eat lots of fruits and vegetables. The findings between income level on the perceived benefit scales is consistent with another study whereby there was no difference by income level on an attitude scale regarding benefits of fruit and vegetables intake (Dittus, et al., 1995).

Individual knowledge/awareness items were significantly different between low income and higher income respondents, with low-income respondents being less aware of the need to consume at least 5 servings of fruits and vegetables for good health. The difference in knowledge/awareness between income groups is small, and awareness is below optimal for all incomes. Knowledge that persons should eat at least 5 servings of fruits and vegetables for good health is associated with increased fruit and vegetable consumption in populations. In this research, the higher income population on average, responded that people should eat more fruits and vegetables than did low income individuals. Indeed, higher income individuals actually consumed more fruits and vegetables. In moving along the continuum of processes of change,

awareness of key health messages is an important step in behavior change (Prochaska, et, al., 1992). Other research has shown that awareness and knowledge of dietary recommendations are significant predictors of increased intake (Patterson, et al., 1996; Neill, et al., 2000) and that parental knowledge and awareness of the need to consume more vegetables and fruit are independent predictors of children's fruit intake (Gibson, et al., 1998). In addition, a strong relationship was found between 5 A Day message awareness and stage of change in 5 A Day community-based research in adults (Campbell, et al., 1999).

Higher income respondents were slightly, but significantly more aware of the 5 A Day Program, than were low-income respondents. These income differences in both message awareness and program awareness, have several implications. It is possible that supermarkets in low-income areas do not display 5 A Day nutrition education materials. Access to interventions to increase fruits and vegetables may not be available to the low-income. The 5 A Day for Better Health Program media outreach may not be targeted to low-income, or simply is not reaching the low-income.

There were significant differences between income levels in weak intent and cost/quality composite scores, and in most of the corresponding individual questionnaire items. The low-income were more likely to agree that fruits and vegetables were too expensive, of poor quality and not readily available, and that it takes too much will power to consume more fruits and vegetables. These kinds of cost, quality, and availability barriers have major policy implications for the low-income.

Variance in Fruit and Vegetable Consumption Explained by Psychosocial Factors

Using a multiple regression model, the factors that significantly contributed to the variance in total fruit and vegetable consumption in the total sample population included demographic characteristics (with the exception of race/ethnicity), all social cognitive factors, and perceived barrier factors. Of the 34.5% of variance explained by these variables, demographic characteristics, self-efficacy and knowledge/awareness of health message all contributed the majority of variance. The self-efficacy variable was responsible for half of the explained variance.

In the low-income population, the factors that significantly contributed to the variance, included demographic characteristics (smoking status, gender, and marital status) most of the social cognitive factors, and weak intent. Of the 36.4% of variance explained by these variables, demographic characteristics, self-efficacy and knowledge/awareness of health message contributed the majority of the variance. Demographic characteristics accounted for almost 13% of the variance versus 9% in the high income, with smoking status showing the most difference between low and high-income. Social support explained 3% of the variance in the low income, but only 1.5% in the high income. Interestingly, perceived barrier factors explained only 2% of the variance in fruit and vegetable consumption in both the low and the high-income respondents.

In the high-income population, self-efficacy alone contributed almost 15% of the variance, with knowledge/awareness of the health message and demographic characteristics contributing 5% and 9%, respectively.

This research suggests that, regardless of income category, social cognitive factors, in particular self-efficacy and knowledge/awareness of the health message, are stronger predictors of fruit and vegetable consumption than are perceived barrier factors. This is in contrast to the findings by Dittus, et al., (1995), whereby barriers were the largest contributor to explaining variability in fruit and vegetable consumption. However, in this study, perceived barrier factors, do explain significant variance in fruit and vegetable consumption in both income groups.

Profile of characteristics which differentiates individuals who a) are aware of the 5 A Day program and message, b) exhibit high level of self-efficacy, c) have high level of perceived personal benefits of good health-related behaviors, and d) eat high levels of fruits and vegetables

One-way analysis of variance with LSD post hoc tests were done to determine differences by demographics in total fruit and vegetable consumption, self-efficacy, and perceived personal benefits of good health-related behaviors. The demographic profile of those who consume larger amounts of fruits and vegetables are female, non-smoker, >50 years of age, more educated, and in the higher income category (Table 12). The demographic profile of those with higher levels of self-efficacy are female, African American, non-smoker, >50 years of age, more educated, and in the higher income category (Table 13). The demographic profile of those with higher perceived benefits of eating more fruits and vegetables are female non-smokers (Table 14).

In addition, chi square analysis was done to determine demographic differences in knowledge/awareness of 5 A Day message and program. The demographic characteristics of those who are aware of the need to consume 5 or more servings of fruits and vegetables daily are female, white, nonsmoker, more educated, and higher income (Table 15). The demographic profile of those who are aware of the 5 A Day program are female, white, nonsmoker, those 18-34 years of age, more educated, and in the higher income category (Table 16).

The ANOVA and Chi square analyses establish a profile of demographics, but it would be misleading to assume that this is everybody's profile. The unadjusted, overall demographic profile of those who consume a high level of fruits and vegetable and have high levels of the mediating or predictive factors to consumption, are white, nonsmoking females who are usually older, more educated, and in the highest income category.

Most Relevant Predictors of Fruit and Vegetable Consumption

A hierarchical regression analysis that adjusted for multicollinearity was done too further analyze the data to determine the most relevant constructs in fruit and vegetable eating behavior and to explore the possibility of shared variance among variables (Table 19). The overall findings reveal that awareness/knowledge of the health message and self-efficacy are the best, most stable predictors of fruit and vegetable consumption. This suggests that further research to devise even better measures and scales of awareness and self-efficacy, and to determine the contributors to awareness and self-efficacy would result in more meaningful predictors of consumption. These factors, along with social support and weak intent, could potentially be addressed by educational interventions designed and tailored to specific demographic groups.

Policy relevant variables that are significant or borderline significant predictors of fruit and vegetable consumption include knowledge/awareness, income level, and educational level. Policies that affect these variables could include broad nutrition education efforts to increase awareness and importance of the need to consume at least 5 servings of fruits and vegetables, price supports for fruits and vegetables for all income levels, and potentially increasing minimum wage to increase buying power for fruits and vegetables.

Conceptual Framework of Fruit and Vegetable Consumption Behavior

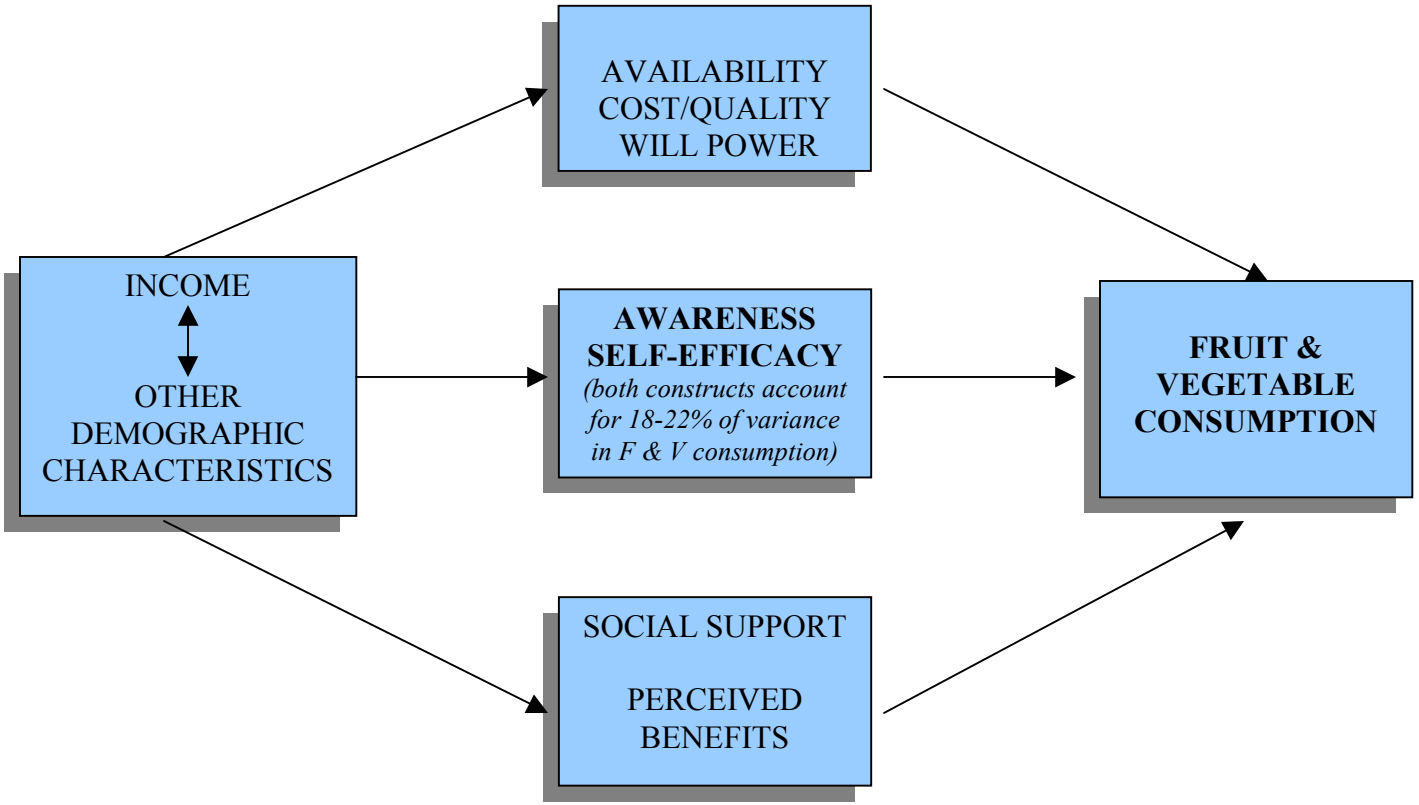
The conceptual model (figure 2) developed from these analyses, is a model incorporating domains from social cognitive theory and based on the findings from the analysis of psychosocial response differences between low income and high income respondents, and on the multiple regression model examining associations between psychosocial constructs and fruit and vegetable consumption. Due to the likely possibility of interactions between income status and other demographic variables, income is portrayed as having an influence on other demographic characteristics, and vice versa. In addition, there were many differences in psychosocial responses between low-income respondents and high-income respondents via analysis of variance

The main factors that emerged from the multiple regression analysis to predict fruit and vegetable consumption were demographic characteristics, awareness/knowledge of the 5 A day message and self-efficacy, with social support and barriers also responsible for substantial variance in intake. The implications of the model is that a person's health behavior (fruit and vegetable consumption) can be changed by changing awareness/knowledge of key health messages, a person's perceptions of social support, self efficacy expectations, and barriers. Although barriers in these analyses did not contribute substantially to variance in intake, perhaps due to an inadequate survey instrument, conceptually, barriers play a role in behavior change. Demographic characteristics are expected to influence behavior through the behavioral determinants.

The design of the conceptual model show that some of the psychosocial constructs are more significant contributors to the variance in fruit and vegetable consumption than others. The model reflects those constructs that contribute significantly to the variance in total fruit and vegetable consumption. The variance explained by both self-efficacy and awareness ranges between 18% and 20%, low income vs. high income, respectively.

A likely next research step could include a path analysis (structural equation analysis) to further investigate causal relationships between the observed variables. This next step would serve to test the postulated relationships developed from the analyses completed thus far, and included in the conceptual model. Awareness/Knowledge of the 5 A Day message and self-efficacy accounted for the largest single variable variance in fruit and vegetable consumption in the regression modeling. It would be especially important to determine the causal relationship via a path analysis, between these two variables and among the other variables.

Figure 2. Theoretical model of fruit and vegetable consumption behavior determinants



Implications for Practice

The findings from this study add support to research suggesting that specific psychosocial constructs are positively associated with increased fruit and vegetable consumption. These constructs and degree of association vary by income group. Self-efficacy and awareness/knowledge of key health messages account for the greatest variance in consumption for both low and higher income participants. Self-efficacy is a more important predictor for high-income respondents, while awareness/knowledge was more important for low-income versus higher income respondents. Social support was twice as important predictor of fruit and vegetable consumption in the low-income group versus the high-income group.

The implications of these study results are that nutrition education interventions to increase fruit and vegetable consumption in adults should include strategies aimed at increasing awareness/knowledge of key health messages, and aimed at increasing self-efficacy toward eating fruits and vegetables. Strategies to increase self-efficacy would include breaking the desired skills down into achievable steps, provide education to achieve these results, and then monitor and reward achievement of these skills. Strategies to increase social support for this behavior, and to affect weak intent are also important. The many differences between psychosocial, educational, and behavioral responses between income groups underscore the need for tailoring educational interventions by income group for greater impact. The design of nutrition education interventions by income category should include formative research to increase our understanding of awareness/knowledge, self-efficacy, barriers, and social support issues in this population.

The findings from the ANOVA analyses are suggestive that issues relating to cost/quality/availability of fruits and vegetables may be more salient in the low-income population. Nutrition education in the low income could include cost strategies (in-season, sale items, farmers market fruits and vegetables), and accessibility/availability strategies (keep frozen and canned fruits and vegetables on hand). Hierarchical regression suggests that income level interacts with other variables and is maintained as a significant predictor of fruit and vegetable consumption even after adjustment for shared variance.

Clearly, the policy issues of income, age, and educational level should be addressed. Price supports for fruits and vegetables are possible policy interventions. Providing additional or double coupons for fruits and vegetables for WIC clients has been tried on a small scale and is successful in increasing consumption among that population. Another possible intervention is to increase the redeemable value of food stamps to buy fruits and vegetables. Monetary incentives for schools to incorporate fruit and vegetable bars into cafeterias is another possibility. Including low-fat snacks at a reduced price in vending machines has also been shown to be successful in increasing consumption of healthy foods in school settings (French, et al., 2001). It may be possible to send a package of fruits and vegetables home with those who eat at senior congregate meal centers. There are many creative ways to provide price supports for purchase of fruits and vegetables, if there is political will to do so.

Policies enacted to increase awareness/knowledge of the need to include 5 servings of fruits and vegetables would mandate broad-scale nutrition education efforts through a variety of intervention channels, including media, point of sale, worksites, faith institutions, and schools. Certainly, the policy issues should be examined further for this population. However, given the relatively low overall variance that is explained in this analysis, it is not possible to make policy recommendations based upon this study.

Future Research Needs

Further research on psychosocial mediators of fruit and vegetable consumption is needed to aid in designing interventions that focus on increasing awareness/knowledge and self-efficacy. Constructing and validating scales for mediating variables of fruit and vegetables consumption is needed to accurately measure change. These measures could be used in a well designed longitudinal study to assess contributors to dietary behavior. By using the information found in this research, better tailoring may be done in developing and delivering nutrition education interventions by income level.

A research focus on determining common terminology for the psychosocial constructs for nutrition education is needed. For example, attitudes were often interchangeable with barriers, across research papers. In addition, a research focus on common measures would also improve generalizability of findings across studies. In some studies self-efficacy was determined by a single question, whereas in others, a composite score of many questions addressing self-efficacy were used.

In keeping with the above research needs, a better understanding of the relationship of mediating variables, such as the psychosocial constructs used in this study, to outcomes is needed to determine the effectiveness of educational interventions. As was true in this study, most models account for approximately 30- 35% of the variance in fruit and vegetable intake. This leaves the majority of variance unaccounted for, and therefore, work needs to be done to increase the projected predictability of behavioral and educational mediators.

Policy research to address the problems of availability, accessibility, and quality and to determine the impact of price supports on fruits and vegetables needs to be done with regard to the entire population. The change in fruit and vegetable consumption in this country has been entirely too slow. Policy changes and changes in the food environment hold promise to speed up the velocity of dietary change. Especially in the low-income population, systems level changes designed to make fruits and vegetables more affordable, and more available, have potential in narrowing the consumption gap, between the low-income population and the high-income population, and to move the entire population to recommended levels of fruits and vegetables. Alternative policy decisions, such as redeemable Farmer's Market coupons for fruits and vegetables for low-income seniors, or doubling of food stamps used to purchase fruits and vegetables, could be examined in small settings for efficacy and effectiveness. The low-income population certainly has many competing stressors in life that take priority over food consumption decisions. However, policy changes that make it easier for the low-income to purchase and consume fruits and vegetables will help to make a healthier diet more attainable.

Finally, this investigation may bolster the efforts to build a set of theories specific to nutrition education for behavior change in adults. The social cognitive theory tends to include many of the constructs that are relevant to nutritional behavior change, but given the large variance unaccounted for when using these constructs, this theory needs to be augmented by new, creative constructs, yet to be discovered, or better ways to measure the existing constructs.

Conclusions

Even though the 1997 5 A Day for Better Health Program survey instrument had major methodologic limitations, implications for practice and future research needs were identified. The psychosocial factors of awareness/knowledge and self-efficacy were the most robust predictors of variance in fruit and vegetable consumption. Further work in construction of reliable and valid scales of these two factors and other promising mediators of nutrition behavior change is warranted, to increase the amount of variance that can be explained. In terms of practice, this research suggests the importance of developing interventions that promote increased self-efficacy and awareness/knowledge of the 5 A Day message. Given the observed differences between low and higher income groups in mediators of behavior change, efforts to tailor interventions to demographic characteristics could be an important strategy in nutrition education.

The observation of potential interactions between income level and other demographic characteristics suggests policy implications that should be investigated further. Price supports and enhanced provision of fruits and vegetables to all individuals, especially the low-income, through existing nutrition entitlement programs and other novel programs are possibilities for further policy interventions and research. Making systems level changes for a more conducive environment to increase fruit and vegetable consumption in all Americans is a policy change that would enhance disease prevention and health promotion efforts.