THE CITY UNIVERSITY OF NEW YORK (CUNY) DIABETES RISK STUDY: PERCEPTIONS OF A MULTI-ETHNIC COLLEGE POPULATION

by

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Abstract

CUNY DIABETES RISK STUDY:
PERCEPTIONS OF A MULTI-ETHNIC COLLEGE POPULATION

By

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Background and Problem: College years are the time when many form detrimental health behaviors that increase diabetes risk. An understanding of students' perceptions about their risk is necessary to determine how best to address issues of healthy eating and physical activity at CUNY.

Methods and Objectives: Quantitative data from a student health survey (n=1,579) and qualitative analysis of five student focus groups (n=53) were used to achieve the study's objectives which were to determine the prevalence of risk factors for diabetes overall and by selected characteristics and to ascertain perceptions of diabetes risk, the level of diabetes risk knowledge and the presence of self-efficacy. Additionally, this study aimed to identify individual, community and institutional barriers which students face that limit their ability to adapt a healthy lifestyle.

Results: Approximately 40% of students were identified as being at high risk for diabetes; these students were significantly more likely to attended a two-year college (p=<.002), be older (p=.048) and have a lower income (p=<.001). Of the high risk students, 39% did not recognize their risk. These students were more likely to be male (p=.010), be an immigrant (p=<.001) and not report a family history of diabetes (p=>.029). Blacks had the highest number of risk factors followed by Hispanics and Asians. On average, the students were able to identity only three of 10 well established diabetes risk factors. Few were aware of the increased diabetes risk among

non-white populations and Asian students were the least likely to perceive the risk associated with their race. Students born outside the country were less active than their native-born counterparts (p=<.001), as were women (p=<.001) and Asian students (p=.030). Interpersonal and intrapersonal factors, primarily lack of time, but also lack of motivation and lack of social support were the reasons most students cited for lack of exercise while the campus environment emerged as the primary theme for poor food choices in the focus groups.

Conclusions: CUNY administrators and policymakers must make diabetes prevention a priority as the university is an ideal setting to provide the multi-level interventions needed to reduce the future burden of diabetes in NYC.

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CHAPTER ONE
A Public Health Crisis: The Diabetes Epidemic

Introduction

It is well established that diet and limited physical activity in young adults are directly linked to type 2 diabetes mellitus (diabetes) and other serious health consequences later in life. The college years are the time when many form detrimental lifestyle behaviors that persist into adulthood. Campus environments can encourage or discourage food and activity options; therefore, college campuses can be an important setting for the promotion of healthy behaviors. While it is well documented in the literature that college students have poor dietary and exercise habits, little is known about the barriers to optimal health and the enablers to eating well and being active in this population. Additionally, it is unclear if college students recognize their risk of future chronic diseases such as diabetes. An understanding of students' perceptions about their health and disease risk is necessary for public health professionals and college administrators to determine how best to address the issues of healthy eating and physical activity in this population, and how to encourage the continuance of these habits after graduation and throughout life.

Overview of Dissertation

This dissertation provides a critical review of the existing literature on the diet, weight status, physical activity behaviors and diabetes risk perceptions of college students and how their behaviors and beliefs are related to their future risk of diabetes. Additionally, the prevalence of risk factors for diabetes among students at City University of New York (CUNY) were

determined, as were students' knowledge of diabetes risk factors and their perceived susceptibility to the disease and their ability to minimize personal risk. The barriers that limit students' capacity to adapt lifestyle behaviors to decrease diabetes risk were also investigated. The subject of each chapter is listed in Table 1-1.

The data generated from this study of CUNY students can be used to inform health interventions and policy change at this and other urban universities. In addition, given the many links between urban public universities such as CUNY and the wider communities from which their students are drawn, the findings may also contribute to efforts to improve population health in cities.

Table 1-1. Dissertation Overview

Chapter One	Introduction and Background
Chapter Two	Literature Review
Chapter Three	Methods
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Public Health Significance

At the dawn of the 21st century, diabetes and its precursor, obesity, have emerged as two of the most important public health threats our nation has ever faced. Self-reported obesity prevalence in the United States is now 34% among adults age 20 years and older[1] and in New York City, more than half of adults are overweight (34%) or obese (22%), as are nearly half (43%) of all elementary school children.[2] The chronic diseases linked to obesity include: hypertension, cardiovascular disease, stroke, gall bladder disease, respiratory dysfunction, gout, osteoarthritis and some cancers.[3] Current obesity trends have spawned a parallel epidemic of

diabetes; each kilogram increase in an adult's body weight increases the likelihood of developing diabetes by between 4.5% [4] and 7.3%.[5]

Diabetes is a group of chronic, progressive metabolic disorders characterized by abnormalities in the ability to metabolize carbohydrate, fat and protein leading to high levels of blood glucose.[3] The consequences of uncontrolled diabetes are numerous and devastating; they include: blindness, heart disease, renal disease, non-traumatic lower-extremity amputations and increased mortality. Diabetes is not only a threat to one's health, but also puts a financial strain on the entire health care system. It is estimated that the overall economic cost of diabetes in 2007 was $218 billion in the United States, with reduced national productivity accounting for an additional $58 to $105 billion.[6]

In 2011, this financial burden is likely even higher as the prevalence of diabetes has more than doubled in the past decade and currently affects more than 31 million (10.2%) American adults, one-fourth of whom are undiagnosed.[7] In New York City, 700,000 (12.5%) adults have this disease and an additional 1.8 million (23%) have pre-diabetes,[8] a condition in which blood glucose levels are higher than normal, but not yet high enough to be diagnosed as diabetes.[3] More than 50% of those diagnosed with pre-diabetes progress to overt diabetes in three to five years if no action is taken to treat the condition.[3]

Although the rapid increase of diabetes is crossing all socio-economic groups, it is still most prevalent among minorities and the poor.[9] Recent data suggest that non-Hispanic African-American (16%) and Mexican-American (15.7%) adults exhibited higher age-adjusted prevalence than non-Hispanic white adults (8.8%)[10] and Asian-Americans are 30-50% more likely to have diabetes than their white counterparts.[11] While the connection between social inequality and health has been recognized since the 19th century, as rates of obesity and diabetes

have surged among minorities and the poor, social justice has emerged as a focal point of health concerns in the 21st century.[12-20] During the past 10 years, many health advocates and researchers have also turned their attention to the environmental context of diet and the access to healthy foods and opportunities for physical activity. As a result, a social-ecological model for health promotion has become popular for nutrition and physical activity interventions.[19] Also, in response to the rise in obesity and diabetes during the past decade, several significant policy documents from the United States government, health organizations and advocacy groups have called for extensive nutrition education and changes in the food environment to promote health and reduce the risk for major chronic disease.[13,16,20-24]

To plan effective interventions, the cause of diabetes must be understood. Diabetes results from a combination of a genetic predisposition to the condition and lifestyle choices shaped by policies and environments.[3] The two major modifiable risk factors are lack of physical activity and excess body weight.[3] As genetics, diet and exercise habits are individual factors, historically, diabetes has been seen as an individual problem. But these proximal factors do not explain the explosion in rates of this disease. It is not biologically plausible to assume that there has been a change in genetic makeup in recent generations, nor is it likely that a large segment of the population has simultaneously made changes in their behaviors in the absence of some contributing shared environmental factor. This has led researchers to explore mechanisms and pathways by which social conditions lead to changes in rates of diabetes. Preventing diabetes and successful outcomes for people with diabetes are difficult, if not impossible, to achieve in settings where there is no opportunity for education, limited access to healthy food, poor health care, barriers to physical activity and insufficient social and peer support.[25] The characteristics of neighborhoods, workplaces and schools have changed in recent years and these changes

negatively contribute to individual food and exercise choices.[26-28] These characteristics include income level, the built environment, access to healthy food, and exposure to marketing.[27,29] For example, nutritious foods are significantly more expensive than calorie-dense, less nutritious foods and pervasive and aggressive marketing of low cost, fatty, high calorie food is a major influence on food decisions.[30] Thus, overeating has become the norm and the obstacles that individuals face when tying to eat well are often overwhelming, especially for those with limited resources.[29] As a result, the Centers for Disease Control and Prevention (CDC) has declared that American society has become "obesogenic", characterized by environments that promote increased food intake, non-healthful foods, and physical inactivity.[31] This obesogenic environment is now recognized as a fundamental cause of the diabetes epidemic; in order to reverse this epidemic, rather than focusing only on the individual level, policies and environments must be created that support healthful eating and obesity prevention in populations.

College Students

Despite this widespread call to action to reverse obesity and diabetes trends, college students represent one group that has been largely overlooked in the fight against these parallel epidemics. The typical college aged student is making the transition from adolescence to adulthood and during this period is forming long-lasting health behavior patterns that are often associated with an increased lifetime risk of diabetes.[32-35] It has been proposed that this critical time in life, between the ages of 18 and 25 years, be considered a new and demographically distinct developmental stage called "emerging adulthood".[36] This period of life, in which young people are no longer adolescents but not yet adults, was not experienced by previous generations.

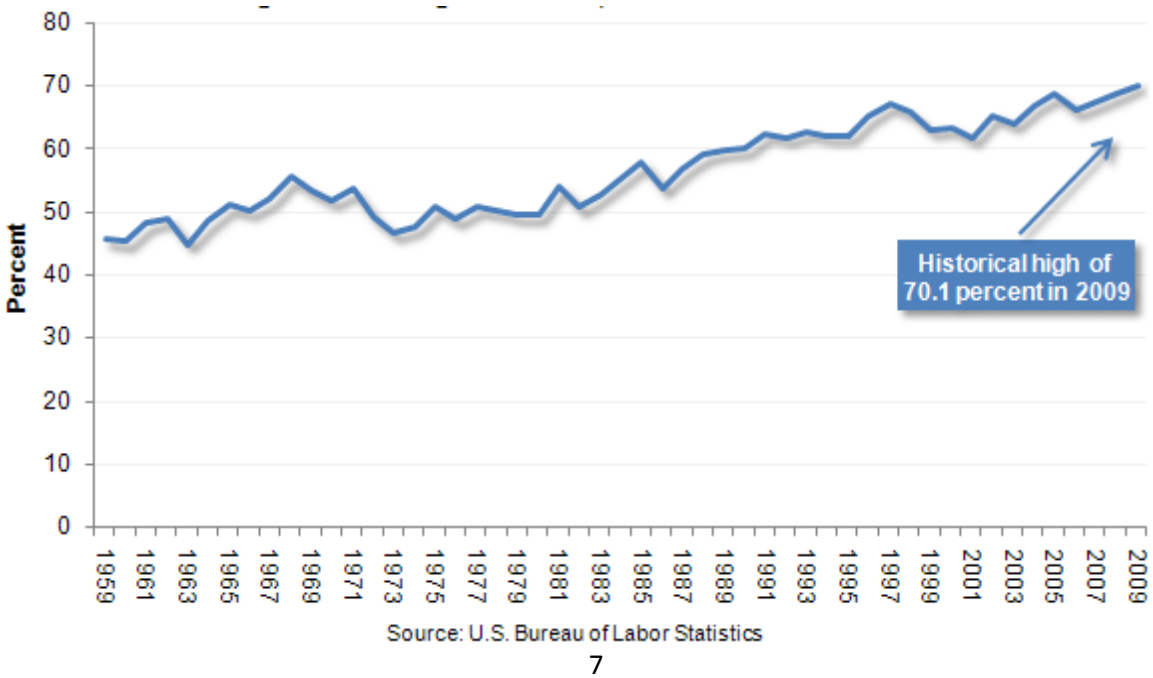
Instead of entering marriage and parenthood in their very early twenties, most people now postpone these transitions until later in life. It is a time of exploration of possibilities as well as increased anxiety and uncertainty.[36] This period is marked by critical events such as deciding to leave home and increasing autonomy in decision-making; while at the same time, adult responsibilities such as steady employment and financial independence have not been realized. One central characteristic of this life stage is the development of self-awareness, which involves exploration of new ideas and behaviors that allow young adults to express their individuality.[37] It may also be a time for changing support systems and shifting interpersonal influences regarding diet and physical activity patterns. Thus, it may represent an important timeframe for health and diabetes related behavior interventions. As so many emerging adults attend college, campus based programs are and ideal setting for theses interventions. Nevertheless, little is known about how this life stage contributes to later patterns of health and disease and whether college-based interventions can reduce the prevalence of such chronic diseases as diabetes.

College and university campuses are an ideal setting to reach large numbers of emerging adults as enrollment has steadily grown over the past two decades reaching 19.6 million undergraduate students in fall 2009. This represents an increase of more than 32% in 10 years, and is expected to increase an additional 17% by 2014.[10] Between 1998 and 2008, the number of full-time students increased by 37%, compared to a 24% increase in part-time students.[38] During the same time period, the number of males enrolled increased 29%, while the number of females enrolled increased 34%.[39] This increase in enrollment was only partially due to the 14% rise in the traditional college-age population between 1998 and 2008,[40] indicating that a larger segment of the population is now attending college.

Some may argue that young adults attending college represent only an upper socioeconomic

class who already have better health care and decreased illness and mortality, and are thus not a logical target population for primary prevention. However, college is no longer exclusively for the privileged; there have been significant changes in the racial/ethnic and social-demographic characteristics of those attending college. In the last 35 years, the number of minorities attending college more than doubled (Table 1-2) and now represent about one-third of the entire student population. In 2008, 55% of high school students in the two lowest income quintiles started college compared to only 36% in 1984.[41] Another recent academic trend is the surge in enrollment at two-year institutions. In 2009 and 2010, there was a 10% increase each year, compared to a 10% growth rate from 2000 to 2006.[42] Community colleges enroll an even more diverse group of students and have larger percentages of low-income and minority students than four-year colleges.[39] As the college population is becoming more diverse, health disparities on campus have been observed; for example, the proportion of ethnic students describing themselves at good health is about five percentage points below that of white students.[43]

Figure 1-1. College Enrollment Rate of Recent HS Graduates age 16 to 24, 1959-2009[40]



Summary

The college years are the time when many form lifestyle and health behaviors that persist into adulthood. Today's college students differ from previous generations as a higher proportion has been obese from a younger age than at any time in our history and this will likely lead to earlier and more severe health complications, such as diabetes, latter in life.[44] These emerging adults may be ill-prepared to prevent diet-related illness as they have been brought up during a period of declining rates of family meals and surging rates of fast food consumption leaving them without basic nutrition knowledge, no food preparation skills and unhealthy eating habits. Thus, by mid-century, if steps are not taken to reverse current trends, college-educated young adults will suffer the grim consequences of a lifetime of obesity and perhaps, for the first time in two centuries, be a generation that lives shorter, less healthy lives than their parents.[44] The environment at CUNY can influence behavior and either facilitate or hinder healthy diet and activity choices. College campuses can be an important setting for the promotion of healthy behaviors and reducing future diabetes risk. However, research is needed to identify which students should be targeted and what type of college-based intervention will be most effective and sustainable.

Table 1-2. Percentage Distribution of Students Enrolled in Degree-Granting Institutions, by Race/Ethnicity: Selected Years, Fall 1976 through Fall 2007[41]

Race/Ethnicity	Institutions of Higher Education					Degree-Granting Institutions				
	1976	1980	1990	2000	2002	2003	2004	2005	2006	2007
White	82.6	81.4	77.6	68.3	67.1	66.7	66.1	65.7	65.2	64.4
Total Minority	15.4	16.1	19.6	28.2	29.4	29.8	30.4	30.9	31.5	32.2
Black	9.4	9.2	9.0	11.3	11.9	12.2	12.5	12.7	12.8	13.1
Hispanic	3.5	3.9	5.7	9.5	10.0	10.1	10.5	10.8	11.1	11.4
Asian/Islander	1.8	2.4	4.1	6.4	6.5	6.4	6.4	6.5	6.6	6.7
Indian/Alaskan	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Nonresident	2.0	2.5	2.8	3.5	3.6	3.5	3.4	3.3	3.4	3.4

CHAPTER TWO
Literature Review

Introduction

This review of literature describes what is known about the diabetes related behaviors and beliefs of emerging adults and provides recommendations for improving the campus food and fitness environment. According to the United States Department of Education, there were more than 4,400 degree-granting colleges and universities in the United States, enrolling close to 20 million students in fall 2009.

Selected Determinants of College Students' Health

College students may believe that they are healthy and invincible,[45] but research indicates a somewhat different picture of today's young adults. There is a growing body of evidence that a large segment of emerging adults have metabolic risk factors for chronic disease, consume poor diets and are inactive and overweight.

First, new evidence suggests that for young people, the behavioral and biological factors associated with chronic diseases likely begin early in life and certainly in young adulthood, not in middle age, as previously thought.[46] As adolescents progress from high school-age to college-age negative changes in health often occur.[47,48] For example, coronary heart disease has been shown to begin in young adulthood,[34,46,49,50] it has been reported that 26% to 40% of college students have one or more components of the metabolic syndrome;[51*] and elevated blood cholesterol in this population is more common than once thought.[49,50] A study conducted at the University of New Hampshire between 2005 and 2007, found high rates of overweight (33%),

[*] Metabolic syndrome is characterized by a group of metabolic risk factors in one person. They include: abdominal obesity, dyslipidemia, elevated blood pressure, insulin resistance, prothrombotic state and proinflammatory state.

Table 2-1. Studies of College Students' Eating Behaviors					
Study	**Subjects**	**Race**	**Location**	**Living in Dormitory (%)**	**Findings**
Butler et al., 2004[52]	54 female freshman	white 93% black 4%	Bloomington, IN	100%	Revealed deficiencies in the intake of daily vegetables, fruits, breads, pasta and meats compared to Food Guide Pyramid recommendations.
Brown et al., 2005[53]	503 students in nutrition course 14% male	not reported (campus is 88% white)	Provo, UT	19%	A study of a 3-day dietary records found that the average intake of almost all students was short of Food Guide Pyramid recommendations.
Strong et al., 2008[54]	43 students gender not reported	white 84%	Blacksburg, VA	100%	Fruit and vegetable intake well below recommendations, fiber intake half of recommendations, mean sodium exceeded recommendations and energy from added sugar was twice the energy excess of 174 kcal/day.
Brunt et al., 2008[48]	557 students 40% male	white 96% black 1.5%	Canada	35%	Only 33% of the students consumed at least one fruit in three days.
Racette et al., 2008[55]	203 students 32% male	white 75% Asian 11% black 6%	St. Louis, MO	100%	Only 29% of students consumed at least 5 servings of fruits and vegetables daily and 50% consumed both fried foods and high-fat fast foods at least twice during the past week.
ACHA, Spring 2008[39]	80,121 students 35% male	white 76% Asian 12% Hispanic 6% black 5%	106 colleges	46%	Most students (94%) reported eating less than five servings of fruits and vegetables daily.
ACHA, Spring 2010[37]	95,712 students	white 71% Asian 13% Hispanic 6% black 5%	139 colleges	61%	Most students (94.8%) reported eating less than five servings of fruits and vegetables daily.
Burke et al., 2009[56]	1,701 students in nutrition course 28% male	white 95%	Durham, NH	69%	Results of a 3-day dietary analysis indicated protein and vitamin A intake met by most students, only 48% of males and 26% of females met vitamin D recommendations, sodium intake was excessive while calcium, folate and potassium intake was low.
Nelson et al., 2009[57]	992 two and four year college students 41% male	white 64% Asian 16% black 14%	Minnesota	22%	Overall findings from the EAT II survey and the Youth-Adolescent FFQ indicate students at four-year colleges reported better dietary intake than those at two-year colleges; however, they were all far from meeting national recommendations for numerous foods and nutrients.

elevated low-density lipoprotein cholesterol (53%) and high systolic (47%) and diastolic (39%) blood pressure in a sample of 1,701 students.[56] It has also been documented that several additional risk factors for diabetes and other chronic diseases emerge during this period[46,49,50,58] and persist into adulthood.[32-35] These include tobacco use,[59] hypertension and high stress levels,[56,60] and excessive alcohol consumption.[61-64]

Second, research indicates that today's college students typically consume a poor diet (Table 2-1). [33,55,56, 39,65] These studies reveal that students' diets are generally lacking in fruits, vegetables, calcium and fiber and contain excessive fat, sodium and sugar. Skipping meals and consuming unhealthy snacks and fast foods, which increase nutritional risk, are other dietary behavior characteristic of college students.[54] In the University of New Hampshire study, few students met recommended intakes for vitamin D (26%), calcium (25%), potassium (35%), iron (31%) and folate (32%).[56]

In the two largest studies of college students, the Spring 2008 (n=80,121) and the Spring 2010 (n=95,712) American College Health Association (ACHA)–National College Health Assessment Surveys, only 8.5% and 6.0% of college students, respectively, reported meeting recommendations for servings of fruits and vegetables daily.[39,65] Illustrating how little attention has been given to the food behaviors of college students, asking about fruit and intake was the only question out of a total of 65 questions in the ACHA health surveys that pertained to diet. The Spring 2002 and 2003 ACHA surveys reported demographic differences in consumption.[66] Full-time students were more likely than part-time students to have higher fruit and vegetable consumption; black students reported significantly lower fruit and vegetable consumption than their white or Asian counterparts and both black and Hispanic students consumed fewer fruits and vegetables than did students identified as multiracial and those belonging to other groups.[66]

Additionally, students who lived in residence halls reported healthier intake than did students living off campus.[66] These results are similar to two additional studies which revealed that students who resided on-campus (and had purchased a meal plan) consumed more fruits and vegetables than those who lived off-campus.[53,67] In one study, of 585 primarily white students, those living off-campus also had a higher BMI than those living on campus and those living with their parents, a limitation of this study is that they did not look at income levels.[67]

There may also be differences between students enrolled in two-year colleges, compared to those in four-year colleges, although only two studies were found comparing these two populations.[57,68] In the larger and most recent survey (2011), data were collected from 16,539 students from 27 campuses (14 two-year college campuses and 13 four-year college campuses), in Minnesota.[68] Students attending two-year schools, particularly females, had a higher prevalence of overweight/obesity, lower levels of physical activity, more television viewing and higher intakes of soda and fast food, compared to students attending four-year colleges ($p < 0.05$).[68] Females attending four-year colleges were more likely to engage in certain unhealthy weight control behaviors (taking diet pills, binge eating, self-induced vomiting) compared to females attending two-year institutions.[68] Generally, those attending two-year institutions have lower incomes compared to those attending four-year schools. Therefore, income, not college type, may be the significant factor. Unfortunately, income was not reported in the study.

The reasons why students make poor food choice have been explored in a few small qualitative studies.[69-71] The common themes that emerged in these studies were that an over abundance of food, ready access to high fat and calorie food and a lack of fruits and vegetables on campus played an important role in the promotion of unhealthful eating and frequent overconsumption. These qualitative studies and the studies listed in Table 2-1 are limited by their

focus on predominantly white students living on campus in non-urban environments. Therefore, these results cannot be generalized to a racially and ethnically diverse student population, such as the one at CUNY. The diet and eating habits of diverse student populations requires a more systematic evaluation. Specifically, the difference in diet intake and behaviors, and the choices among different groups of students need to be understood to inform interventions that can help emerging adults develop and maintain healthy dietary behaviors. affects

The third factor that can be detrimental to the health of today's college students is their lack of physical activity.[72,73] Exercise habits of college students and factors influencing activity levels in this population have been examined by several researchers.[52,74-76] The American Heart Association, and the American College of Sports Medicine jointly recommend a minimum of 150 minutes of moderate physical activity each week or at least 20 minutes of vigorous-intensity exercise on three or more days per week.[77] Available data indicate that most college students do not achieve this goal. Only about 40% to 50% of students participate in any kind of regular exercise, with 30% or more not participating in any physical activity at all on a regular basis.[72,74,78]

It is import to note that there is an extreme decline in physical activity between high school and college.[79,80] Nelson, et al. examined vigorous physical activity during high school and college among 10,437 students attending 119 four-year colleges using gender-stratified logistic regression analyses.[81] While 74% of males and 68% of females reported engaging in vigorous physical activity in high school, only 52% and 44%, respectively, did so in college; and while 51% of these students engaged in athletics in high school, the proportion dropped to only 15% in college.[80] This trend informs us that finding ways for incoming freshman to maintain the activity level they were accustomed to in high school should be a primary goal of intervention for this

group because maintaining an exercise regimen is likely less of a challenge than beginning one as a junior or senior after years of inactivity.

Some, but not all, studies indicate lower rates of physical activity in minority compared to white students.[73] For example, in one large study (n=2,827), students were instructed to select the highest value that described their current physical activity levels. The values ranged from 0 (no regular physical activity) to 7 (regular, heavy physical activity, such as running more than 10 miles per week). Ethnic and racial specific rates of no physical inactivity (reported scores of 0 or 1) for the month preceding the study for women were Asian, 28.1%; black, 23.5%; Hispanic, 20.3%; and white, 17.4%.[74] For men, rates of inactivity were Hispanic, 13.8%; Asian 11.7%; white, 12.0%; and black, 7.7%.[74] Asian women, who were the least active of all the groups, also reported being the least active as young girls.[74] Nelson also documented that Asians, both female and male, were less likely to engage in vigorous physical activity in college and Asian women in particular were also inactive in high school.[80] As Asian women may have less exposure to exercise and sports prior to college, different strategies may need to be employed to engage them in an active lifestyle during college and throughout life. Most studies of racial/ethnic differences in health-related behavior fail to consider the heterogeneity of categories like Asian and Latino, each of which includes many sub-groups which may differ significantly.

Other examples of cultural difference among women were discussed in a qualitative study that examined how culture informs the decision to initiate and adhere to exercise programs among black and Hispanic college women.[82] Hispanic students, particularly those who were born outside the United States, were less likely to have participated in competitive sports or vigorous exercise in the past because they were less likely to have family members who were role models for physically active lifestyles than black women. Foreign-born women were more likely to

believe that certain vigorous physical activities were "unfeminine," whereas both foreign-born and American-born Hispanic women were more likely to cite family responsibilities as constraints to exercise.[82] Black women reported that they enjoyed the competition and camaraderie of exercise, but felt pressure to conform to white standards of beauty which made them feel uncomfortable in most gyms.[82] It has also been observed that female and white students place more importance on appearance-related motives to exercise compared to male and black students, which may be in part attributable to societal and cultural influences.[83] This gender difference was also significant in a study of over 2,000 college students.[84] Males reported being motivated by intrinsic factors such as strength, competition, and challenge and females by extrinsic factors, such as weight management and appearance.[84] According to a 2005 meta-analysis, most studies report lower rates of activity in women compared to men, with 22-48% of college-aged women compared to 10-37% of college-aged men reporting no physical activity in the past month.[73] Additionally, men and women engage in different types of activities. Women are significantly more likely to participate in aerobics and moderate activities such as walking, whereas men are significantly more likely than women to participate in weight lifting.[73] Understanding these cultural and gender differences is important for health professionals who craft strategies to promote physical activity in college students.

Only a few studies have examined changes in physical activity during the college years. Using a longitudinal study design, Racette et al. observed a decline in aerobic exercise during the first two years of college among both men and women at a medium-sized private university in St. Louis.[55,72] The changes in physical activity in this study may have also contributed to the significant weight gain observed during the first two years of college among these students.[44] In a follow-up study, Racette et al. continued to track the students throughout their senior year and

saw an additional decrease in physical activity.[55] However, the study was limited by the fact that only 204 of the 764 students evaluated as freshman returned as seniors. Although these, and other studies, indicate a similar change in exercise patterns during college,[73] No study was found that provided explanations for the change or if different groups experienced different types of change, two factors that are significant when developing physical activity programs.

Also important to note is that the intensity and duration of physical activity appear to be related to the proximity of exercise facilities.[76] Additionally, adequate transportation, perceived enjoyment, self-motivation, weather and campus safety are often cited as factors that limit physical activity among college students.[73] In the only study found of predominately black students (n=514), those living off-campus reported exercising more often than their peers living on-campus.[47] These findings suggest the importance of opportunities for activity and recreational facilities on campus, as well as qualified staff to help students in starting and maintaining a regular fitness program. It has also been observed that most college students are less active on weekends compared to.[85] Recognizing these determinants of physical activity in the college student population is necessary to develop successful interventions that promote physical activity.

Lastly, the health of today's college students and their risk for diabetes is a function of their body weight. As college students are eating more and moving less, it is not surprising that their weight is increasing. The rates of obesity among the young, which have more than tripled since 1980,[22] illustrates that the era of youth as a protective factor against weight gain has ended. The Behavioral Risk Factor Surveillance System indicates that the greatest increases in obesity occur in individuals between the ages of 18 and 29 years, during the transition from adolescence to adulthood when many attend college.[86] Using an eight year longitudinal study, Hill et al.

estimated that American adults gain, on average, at a rate of approximately 1.8 to 2 lb (0.8 to 0.9kg) per year between the ages of 20 and 40 years of age.[87] However, those starting college appear to gain weight more rapidly compared to others their age who are not attending college, with a mean weight gain of approximately 4 to 9 lb (1.8 to 4.1 kg) during their freshman year at college.[88,89]

The transition from high school to college includes many lifestyle changes that influence weight. In high school, students generally have fewer choices and more structure as they are still living at home. Compared to high school students, college students play less organized sports, eat more, sleep more, wake up later and stay up later, and their vigorous physical activity declines markedly.[54,80,90] These factors result in poor dietary choices, physical inactivity, increased caloric intake, increased stress and disturbed sleep patterns and have all been identified as contributing to weight gain in college-aged people.[60,89,91]

Findings from the Spring 2010 ACHA survey, representing 95,712 respondents from 139 institutions, indicate that more than 33% of college students are overweight or obese (Table 2-2).[65] This is an alarming increase from the 2000 ACHA survey in which approximately 27% of students reported being either overweight or obese.[92] The greatest increase was seen in the number of obese women, which almost doubled in the past 10 years bringing them close to the rates in male students. A similar increase in female obesity rates over time was seen in 18-24 year old females in the New York City (NYC) Community Health Survey; however in NYC more women are obese in this age group than men.[93] The higher rates of overweight and obesity in those age 18-24 years in NYC and in the Nation compared to college students is likely due to racial and ethnic differences in the samples; the NYC sample was only 38% white, compared to the ACHA sample which was 71% white. Although the ACHS study was large, less than 6% of

participants were Hispanic and only 5% black.[65] Because of the diverse student body at many urban colleges, overweight and obesity rates are likely to be much higher than the ACHA findings, as body weight is generally higher among blacks and Hispanics as compared to whites.[22] This was illustrated in the Fall 2007 ACHA survey which indicated 44% of blacks were either overweight or obese compared to 30% of whites;[94] unfortunately racial differences were not reported in subsequent surveys. Although Asians tend to have lower rates of obesity, it is now known that this group develops diabetes at a lower BMI.[11] This, plus the findings that they tend to be inactive, makes them a group vulnerable to diabetes.

Although inactivity and poor dietary choices have been frequently observed in college students, the reasons for these behaviors have not been thoroughly explored. Therefore, an important goal of college health research must be to investigate factors that influence health-promoting behaviors either positively or negatively.

The limited data describing the barriers and enablers to a healthy lifestyle on college campuses that is available is primarily qualitative and gathered through focus group studies. This methodology is useful as it draws upon respondents' beliefs, attitudes, knowledge, experiences and feelings by utilizing the group dynamic. Focus groups have long been associated with qualitative approaches to public health research as they provide a rich understanding of people's lived experiences and perspectives, situated within the context of their unique circumstance and settings.[95] More recently, focus groups have also been recognized as an ideal methodology for environmental health researchers in the development of programs, policies, social campaigns and strategies for limiting exposures to unhealthy products or messages.[96]

Specifically, focus groups are useful in understanding the behaviors of college students, a natural group composed of participants who are similar to each other.[95] The homogeneity of

Table 2-3. Focus Group Studies Of College Students and Barriers to Eating Well and Physical Activity, 2000-2010			
Author	**Subjects**	**Objective**	**Key Findings**
Davies[97] 2000	n = 7 FG, n= 49 male mainly white 100% lived on campus University of Oregon	to identify health concerns, barriers to seeking help and recommendations to help college men adopt healthier lifestyles	The greatest barrier to seeking services was the men's socialization to be independent and conceal vulnerability; the most frequently mentioned suggestion for helping men adopt healthier lifestyles were offering health classes, providing a health information call-in service and developing a men's center on campus.
D'Alonzo[82] 2008	n = 3 FG, n= 26 female 57% Hispanic 43% black 66% lived on campus Rutgers University	to examine the cultural knowledge that informs exercise behaviors among black and Hispanic college-age women	Latinas were found to be more likely to view vigorous exercise as "unfeminine" and cited family responsibilities as barriers. Black women enjoyed the competition and camaraderie of exercise, but felt pressure to conform to White standards of beauty. There appear to be distinct differences in the cultural beliefs that inform exercise behaviors among these women.
Kolodinsky[98] 2008	n = 1 FG, n=15 81% female, 94% white 18-20 years old University of Vermont	to determine when, why and if nutrition labels impact student food purchases	Students were interested in the provision of nutrition labels in the university food court; those exposed to labels noticed them and often referred to them when making purchases; price and convenience played a role in food purchases; calories and fat were most important to the study population.
Strong[54] 2008	n = 2 FG, n= 13 50% female, 84% white 100% lived on campus mean age=18.6 years Virginia Tech	to identify theory-based targets for health behavior change in college students	Regularly engaging in exercise was difficult due to poor planning/time management, satisfaction with body image, lack of accountability, and feelings of laziness. Dietary patterns generally met recommendations but were low in fruits, vegetables and whole grains. Social support for exercise and dietary habits were important factors and a decline in exercise and dietary habits relative to high school were reported.
Cluskey[99] 2008	n = 4 FG, n=19 52% female 84% white, 16% Asian 68% lived on campus mean age=19.1 years Oregon State University	to determine gender differences on college weight gain and behavior transitions	While college student activity levels differed from the past, there was consistent agreement that eating healthful diets was perceived to be a greater challenge in the transition to college. Male students were less concerned about weight and used fewer strategies to control weight gain than females. There was complete agreement that coming to college was an important and somewhat difficult transition in their lives, relative to health.
Nelson[69] 2009	n = 6 FG, n=40 90% female, 86% white 100% lived on campus mean age=19.4 years University of Minnesota	to identify key factors underlying college weight gain, nutrition, and physical activity	Modifiable environmental factors notably did not emerge as key barriers to physical activity; a substantial proportion of the sample experienced weight gain during the transition to college; an abundance of food on campus played an important role in the promotion of unhealthful eating and frequent overconsumption.
Greaney[70] 2009	n = 16 online FG, n=115 55% female, 94% white mean age=19.7 years 8 universities (8 states)	to identify barriers and enablers for healthful weight management among college students	Few sex differences were identified when considering barriers and enablers to weight management; intrapersonal barriers (not eating healthful food; not exercising), inter-personal barrier (social situations) and the environmental barriers of time constraints associated with being a student and ready access to unhealthful food were cited.
Walsh[71] 2009	n= 6 FG, n=47 100% male, 94% white 72% lived on campus 18-24 years old University of Maine	to identify factors affecting healthy weight maintenance in college men	Healthful eating and physical activity barriers included lack of fruit and vegetables, too many tempting foods, lack of time and being lazy.

students from the same institution can often foster discussion and interaction because of shared experiences and goals. Group discussions are also more likely to present a comfortable environment for students than an individual interview because students are accustomed to group interaction in the classroom setting.[95] Additionally, the group process helps to explore and clarify students' views and attitudes efficiently and often encourages participation from all group members, even those who may feel that they have little to say.[100]

Despite the advantages of focus group research, to our knowledge, only eight focus group studies (Table 2-3) exploring barriers and enablers to eating well and physical activity have been conducted with college students between 2000 and 2010. While these studies provide insight to the students' perception and experiences they face regarding diet and activity choices, they cannot be generalized to CUNY students because of vastly different demographics. Of the 325 students who participated in these eight studies, over 78% were white and 92% resided in campus housing. Additionally, the subjects were young with a mean age of 19.4 years (Table 6-1). CUNY students are somewhat older, more diverse and live off-campus. The barriers that limit their ability to recognize and adapt a healthy lifestyle on campus and minimize their future diabetes risk is largely unknown at CUNY and on campuses throughout the country.

The data presented above make it clear that emerging adulthood is an important and vulnerable period for the development of the three most significant modifiable risk factors linked to diabetes: poor diet, physical inactivity and obesity. More than 70% of high school graduates now enroll in college, making college campuses an ideal setting to target large numbers of emerging adults at risk for diabetes. However, little work to date has sought to understand the determinants of these risk factors in emerging adults and even less has been done on minority

students in urban settings. Also unknown, is whether these students are aware of their risk for future diabetes.

Table 2-2. Overweight and Obesity Prevalence and Trends Data							
ACHA Survey College Students, 2000 & 2010							
Year	% Overweight			% Obese			% Overwt+Obese
	Male	Female	Total	Male	Female	Total	Total
2000[92]	28.3	14.1	19.9	9.2	6.1	7.3	27.2
2010[65]	28.3	18.3	21.9	12.2	11.2	11.6	33.5
NYC Community Health Survey, 18-24 years, 2002 & 2009							
Year	% Overweight			% Obese			% Overwt+Obese
	Male	Female	Total	Male	Female	Total	Total
2002[93]	32.5	22.1	27.1	8.2	10.0	9.1	36.2
2009[101]	27.8	25.5	26.6	15.9	17.9	16.9	43.5
Behavioral Risk Factor Surveillance System – NYS, 18-24 years, 2000 & 2009							
Year	% Overweight			% Obese			% Overwt+Obese
2000[102]	25.6			9.1			34.7
2009[102]	20.5			16.0			36.5
Behavioral Risk Factor Surveillance System – U.S., 18-24 years, 2000 & 2009							
Year	% Overweight			% Obese			% Overwt+Obese
2000[102]	26.3			11.4			37.7
2009[102]	25.3			17.7			43.0

Diabetes Risk Perception

For several decades it has been reported in the health and psychology literature that people tend to underestimate their own risk of developing injury and disease.[103] At an individual level, this optimism may be realistic or unrealistic. However, if a group of people collectively sees their relative risk as more favorable than that of comparable others, it is unlikely to be realistic as

the majority cannot be at a less-than-average risk. The psychologist, Weinstein, writing in the 1980's, was first to identify this phenomenon and referred to it as "unrealistic optimism" or "optimistic bias" about susceptibility to harm and a tendency to claim that one is less at risk than one's peers.[103,104,105] He found that not only do people believe that negative events are less likely to happen to them, but they believe that positive events are more likely to happen to them than to others. This phenomenon has been identified for many negative events including: motor vehicle accidents,[105] the consequences of tobacco use,[106] HIV/AIDS,[107] stroke,[108] heart disease[109] and prostate cancer.[110] Studies have shown stronger optimistic bias for problems that are considered preventable, controllable, unfamiliar, uncommon and embarrassing,[111] and individuals who underestimate their risk are likely to defer seeking care, complying with medical recommendations and engaging in preventive behaviors.[104,106,112]

Different explanations for this optimistic perception have been presented. According to some psychologists, people judge their own susceptibility for a disease lower than the susceptibility of others in order to increase one's self-esteem.[107,113] An individual's self-esteem is threatened when a known danger is not averted, especially if the problem is avoidable. So, unrealistic optimism allows people to maintain their self-esteem by not having to admit that their lifestyle, behaviors or choices are negative enough to put them in danger.[107] It has also been theorized that being optimistic about one's health is a valuable defense mechanism since denial of actual risk allows individuals to cope with stressful situations by lessening their anxiety and protecting them from negative or unpleasant information.[111] It is believed that this defense-mechanism can have a positive influence on personal health outcomes, as positive affect seems to be associated with improved health.[111,114,115] However, it is also plausible that being unaware of one's risk for a specific condition may be due simply to lack of information or experience with the disease.

According to the Health Belief Model, if this underestimation of risk is widespread, it has important implications for health intervention and behavior modification programs. The Health Belief Model is a cognitive theory used in a wide range of health contexts, including preventive and screening activities. It posits that in order for an individual to take action to avoid a disease, the individual needs to 1) believe that he or she is susceptible to the disease (perceived susceptibility); 2) believe that the disease could have at least a moderately severe impact on some component of his or her life (perceived severity); 3) believe that certain behaviors could be beneficial in reducing his or her perceived susceptibility or severity in the event of contracting the disease (perceived benefits); 4) believe that these behaviors would not be impeded by factors such as cost, pain or social isolation (perceived barriers); 5) be exposed to factors that prompt action (cues to action); and 6) be confident in his or her ability to successfully perform an action (self-efficacy).[116]

So, the greater the perceived susceptibility and the perceived severity of the condition, the greater the likelihood of taking action. Conversely, those with an optimistic or unrealistic bias regarding a condition or a disease are less likely to adopt health promoting actions. The final part of the Health Belief Model, cues to action and self-efficacy, would also likely be contingent on one's realistic view of risk. Cues to action may be internal, such as responding to a physical symptoms, or external, such as accepting encouragement to attend a diabetes screening. It is reasonable to assume that if the target population does not acknowledge that they are at any risk or that they have little control over their health, they are unlikely to recognize that the call to action pertains to them. This would likely mean that social marketing campaigns and policy changes such as signage to encourage use of stairs and calorie labeling would not be effective for those with low self-efficacy or an unrealistic view of their susceptibility to such diseases as

diabetes, as they are likely to believe that the message is for others who are at more risk or for those that have the ability to control the condition. It is therefore important to understand what determines a person's perception of risk and how these perceptions can be made more realistic and to what extent faulty risk perceptions is present in emerging adults.

Although the majority of empirical studies find positive associations between risk perceptions and behaviors as the health belief theories suggest, there are inconsistencies as all types of relationships have been reported. Nevertheless, a review of the literature informs us that:[116-117, 121-125]

- perceived risk seems a necessary, although not sufficient, condition for behavioral change
- most individuals' perception of risk for disease is frequently and substantially incongruent with their actual risk
- under-estimators of risk often defer seeking care and complying with medical guidance
- under-estimators of risk are less likely to take preventive action because they interpret warnings as applying more to others than themselves
- a clear understanding of the psychology of risk perception is essential for the effective communication of all health information

The findings mentioned above have long been considered robust, but the widespread prevalence of unrealistic disease perception has recently been questioned, and it has been suggested that people's judgments may be more rational than previously assumed.[118] At the core of these concerns lies the fact that the negative events that form the focus of risk perception studies are generally rare events and most studies do not assess a person's actual risk. Without knowing a person's true risk or being able to see into the future it is impossible to determine whether a specific individual is accurate in stating that he or she is less likely to experience a given event than the average person. For example, Weinstein looked at lung cancer, and reported unrealistic optimism.[117] While lung cancer is a commom form of cancer and the leading cause of cancer mortality, it is predicted that less than 7% of the general population (17% of tobacco

users) will contract this disease.[119] Thus, if 94% of a population state that they are not likely to develop lung cancer, this seems optimistic but this prediction may actually be realistic. Under-sampling minority populations may be another factor contributing to the optimism often reported. Most studies have focused primarily on white populations that are typically least likely to develop many of the health problems being studied.[118]

The tenets of the Health Belief Model that both susceptibility and severity need to be high for the individual to consider altering his or her behavior may be necessary; but, it provides only part of the picture. The individual serves as the object of this theory and it does not take into account the numerous cultural, social, environmental and economic factors that can influence the development or continuance of health behaviors. These factors often create barriers that can decrease the individual's ability to engage in preventive behavior and may account for inconsistent findings regarding the relationship between perceived risk and severity and behavior change. Although the Health Belief Model does take into account barriers, it focuses on the individual's perception of the barrier and does not explore the ramifications of environmental obstacles to good health, which the individual has little or no control over. The Health Belief Model also informs us that cues to action are the specific stimuli that are needed to trigger the desired health behavior. It does not factor in, however, the ubiquitous environmental cues to undesirable health behaviors that individuals face daily.

It is doubtful that a single theory can explain the extensive range of all health behaviors; and it unlikely that one theoretical framework can be used to design interventions for preventing diabetes. Public health research and programs are most likely to be valuable if they not only target individuals but also seek to understand and utilize an ecological framework.

Many questions remain unanswered regarding diabetes risk perception. Is an unrealistic perception regarding disease, in particular diabetes, as widespread as some believe? Do perceptions of risk of diabetes and recognition of risk factors vary between different races, ethnicities and cultures? What are the characteristics of those who underestimate their risk? There is a need to find answers to these questions in order to develop models of behavioral change that are relevant to the needs of specific populations in reducing their risk of diabetes. With obesity and diabetes rates growing disproportionately among minorities, it becomes imperative to develop culturally accessible and effective methods of primary prevention to minimize risk.

Currently, little is known about the population of interest in this study, urban college students and their beliefs about diabetes. What is needed when planning health programs and policies on campus are: an understanding of how susceptible the target population feels to the health problem, whether they believe it is serious, and whether they believe action can reduce the threat at an acceptable cost.[116] Specifically, we need to learn:

- what proportion of students at urban universities, like CUNY, are at risk for diabetes
- whether students have the knowledge to identify risk factors associated with diabetes
- if students recognize their individual risk for diabetes
- the extent of students' understanding of how to decrease their risk
- the role of risk perceptions in shaping health behaviors
- whether lack of education or psychological factors are the root cause of inaccurate risk perception

A review of the literature was not helpful in answering the above questions as no study was found regarding diabetes risk perception or knowledge of diabetes risk factors in the college student population. There are data regarding the personal risk perceptions related to diabetes

among physicians,[120] primary-care patients,[121] pharmacists,[122] women with histories of gestational diabetes,[123,124] African-Americans[125] and Arab-Americans.[126] Although these findings on perception of diabetes risk may not be generalizable to the college student population, given the differences between students and the general adult population in terms of age, lifestyle, income and life experiences, it is still useful to examine them.

Eight studies on diabetes risk perception or risk knowledge were found that were published between 2005 and 2010.[121-125,127-129] Earlier studies were not included in this review, as they were not considered relevant since the prevalence of recent diabetes health campaigns may have changed diabetes awareness. Also, only studies that used a measure of actual risk were evaluated because, as mentioned above, without knowledge of a person's probable risk it is not possible to judge the reality of their perception.

This review summarized in Table 2-4 shows a distinct disconnect between objective and perceived risk of diabetes in six of the seven studies that measured this relationship.[122-125,128,129] In five of the studies, subjects' risk for future diabetes was assessed either by identifying known risk factors, biochemical measures or both. In one study, family members of those with diabetes were compared in Ireland (random sample), a low risk country, and Bahrain (convenience sample), a high risk country.[129] In each study, subjects' perceived risk was compared to the researchers' estimation of their risk. It was found that between 40%-89% of participants under-estimated their risk and believed that they were not likely to get diabetes when in fact they had a greater than average chance of developing the disease in their lifetime.

Hivet et al. were the only investigators to find a population with an accurate understanding of their risk.[121] However, this study is limited in several important ways. First, the subjects were patients receiving care from an internal medicine primary care practice, so it is likely that they

were previously counseled about their risk factors by their physician. Plus, the study was the smallest of the five reviewed with only 150 subjects. Finally, the subjects were highly educated and mainly white, those at least risk for diabetes, on average.

Table 2-4. Diabetes Risk Perception Studies 2005 to 2010

Author	Subjects	Risk Assessment	Risk Knowledge	Risk Perception	Associated Behavior
Graham, et al. 2006[125]	African-American n=225	Risk assessment questionnaire use to determine those at high risk.	Not measured.	**Unrealistic:** 1/3 of those who did not believe that they were at risk for diabetes and 40% of those who believed they would never develop diabetes were actually at high risk.	Not measured.
Baptiste-Robert, et al. 2007[127]	African-American n=1,122	Those with a parent or sibling with diabetes were considered at high risk.	Subjects were asked to identify 7 risk factors; those with a family history were more aware of all risk factors for diabetes.	Not measured.	Having a family history of diabetes was significantly associated with more daily consumption of fruits and vegetables and participation in diabetes screening.
Kim, et al. 2007[123]	U.S. women with a history of GDM (83% white) n=217	35% - 60% of all subjects will likely develop diabetes.	90% of women recognized that GDM was a risk factor for diabetes.	**Unrealistic:** Although all were at very high risk only16% believed that they would get diabetes.	Greater risk perception was associated with more frequent plans to modify future behavior.
Adriaanse, et al. 2008[128]	Dutch n= 4,435 low risk n= 2,607 high risk (30% or more estimated to get diabetes within 6.4 years)	Data were collected in subjects of a screening program for diabetes which included glucose testing.	Not measured.	**Unrealistic:** 43.0% of all 7,042 subjects reported that they did not know their risk of diabetes. Only 10.8% of the high risk group believed they were at risk.	Not measured.
Hivert, et al. 2009[121]	White primary care patients n=155	Measured metabolic risk factors (anthropometric and biochemical) to determine risk level.	Not measured.	**Realistic:** Primary care patients with high perceived risk to develop diabetes actually were at higher risk.	Those with high perceived risk did not modify their lifestyle more than the patients with low perceived risk.

Table 2-4. Continued					
Whitford, et al. 2010[129]	Bahrain n=244 Ireland n=364	Relatives of those with diabetes and there is a higher prevalence of diabetes within Bahrain (15.2%) compared to Ireland (5.7%).	Risk Factor Knowledge is higher in Bahrain than in Ireland.	**Unrealistic:** The increased prevalence of family hx, knowledge about DM and perception of seriousness is not associated with an increased perception of risk.	No difference in intention to adopt risk reducing behaviors between the two countries were observed.
Pinelli, et al. 2009[122]	Pharmacist (86% white) n=218	Actual risk was assigned according to the American Diabetes Assn. Diabetes Risk Test.	Not measured.	**Unrealistic:** A trend toward more optimistic bias was reported.	Perceived risk is associated with willingness to engage in diabetes prevention activities.
Morrison, et al. 2010[124]	Australian women with a history of GDM n=1,176	35% - 60% of all subjects will likely develop diabetes.	The majority of women in this study recalled being advised of an increased risk of diabetes.	**Unrealistic:** Only 26% of women perceived their risk as high.	No association between the perception of being at high risk of developing diabetes and sufficient physical activity or diet quality.

An additional finding from this review is that risk perception appears to be a parameter distinct from both diabetes risk knowledge and presence of personal risk factors. For example, in the two-country study, respondents in Bahrain had a better knowledge of the risk factors for diabetes and an increased perception of the seriousness of diabetes.[129] In spite of this increased knowledge of risk, the Bahraini considered themselves no more susceptible to diabetes than those in Ireland who had less diabetes knowledge and less risk.[130]

The most striking cases of the disconnection between having knowledge of risk factors and associating them with one's personal risk are the studies of gestational diabetes. Approximately 7-18% of pregnant women in the United States develop high blood glucose levels during pregnancy, which then return to normal after the birth.[131] This condition is known as gestational diabetes. Women with a history of gestational diabetes are likely to develop it again in subsequent pregnancies and have a 35% to 60% chance of developing overt diabetes in the next

5 to 20 years.[131] Therefore, women with gestational diabetes are considered an extremely high risk group.

Kim et al. found that, among 217 well educated, white women with previous gestational diabetes, only 16% believed that they had a high chance of developing diabetes in the future.[123] What makes this remarkable is that 90% of the women recognized that gestational diabetes was a strong risk factor for future diabetes.[123] Similar findings were reported by Morrison et al. in a large study of Australian women, also with a history of gestational diabetes.[124] *This indicates that knowledge of diabetes risk factors or warning signs do not predict perception of risk.* Research with other diseases support these findings.[108,109,125] For example, in a study of awareness of risk for stroke, neither knowledge of risk factors nor the number of risk factors correlated with risk perception,[108] suggesting that risk perception is a subjective measure, which is not entirely modulated by disease knowledge or actual risk.

Denial of risk, in the presences of knowledge, lends credence to the theory that risk perception is a psychologically influenced coping mechanism that allows people to be unrealistically optimistic in order to deal with stressful situations, minimize anxiety and eliminate the need to change behavior. Thus, knowledge of risk factors for diabetes may not necessarily be sufficient to alter risk perception.

Data supporting an alternative interpretation also exist. Several studies found that having a family member with diabetes is a significant predictor of a realistic diabetes risk perception.[121,124,126,128] This implies that proximity of the disease may help foster an accurate estimate of one's personal susceptibility to diabetes. Additionally, in a study of Arab-American men, having a family member with diabetes predicted their willingness to engage in diabetes prevention activities[126] and African-Americans with a family history of diabetes were also more

aware of diabetes risk factors and more likely to engage in certain health behaviors than were African-Americans without a family history of the disease.[127] Risk perception was not determined in either of these studies. These finding indicate an optimistic perception of future health may not strictly be a coping mechanism as some have suggested, but rather due simply to lack of information or experience with a condition. If this is the case, then *risk education is a necessary first step in diabetes prevention programs.*

Health behavior theories indicate that perceived high risk for diabetes should encourage people to take action to reduce their risk, but again the data are mixed and risk perceptions may not necessarily translate into healthy behaviors. In the study of Arab-Americans and African-Americans, knowledge of risk factors influenced behavior;[126] but this was not seen in the primary care patients.[121] Although the patients in the study acknowledged their increased likelihood of diabetes, they did not engage in preventive behaviors any more than those who did not believe that they were at risk.[121] The inconsistency of these findings and the lack of association with these variables may reflect the complex relationship between knowledge, risk perception, environmental factors and preventative behaviors. Alternatively, it may be the result of the shortcomings of cross-sectional data in examining such associations, especially when trying to assess dynamic associations like risk perception and risk behavior.

There is evidence that changing perceptions can lead to important and widespread behavior changes. Consider the numerous breast cancer campaigns targeting women, such as "Race for the Cure" and the pink ribbon campaign. They are examples of pervasive education and outreach programs that have greatly altered breast cancer risk perception.[132] As a result of these efforts, women now perceive breast cancer to be one of the biggest health concerns they face today, despite the fact that six times more women die of stroke and heart disease.[132] This unrealistic

pessimism regarding risk of breast cancer has been reported in female college students as well.[133] Additionally, in the case of breast cancer, this perception of high self-risk has been shown to be a consistent predictor of mammography screening.[132] This indicates that helping people recognize their risk can lead to behavior change.

Risk is a complex multidimensional phenomenon and the interpretation of risk varies greatly. An individual's perceived risk with regard to a particular health condition, such as diabetes, is likely based upon a variety of factors including actual health behavior, individual health beliefs, culture, previous experiences and access to health-care. Although the literature points to some groups, primarily Hispanics and African-Americans, as having a rather unrealistic perception of their health risk[109,125,134-136] the findings are inconsistent. The bases for disparities in risk perception that have been observed are also unclear. It is clear however, that understanding the cultural, social, economic, motivational and education factors regarding disease risk and behavior change is a critical aspect of designing useful interventions. The content and style of risk communication can be enhanced by understanding these factors and addressing them. Research is needed to fill gaps in knowledge about the characteristics of those with an optimistic bias and to determine if unrealistic perception of risk affects behavior and to identify factors that should be targeted for intervention.

Campus Interventions

Many of the nation's young adults, whether they recognize it or not, are on course for a future of diabetes. The good news is that diabetes can be prevented, delayed or alleviated, through lifestyle changes focusing on weight loss and increased physical activity.[31] However, the solution is not simple, as the reasons why people eat poorly and are inactive are intertwined with the environment in which they live, work, learn and play. The built environment, for example, is

recognized as an important contributor to one's level of exercise because it can either facilitate or impede physical activity. The way our buildings and surroundings are designed can give people more or fewer opportunities and choices to be active; ready access to parks and trails may facilitate walking for exercise; bike paths and bike racks can make riding to school possible and well-it and easily-accessible stairs can reduce elevator use. To stave off chronic diseases, such as diabetes, requires that the environments of our communities, workplaces, schools, and social venues facilitate choosing a healthy and active lifestyle.

Recognizing this, there is broad support within the public health community for social-ecological approaches to improve eating and physical activity behaviors.[116] An ecological perspective involves more than simply educating individuals about healthy practices; it emphasizes the interaction between, and interdependence of, factors within and across all levels of a health concern. While lifestyle choices directly affect disease prevalence, individual behaviors are often determined by multiple levels of influence, including factors characterized as individual, interpersonal, institutional or organizational, community, and public policy [116] Additionally, reciprocal causation, which suggests that people both influence, and are influenced by those around them, is a key factor in this theory.[116]

Ideally, the college campus should be an environment that supports the development and maintenance of a healthy body, mind and spirit for all students, thus enabling them to engage in their studies and life more completely. Colleges and university administrators can and should create an atmosphere where the healthy choice is the easy choice. By doing so, they lay the foundation necessary for sound individual behaviors that lead to the physical, mental and academic health of their students. There is evidence that administrators at colleges and universities understand the value and need for facilitating good food choices and increased

activity on campus. Point-of purchase food labeling,[137,138] healthy vending machine snacks,[139] increased access to campus recreation facilities,[140] dietitian services,[141] food and nutrition classes[142] and peer educators[143] are examples of programs and policies that are available on campuses throughout the country (Appendix A). Unfortunately, these initiatives, especially those at the policy or institutional level, are rarely evaluated in a scientific manner so their effectiveness is largely unknown.

Interventions at the individual level have been more systematically and rigorously evaluated; specifically, food and nutrition courses and activity programs. Although nutrition knowledge does not necessarily lead to healthy diet choices, knowledge is logically considered an important step in influencing behavior change and has been the center of some college health campaigns. Yet, very little is known empirically about college students' nutrition knowledge and the relationship between improved dietary knowledge and eating patterns as the finding are limited and mixed (Table 2-6). There is some evidence that CUNY students lack the nutrition skills necessary to read a food label, identify nutrients that are linked to chronic disease and estimate the calories in the food they consume. Fifty CUNY students from 10 campuses attending a *Diabetes & Health Workshop* in January 2010 were given a general nutrition knowledge pre-test, although these students participated in the workshop because of their interest in health issues, many were unable to "pass" the test (Table 2-5). Additionally, a recent study of 222 Queens College students that focused on trans fat had similar results.[144] Only 37% of the students scored high on their knowledge of trans fats, despite the fact that 26% of this sample had taken a college level nutrition course.[144] Tellingly, 81% of the Queens students stated that they did all or some of the grocery shopping for their household,[144] and therefore should have had numerous exposures to and knowledge about food labels. In a study of 400 Hunter College

freshmen, Yeh et al. found that 96% of participants had no knowledge of the USDA's 5-A-Day For Better Health program, indicating an unawareness of a well publicized nutrition campaign.[145] Improved nutrition literacy may lead to a change in behavior in college students, but the evidence is scarce. Nevertheless, in one study of the diets of 200 college students, it was

Table 2-5. Nutrition Test Scores 2010 (n=50 students from 10 campuses)

Test	Nutrition Majors Mean Score (range)	Non-Nutrition Majors Mean Score (range)
Label Reading Skills	72% (20-100)	61% (40-100)
General Nutrition Knowledge	75% (63-90)	64% (44-88)
Combined	74% (57-91)	64% (45-87)

concluded that nutrition knowledge is indeed related to healthier food choices.[146] It was observed that, for fruit, dairy, protein and whole grains, increased nutrition knowledge is associated with the likelihood of meeting dietary guidelines and more healthful eating patterns.[146] Based on results of this study, the authors recommend nutrition education to improve eating behaviors of all college students. Several authors have assessed nutrition education courses and dietary behavior improvement, the findings, listed in Table 2-6, are fairly consistent.[147-154,155] While most report a positive change in behavior, these studies are limited as none of them followed the students to see how long the dietary improvements persist. In most cases, diet behavior was assessed soon after the intervention was completed. It is not known if any significant improvement was sustained overtime.

Although there is little proof that nutrition knowledge alone leads to behavior changes, it clearly is a good start and some institutions do require their students to complete a nutrition course or at least allow the use of a nutrition or health class to fulfill a general core requirement.

Many institutions also require credits in physical education. Currently within the CUNY system, one four-year college has the option of using a nutrition course to meet a general education requirement, three community colleges require a health class for some of their students and six require at least one physical education class (Appendix B). In summary, we have little in the way of evaluated public health initiatives to promote ideal weight and activity levels on college campuses to inform program development.

Recommendations

Recognizing the declining health of today's college students, in 2000 the ACHA identified a set of 10-year health targets to achieve during the first decade of the 21st century.[43] College campuses across the country were challenged to improve health for all students. A midcourse review of this *Healthy Campus 2010* project made it clear that many of the goals are completely out of reach.[43] In fact, all of the nutrition, weight and diabetes indicators worsened. Consistent with the change seen for the general population, as reported in the *Healthy Campus 2010* midcourse review,[43] the proportion of students at a healthy BMI range decreased from the baseline 65.2%. In 2007, the proportion with a normal BMI was 62.4% moving away from the 2010 target of 75%. The proportion of students eating five or more servings of fruits and vegetables daily declined by 4% remaining under 5% of all students surveyed.[43] Clearly, this review indicates that changes must take place in our colleges and universities to improve student health and prevent further decline.

Although there has been a great deal of attention to environmental determinants of dietary behavior, the empirical evidence about environmental factors on college campuses is limited. Little research has sought to determine which aspects of the food environment are most influential,

Table 2-6. Nutrition Education Studies					
Study	**Subjects**	**Intervention**	**Knowledge Change**	**Behavior Change**	**Follow-up**
Matvienko et al., 2001[147]	49 female freshman, (intervention n=21, control group n=19)	a one semester nutrition science course	not measured	The intervention group had lower fat, protein, and carbohydrate intakes in women with a high BMI compared to women with a high BMI in the control group. Dietary changes were associated with maintenance of baseline body weight in the women with a high BMI in the intervention group in contrast to a weight gain in the women with a high BMI in the control group(P=0.012).	16 months from baseline
Abood et al., 2004[148]	women's soccer team (n=15) and a women's swim team (n=15)	eight 1-hour nutrition educational sessions	significant (p=0.05) increase in nutrition knowledge based on pre/post test comparisons in the experimental and control group	There was a significant (P=0.03) overall difference in the number of positive dietary changes favoring the experimental group.	8 weeks from baseline
Hivert et al., 2007[149]	115 non-obese freshman (intervention n=58, control group n=57)	small group educational /behavioral seminars, 23 meetings over two years>	not measured	The control group gained weight, the intervention group lost a slight amount of weight over two years, resulting in a significant difference in weight (P=0.04). No detectable difference in fitness, activity or caloric intake. Triglycerides increased in the control group and decreased in the intervention group (P=0.04).	2 years from baseline
Franko, et al., 2008[150]	476 students from six colleges	mystudentbody.com-nutrition, an internet-based nutrition and physical activity education program	intervention subjects were more likely to increase their social support and self-efficacy for dietary change (p=0.05) and improved their attitude toward exercise (p=0.05)	Intervention group increased their fruit and vegetable intake by .33 servings (P<0.01) at post test but no difference at 3 or 6 months relative to the control group. Improved motivation to change eating behaviors was seen at post test and at 3 and 6 months (P=0.05). No behavioral changes in physical activity were noted at any point.	program completion, 3 months and 6 months

Pawlak et al., 2009[151]	53 students	an introductory nutrition course offered to all students but only required for students in health-related majors	not measured	Intakes of fiber, folate, potassium and calcium were statistically improved; intake of saturated fat was higher than the recommendation at baseline and slightly lower than the recommendation post intervention. Fiber increased by nearly 50% and folate increased by 80%, and it was close to the recommended amount in the post intervention.	last week of class
Ha et al., 2009[152]	80 students	15-week class based nutrition course	not measured	Total milk consumption, specifically fat free milk, increased in females. Males changed milk choices favoring skim milk over low fat, soft drink consumption decreased overall.	last week of class
Kicklighter et al., 2010[153]	34 freshman	75-minute nutrition module presented by nutrition graduate students as part of new student orientation	students reported increased knowledge of food portions and healthier breakfast and snack food choices	Several students said they were unlikely to change until it was necessary, others expressed an immediate interest in changing eating habits, some stated they have begun to consume regular meals and healthy snacks, avoid soft drinks and started cooking themselves.	focus groups 2 to 5 weeks after the nutrition education module
Heckler et al., 2010[156]	100 students (intervention n=28, control group n=72)	food, society and policy course which focused on food-related social issues, but did not focus on health issues and thus was designed as a stealth intervention	not measured	The students who took the course reported significantly improving their healthful eating (P=0.02), with greatest improvements in increased vegetable (P=0.001) and decreased high-fat dairy (P=0.02) intakes relative to the comparison group.	last week of class
Gow et al., 2010[155]	170 freshman	four treatments: no treatment, 6-wk online intervention, 6-wk weight and caloric email feedback and 6-wk combined feedback and online intervention	not measured	The combined intervention group had lower BMIs at post-testing than the other three groups.	end of semester

how environmental factors interact with individual factors, or about the most achievable interventions and policies for students, as indicated in Table 2-6. The research conducted, mainly in other settings, point to three environmental approaches to healthful eating that may be both feasible and effective on college campuses: 1- pricing policies to increase access to healthful foods; 2- providing point-of-purchase nutrition information; and 3- limiting access to sugar sweetened beverages.

The food environment on campus can be improved by reducing the cost of healthy options either by college subsidies or by negotiating with food service vendors. Decreasing cost increases accessibility. This type of price manipulation is warranted because the cost of a calorie has been shown to be substantially lower when obtained from unhealthful, high energy foods as compared to more healthful, lower energy foods.[30] The effectiveness and feasibility of cost reduction interventions have been demonstrated in several studies.[157-163] In a study of restaurant purchases it was reported that a 25% price reduction for salads was associated with a doubling in sales,[164] while a 50% price reduction in fruit and salad in a university cafeteria led to a threefold increase in fruit and salad purchases.[165] A vending machine study examined a range of price reductions and point-of-purchase promotions on sales of lower-fat vending machine snacks in 24 worksites and secondary schools in Minnesota.[159] The price reductions resulted in an increase in the percentage of lower-fat snack sales. Overall, snack sales volume also significantly increased in the 25% and 50% price reduction range, while average monthly profits per machine did not change.[159] In a second school-based study, when the price for fresh fruit and baby carrots was cut by 50% in two high school cafeterias, sales of fresh fruit increased four-fold and sales of the carrots doubled.[161] Sales returned to baseline levels with the restitution of usual prices.[161] One school was located in a primarily white, middle-income suburban area, while the other school

was located in an urban area with a mixed racial/ethnic and socioeconomic population;[161] demonstrating the potential of price reductions in young people of varying backgrounds.

In a study of 18-23 year olds, food prices and food availability in neighborhoods were compared to fruit and vegetable use.[166] The results showed that higher levels of fruit and vegetable consumption were associated with lower fruit and vegetable prices and that this price effect was robust to the inclusion of other food prices and food outlet availability.[166] In this and other studies, lower income and lower educated young adults and those with lower educated mothers were found to be most price sensitive and the effectiveness of pricing policies were larger for low-socioeconomic status populations as well as for those at risk for overweight or obesity.[166,167]

The profitability of lowering prices as a strategy to encourage healthier food choices is a genuine concern. Increases in sales volume may offset decreases in profits resulting from price reductions on targeted foods, but it is likely that colleges and universities will need to provide subsidies or increase prices of high-fat and high-sugar foods and beverages to replace lost revenues. A mix of subsidies and price increases may encourage positive dietary behaviors while discouraging negative ones. This was illustrated by the results of a large cross-sectional study of adolescents, which suggests a 10% increase in the price of a fast food meal leads to a 3.0% increase in the probability of frequent fruit and vegetable consumption, a 0.4% decrease in BMI and a 5.9% decrease in probability of overweight.[168]

The argument for point-of-purchase nutrition information is that awareness of the amount of fat and calories is most useful at the point of choice, and therefore should be displayed on menus or menu boards near the food. Although the empirical evidence is mixed regarding the overall effectiveness of point-of-purchase information,[169] it is generally considered to have the potential

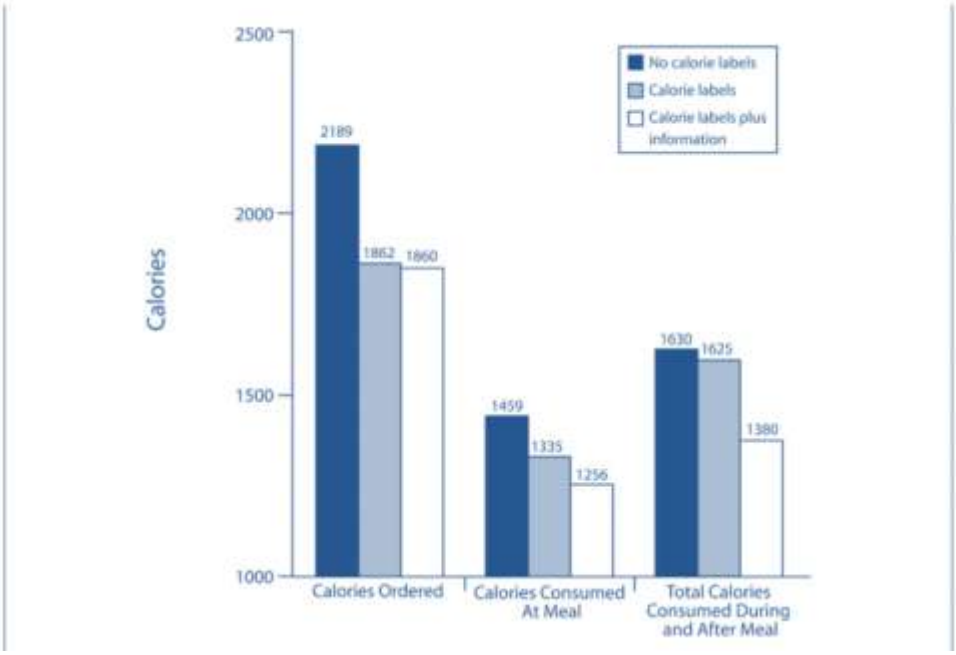
to influence healthful eating patterns in entire populations.[169] For example, since inception of New York City's calorie labeling regulation in 2008, approximately one million adults see calorie information each day.[170] Among fast food customers who saw calorie information post-enforcement, 27% said they used the information, which represents a two-fold increase in the percentage of customers making calorie-informed choices (10% vs. 20%, weighted; $P < .001$) compared to pre-enforcement.[170] Legislating the provision of point-of-purchase information has moved from local municipalities and states to the federal government. The Patient Protection and Affordable Care Act of 2010 (PL111-148) requires calorie labeling on chain restaurant menus, menu boards and drive through displays, as well as on vending machines.[171]

Most college cafeterias will not be required to adhere to the new federal labeling legislation; nevertheless, they should require their foodservice venders to display point-of-purchase nutrition information. It is a simple and relatively inexpensive method for disseminating useful dietary information when and where it can be instantly utilized. Two point-of-purchase studies were conducted on campuses. The first, an 11-week quasi-experimental design was used to assess the impact of point-of-purchase information.[172] Baseline and intervention computerized sales data were obtained from an on-campus convenience store located at an urban university with a diverse student body (23% Asian, 16% Hispanic, 29% white) were compared.[172] Although not statistically significant ($P>0.082$), the intervention resulted in a 3.6% increase in sales from lower calorie items.[172] In the second study, 205 university students were surveyed regarding their use of nutrition labels in the dining hall; almost 60% reported using the labels to make healthier choices.[173]

Ideally, in addition to calorie labeling, a recommended daily caloric requirement label should be posted in campus cafeterias and stores. The importance of this was demonstrated in a recent

study conducted in Connecticut.[174] Participants were randomly assigned to either (1) a menu without calorie labels, (2) a menu with calorie labels or (3) a menu with calorie labels plus a label stating the recommended daily caloric intake for an average adult.[174] The calorie label group and the calorie label plus information group consumed 124 and 203 fewer calories, respectively, than did those in the no calorie label group.[174] Moreover, when calories consumed during and after the study meal were combined, participants in the calorie labels plus information group consumed an average of 250 fewer calories than those in the other two groups (Figure 2-1),[174] indicating just how useful nutrition information is to college students.

Figure 2-1. Calories Ordered and Consumed by Menu Type, New Haven CT 2007-2008[174]



Emerging adults are an extremely desirable market for the food industry, particularly soft drink producers. Billions of dollars are spent each year targeting this demographic using integrated marketing communications strategies.[175] These strategies include creating special products and packaging for age groups; adjusting price points so products are affordable to youths with limited budgets; making products available in the places frequented by youths; and

conducting numerous promotions so that young people will remember, prefer and predictably select specific companies' brands.[175] Of particular and growing interest to marketers are Hispanic and African-American adolescents and young adults who are considered early adopters and trendsetters.[175] Ethnically targeted advertising is now omnipresent across traditional and new media, such as social networks, and the populations most at risk for overweight and obesity are subject to environments where marketing of unhealthy foods and beverages is pervasive and constant.

Due in large part to these marketing techniques, the single highest source of excess calories and consequently obesity and diabetes in young peoples' diets comes from sugar sweetened beverages.[176,177] The highest consumers of sugar sweetened beverages are adolescents aged 12 to 19 years (13% total calories), particularly males, who are low-income or obese.[176] Among racial/ethnic groups, the percentage of sugar sweetened beverages drinkers and per capita consumption of sugar sweetened beverages is highest among blacks followed by Mexican Americans (14% to 16% total calories).[176] Consumption of sugar sweetened beverages has been associated with an elevated risk of coronary heart disease,[178] metabolic syndrome,[179] diabetes,[179] gestational diabetes[180] and hypertension.[181] In addition, the results of a recent trial demonstrated that a reduction in sugar sweetened beverages consumption among adults was significantly associated with weight loss.[182] This empirical evidence makes it clear that strategies are needed to counter the target marketing of sugar sweetened beverages to emerging adults. The most effective way to do this is by limiting or prohibiting the use of sugar sweetened beverages on college campuses.

As with other foods, pricing strategies have shown to be effective in reducing the consumption of sugar sweetened beverages. In a Norwegian study, increasing the price of soft

drinks by 11% was estimated to decrease consumption by nearly 7% in the lowest sugar sweetened beverages consumers and 17% among highest consumers. Increasing the price by 27% was associated with a 17% drop in consumption in the lowest use group, 44% in the highest use group and 24% overall across the population.[183] At the University of Virginia, a pricing and labeling incentive to encourage healthy beverage consumption demonstrated that after the first year of implementation overall sales of sugar sweetened beverages decreased by 36%, while the increase in price yielded an increase in profits.[184]

Perhaps, the most effective way to decrease sugar sweetened beverages intake on campus is prohibiting its sale. A policy banning the sale of sugar sweetened beverages is possible and has been accomplished at the secondary school level. As part of the Zuni High School diabetes prevention program, the environmental change component included providing water coolers for students in several locations and gradually replacing sugar sweetened beverages with calorie-free soft drinks in vending machines. Within two years, sugar sweetened beverages in the schools were completely replaced by 150 gallons of water per week (24 ounces/week/student) and 260 12 ounce cans of diet soda (7.8 ounces/week/student).[185] In 2004, Boston's high schools banned the sale of sugar-sweetened beverages like sodas and sports drinks. Two years later, local high school students were consuming significantly fewer sugary drinks (from 1.71 average servings per day in 2004 to 1.38 servings in 2006) in contrast to the average consumption of sugary beverages did not decline among teens nationwide,[186] demonstrating the effectiveness of this type of intervention in an educational setting.

Summary

Today's college students are a growing and diverse group that consume poor diets, do not engage in adequate physical activity and have little nutrition knowledge. As a result, they are

overweight and are likely to experience the onset of diabetes at a younger age than previous generations. Although substantial evidence indicates that the college years are an important and vulnerable period for the development of the three most significant modifiable risk factors linked to diabetes -poor diet, physical inactivity and obesity- little work to date has sought to understand the determinants of these risk factors in emerging adults and even less has been done among minority students in urban settings. Specifically, it is not known what proportion of students at urban universities, such as CUNY, are at risk for diabetes, nor do we know whether these students are aware of the risk factors associated with the disease.

There is also a lack of knowledge regarding diabetes risk perception among racial and ethnically diverse college students. The belief that one has the ability to prevent illness is an essential concept in a number of theoretical health models. In the health belief model, for example, perceived risk and self-efficacy are considered to be primary motives to adapt health-protecting behaviors. This theory posits that the higher the perceived threat and the higher the self-efficacy, the more likely an individual will modify his or her behavior to circumvent that threat. Studies suggest that there is a lack of public awareness and knowledge of various risk factors related to diabetes. If this is the case, risk education and awareness are essential components of any strategy aimed at diabetes prevention.

In addition, there is little information about students' understanding of how to decrease their risk; nor is there much information about the individual, community and institutional barriers, real and perceived, that students face when trying to maintain a healthy lifestyle for themselves and their families. As there is a paucity of epidemiologic research informing us of the most feasible and effective ways to modify health behaviors in emerging adults, research is needed on all levels of influence to understand how to tailor health promotion strategies to best suit the

needs of students attending urban universities, such as CUNY. Table 2-7 outlines possible areas for future investigation.

It is time to develop a comprehensive strategy which focuses on eating and activity behaviors that will benefit the future health of our students and remain with them long after they graduate. Such guidance has the potential to reach thousands of CUNY students and indirectly their families and friends and indeed NYC as a whole, since the CUNY population is so large.

Table 2-7. Socio-Ecological Goals for Diabetes Prevention Research in College Students

Level of Influence	Proposed Research
Intrapersonal	Determine whether students have the knowledge to identify risk factors associated with diabetes; if they recognize their individual risk for diabetes; whether knowledge deficiencies or psychological factors are the root cause of inaccurate risk perception.
	Evaluate intervention strategies targeting lifestyle factors which likely have a role in diabetes prevention among emerging adults; such as stress, time management, and alcohol use.
Interpersonal	Study the social influences on food choices and physical activity among students to discover ways to manipulate behavior.
	Assess the use of peer educators to motivate students, teach skills and influence behavior.
Institutional	Explore how diet and exercise behaviors and influences differ among; (1) students enrolled at four-year vs. two-year colleges; (2) males vs. females; (3) racial/ethnic groups; and (4) students living on-campus vs. off-campus, to identify how intervention strategies will need to be tailored to address the specific needs of each population.
	Examine the barriers and impediments to eating well and being active on campus to inform policy changes.
Community	Explore the food environments surrounding campuses and determine ways to increase the availability of sound food choices.
Public Policy	Investigate policies that can counter or prevent the adverse effects of marketing to emerging adults, especially to those groups that are most vulnerable to diabetes and obesity.

CHAPTER THREE
Methods

Aims and Hypothesis

This project used a mixed-methods approach to achieve the goals stated below, combining quantitative analysis of data from the 2008 CUNY Campaign Against Diabetes' *Student Health Survey* (Appendix C) and qualitative analysis of transcripts from five focus groups with CUNY students in 2010 and 2011. The specific aims of this project are to:

- **Aim 1.1** – Determine the prevalence of risk factors for diabetes overall and by selected demographic, socio-economic and behavioral characteristics among a sample of CUNY students.

- **Sub Aim 1.2** – Describe levels of knowledge about diabetes risk factors overall and by selected demographic and socio-economic characteristics among a sample of CUNY students.

- **Sub Aim 1.3** – Identify predictors of having-multiple risk factors ($\geq$3) for diabetes and low diabetes knowledge scores.

    - **Hypothesis 1**: The probability of having multiple ($\geq$3) risk factors for diabetes and low knowledge scores will vary by race/ethnicity, income, college type, place of birth and family history of diabetes.

- **Aim 2.1** – Determine the distribution of under-estimators regarding susceptibility to diabetes in the sample overall and identify and describe their demographic predictors.

- **Sub Aim 2.2** – Determine the distribution of self-efficacy in regards to preventing diabetes and identify and describe the demographic predictors of self-efficacy.

    - **Hypothesis 2**: Under-estimating diabetes risk and self-efficacy will differ by race/ethnicity, age family history, income, college type, place of birth, BMI and gender.

- **Aim 3.1** – Identify community, institutional, family and individual-level barriers that students face which limit their ability to recognize and adapt a healthy lifestyle to minimize diabetes risk.

- **Sub Aim 3.2** – suggest institutional level (CUNY) strategies for minimizing the barriers identified in this study and to promote healthy choices on campus.

Quantitative Data Source and Collection

Quantitative data generated from the 2008 Campaign Against Diabetes' Student Health Survey address aims one and two. This survey collected self-reported data on health behaviors, health care access, health status, diabetes knowledge and diabetes risk factors from a convenience sample of 1,579 students at three CUNY campuses (Hostos Community College, Hunter College and Medgar Evers College). Approximately 1,000 CUNY students were recruited to take the survey from pre-selected general core classes at each of the three schools and from the Hunter College Psychology 100 Research Participation Website. After receiving faculty permission, a research assistant entered the classroom and explained the survey to the students and read the consent form to them. Students were given a copy of the consent form and had the opportunity to ask questions. Students were not offered any incentive to complete the survey and were not penalized in any way if they chose not to participate. No record was kept of the number of faculty members who refused to allow us to recruit students from their classes. In addition, approximately 500 students were recruited from the Hunter Psychology Website. Students enrolled in an introduction to psychology course at Hunter College are required to participate in research, and participation in this project fulfilled this requirement. This website lists all the studies in progress and the date and time of each study. Students were able register online from numerous timeslots that were offered, but the survey was completed in a classroom following the same procedure as described above. Recruitment and study procedures were reviewed and approved by the CUNY-wide institutional review board (IRB).

Statistical Analysis

Inferential statistics were used to draw conclusions from the sample population tested. SPSS for Windows (Rel.19.0.0. 2010. Chicago: SPSS Inc.) was used to code and tabulate data collected from the survey and provide summary values where applicable. The variables of interest were described for the total sample and separately by specific characteristics of interest. The chi-square test was used to assess statistical significance of associations between categorical variables and Mann Whitney U and Kruskal Wallis when looking at the association between a categorical variable and a numeric variable. In addition, we used multivariate logistic regression to examine associations while adjusting for potential confounders and covariates of interest. We tested for regression assumptions including colinearity among the independent variables and outliers and found no violations. Fifty-three students who reported that they had been diagnosed with diabetes at the time of the survey were excluded from all analyses. There were 1,526 cases with complete data analyzed and the observed power to detect differences among subgroups was >.80.

Measures

Several of the questions on the Student Health Survey were taken from the Risk Perception Survey for Developing Diabetes (RPSDD), which is a validated survey for assessing multiple dimensions of perceived risk for developing diabetes.[123] The questions from the RPSDD include three components 1) optimistic bias, 2) diabetes risk knowledge and 3) personal control.

Optimistic bias is typically assessed by using comparative judgment questions which ask participants to compare their likelihood of getting the condition of interest compared with others like themselves.[110] The Student Health Survey used one comparative judgment statement: "*Compared to other people of my same age, I am less likely than they are to get diabetes*", to

evaluate perceived risk for developing diabetes. Personal control or self-efficacy over developing diabetes was evaluated with the agree/disagree response to the statement: *"If I am going to get diabetes, there is not much I can do about it."*

The diabetes risk knowledge section included 10 items on known risk factors for diabetes. The diabetes risk knowledge score was determined by calculating the sum of correct responses to the following: "*Which statement most closely reflects your view of how each characteristic affects a person's risk for diabetes: being native American, being Asian American, being white, being black, being Hispanic, having a relative with diabetes, being older than 65, exercising regularly, having diabetes during pregnancy, being overweight or obese"* The prevalence and characteristics of students with high and low diabetes risk knowledge scores were analyzed using nonparametric methods.

A determination of objective diabetes risk in each subject was based on a simple count of established diabetes risk factors previously demonstrated to predict long-term outcomes (Table 3-1).[187,179,188] Those with either a history of gestational diabetes or with three or more risk factors were identified as high risk, while those with less than three risk factors and no history of gestational diabetes were considered at low risk.

Table 3-1. Factors Used to Determine Diabetes Risk

Factor:	At Risk Criteria:
Race/ethnicity	black, Hispanic, Asian, American Indian
BMI	greater than 25 kg/m^2
Family history of diabetes	at least one parent with diagnosed diabetes
Sugar-sweetened beverage consumption	intake of 24 or more ounces per week
Activity Level	less than three hours per week
Smoking History	current smoker
Gestational diabetes history	diagnosed in past or current pregnancy

The relation between optimistic bias and objectively-measured risk for diabetes was examined. A dichotomous variable was created (under-estimator/realistic-estimator) to distinguish between students who accurately perceived their risk and those who did not. The under-estimators were those students who had an optimistic view of their susceptibility to diabetes, but were actually at high risk (gestational diabetes and/or >3 risk factors); while, those at high risk who acknowledge that they were at high risk were classified as realistic-estimators. Logistic regression was used to identify characteristics that predict underestimating personal diabetes risk level. Descriptive statistics, including race/ethnicity, gender, age, family income, college type, place of birth (U.S./outside U.S.) and family history of diabetes, were examined by risk for diabetes, under-estimators, realistic estimator, low self-efficacy versus high self-efficacy and knowledge scores.

The race/ethnicity variable included four categories: non-Hispanic white, Hispanic, non-Hispanic black and Asian and Pacific Islander. Other variables with more than one category were dichotomized as follows: age – less than 25 years of age, 25 years and older, household income – less than $60,000, $60,000 or greater in 2007, BMI – 24.9 or less, 25 or greater.

Hypothesis 1 was tested by comparing those at high diabetes risk versus low diabetes risk in terms of their race/ethnicity, gender, age, family income, college type, place of birth (U.S./outside U.S.) and family history of diabetes. Those with low diabetes risk knowledge scores were compared to those with high scores, and then these twp populations were compared and tested for statistical differences by race/ethnicity, gender, age, family income, college type, health insurance and family history of diabetes.

Hypothesis 2 was tested by comparing students who were under versus realistic-estimators, and who had low versus high self-efficacy. Statistical differences between the groups were

examined by race/ethnicity, gender, age, family income, college type, place of birth, family history of diabetes and BMI.

Qualitative Data Sources, Collection and Analysis

A total of 53 students participated in the five focus groups, 33 from eight senior college and 20 from four community colleges (Baruch College, Borough of Manhattan Community College, Bronx Community College, Brooklyn College, City College of New York, Hostos Community College, Hunter College, Kingsborough Community College, Lehman College, Medgar Evers College, Queens College, and York College). The students were primarily female and there was substantial variability in age: 30 participants were 18 to 24 years of age, 15 were 25 to 34 years, 5 were 35 to 44 years, and 3 were older than 45 years.

The participants were recruited from attendees at a *Healthy CUNY Workshop* at the Graduate Center. The workshop, was conducted twice a year from 2008 to 2011, and drew students from a variety of disciplines. Participants generally have an interest in health, either for their personal well-being or to prepare for a future career in the health sciences. As space is limited, less than half of students applying for the workshop are selected to attend. All students in the June 2010 workshop and one-third of the students in the January 2011 workshop participated in this study.

The five group sessions were held in a conference room at the CUNY Graduate Center and lasted approximately 70 to 90 minutes. Group size ranged from nine to 11 participants. The groups were moderated by the researcher assisted by a graduate student. The focus groups were audio taped using a digital recorder to reduce the risk of recorder bias. Recruitment and study procedures were reviewed and approved by the CUNY Graduate Center's institutional review board (IRB).

Prior to the group discussion the students were asked to complete a brief survey (Appendix D). The purpose of this survey was to gather information to characterize the study sample demographically and identify students' perceptions about their body weight and general health. During the group sessions participants were first asked to identify and then prioritize health concerns facing CUNY students. This question was intended to break the ice and elicit students' opinions and beliefs regarding health issues. The remainder of the questions were designed to move participants from a general discussion of health issues toward the specific areas of interest, namely; barriers to eating well and keeping active on campus, and possible strategies to overcome these barriers.

The audiotapes from each focus group were transcribed verbatim by a professional transcriber. To identify errors or incomplete data, the researcher replayed the audiotapes while reviewing a copy of the transcript and notes taken during the group sessions. To help ensure high scientific rigor, two researchers independently coded all transcripts. First, specific barriers to eating well and physical activity that were similar in nature across the data sets were grouped together and labeled, as were strategies for minimizing barriers and improving health related behaviors. Second, using an ecological model as the framework, each of the barriers and strategies was independently coded by each researcher as: intrapersonal (characteristics of the individual), interpersonal (formal and informal social networks and support systems), institutional (within CUNY), community (outside CUNY), public policy (local, state, and national laws and policies) or unclassifiable. Validity was contributed to the study by the use of this a priori theoretical framework with well-defined variables. Finally, the two researchers met to review the coded transcripts; the items that were not similarly categorized were discussed until consensus was reached.

The results were highly consistent across the five groups, for males and females, and for the two-year and four-year colleges. Therefore, the results were summarized according to the major themes expressed across all of the five focus groups. A social-ecological model was used to interpret the data. Barriers and enablers to eating well and engaging in physical activity on campus were identified at the intrapersonal, interpersonal, and environmental levels as were strategies proposed by students to overcome barriers and enhance the campus environment to promote a healthy lifestyle.

Although neither participants in the focus group nor respondents to the survey study constituted a random sample, the respondents were very similar in terms of demographics to the CUNY student body as a whole (Table 3-2). The only notable difference was gender, the study sample contained a higher proportion of women than does the city as a whole.

Table 3-2. Demographics of CUNY Undergraduates,[189] Survey Respondents and Focus Groups

	Senior Colleges	Community Colleges	CUNY Total	CUNY Survey	Focus Groups
White	30.6%	19.3%	26.1%	22.4%	13.0%
Black	24.4%	35.5%	28.7%	30.8%	34.0%
Hispanic/Latino	30.6%	19.3%	26.1%	27.1%	24.5%
Asian/Pacific Is.	18.2%	15.7%	17.2%	18.5%	25.0%
Female	59.0%	58.9%	59.0%	73.9%	81.1%
Born Outside U.S.	43.2%	45.4%	44.2%	43.2%	47.2%
Income < 20,000	33.7%	44.9%	37.8%	34.0%	35.9%

Summary

Survey and focus group findings were used to determine the prevalence of inactivity and other risk factors for diabetes, identify predictors of being at high risk, describe levels of knowledge about risk factors and ascertain attitudes regarding risk perception and self-efficacy among CUNY students. Additionally, this study identifies community, institutional, family and individual level barriers which students face that limit their ability to recognize and adapt a healthy lifestyle to minimize diabetes risk. The research questions and analysis are outlined in Table 3-3.

Table 3-3. Summary of Research and Results

Research Questions	Analysis	Dependent Variable	Independent Variables	P-Value
1: What are the predictors of being at high risk?	Logistic Regression	Diabetes Risk (low/high)	Age Group, Race, Income, College Type, Birthplace, Gender, Health Insurance	< *.001*
2: Are there differences in the number of risk factors among races?	Kruskal-Wallis	Number of Risk Factors (excluding race)	Race	< *.001*
3: What are the predictors of inactivity?	Logistic Regression Chi Squared Test	Activity (</≥ 3 hours/wk)	Age Group, Race, Income, College Type, Birthplace, Gender, Family History, BMI	< *.001*
4: What are the predictors of under estimating risk?	Logistic Regression	Risk Perception (realistic/unrealistic)	Age Group, Race, Income, College Type, Birthplace, Gender, Family History, BMI	< *.001*
5: What are the predictors of low risk factor knowledge scores?	Mann Whitney U Kruskal-Wallis	Risk Knowledge Score	Age Group, Race, Income, College Type, Birthplace, Gender, Family History	< *.001*
6: What proportion of students can accurately identify the effect of their race on diabetes risk?	Chi Square Test	Correct Response for the Risk of their Race Question	Race	<*.001*
7: Is there a relationship between risk perception and test scores?	Mann Whitney U Kruskal-Wallis	Risk Knowledge Score	Risk Perception (realistic/unrealistic)	<*.001*
8: What are the predictors of low self-efficacy?	Logistic Regression	Self-Efficacy (low/high)	Age Group, Race, Income, College Type, Birthplace, Gender, Family History, BMI	>.05

CHAPTER FOUR
Findings: Diabetes and Diabetes Risk Factors at CUNY

Introduction

Approximately 2.5% of 18 to 24 year old CUNY students responding to the *Student Health Survey* reported being diagnosed with either type 1 or type 2 diabetes. These rates are slightly higher than the 2008 *NYC Community Health Survey* findings that 2.2% of New Yorkers in this age group have been diagnosed with diabetes. In both surveys, those who had diabetes only while pregnant were not included. As expected, those students 25-years and older had a higher proportion diagnosed with diabetes (5.7%). Few students in either age group reported being told that they had type 1 or prediabetes (Table 4-1).

Table 4-1. Diagnosed Diabetes at CUNY by Age Group

Age Group	Any Diabetes	Type 1 Diabetes	Pre-Diabetes
≤ 24 years	2.5%	.02%	.04%
> 24 years	5.7%	.23%	1.0%

More than one-third (37.8%) of all students were identified as being at high risk for diabetes, defined as having had gestational diabetes or having 3 or more risk factors for diabetes. Specific risk factors varied by both race and gender (Tables 4-2 and 4-3). Males were more likely to be high consumers of sugar-sweetened beverages than women (p=.002), while the female students were less active than their male counterparts (p=.001) White students were most likely to smoke cigarettes, Hispanic students had the highest intake of sugar-sweetened beverages, the most

common risk factor for blacks was a BMI of 25 or higher and Asians were the least likely to exercise. The differences in types of risk factors were significant between all racial/ethnic groups and sugar-sweetened beverage intake and activity were significantly different between genders.

Table 4-2. Proportion of Risk Factors by Gender

Risk Factor	Male	Female	P-Value Chi-Square Test
Family History	25.4%	25.1%	.904
BMI ≥ 25	37.2%	34.6%	.339
Smoking	9.6%	8.6%	.534
SSB Intake*	51.7%	42.9%	*.002*
Inactivity	21.3%	33.2%	*<.001*

*sugar-sweetened beverages

Table 4-3. Proportion of Risk Factors by Race

Risk Factor	White	Hispanic	Black	Asian	P-Value Chi-Square Test
Family History	15.6%	25.9%	28.6%	25.3%	*.002*
GDM^ History	1.4%	6.1%	6.0%	3.0%	*.006*
BMI ≥ 25	19.2%	40.6%	45.9%	21.6%	*<.001*
Smoking	15.3%	8.5%	7.0%	5.7%	*<.001*
SSB* Intake	27.6%	53.8%	52.4%	38.6%	*<.001*
Inactivity	18.9%	31.4%	33.5%	34.0%	*<.001*

^gestational diabetes, *sugar-sweetened beverages

High Risk Predictors

Logistic regression was performed to assess the effect of individual characteristics on the likelihood that respondents would have high diabetes risk (Table 4-4). The model contained six independent variables (college type, age, income, gender, place of birth and health insurance). The full model containing all predictors was statistically significant (χ^2 (6, n = 1,244) = chi

squared coefficient 70.399, $p < .001$), indicating that the model was able to distinguish between respondents who have a low diabetes risk and those who have a high diabetes risk. The model as a whole explained between 5.5% (Cox and Snell R square) and 7.5% (Nagelkerke R squared) of the variance in diabetes risk. As shown in Table 4-4, three predictor variables, college type, income and age, in the logistic regression model were significantly associated with diabetes risk. Specifically, those who attend a two-year college have an odds that is 1.6 times higher than those from a four-year college. (p=.002) and as income increased odds of being at high risk decreased (OR=0.36, p < 001). Age was also significantly associated with diabetes risk level (OR=1.02, p = .048) as older students had higher odds ratio of having three or more risk factors.

Table 4-4. Diabetes High Risk Predictors

	Odds Ratio	95% C.I.	P-Value
Age (≥25 years)	1.02	1.00-1.03	*.048*
Two-Year College	1.62	1.19-2.19	*.002*
Gender	.954	.729-1.25	.735
Health Insurance	1.29	.927-1.78	.132
Immigrant	.944	.739-1.21	.644
Income (<$60,000)	.363	.261-.505	<*.001*

Race/Ethnicity and Risk Factors

A Kruskal-Wallis test was used to determine if there were statistically significant differences in number of risk factors (excluding race) depending on racial/ethnic groups. A significant difference was found (χ^2 (3) = 98.208, p < 0.01). Non-Hispanic blacks had the highest number (Mean=1.67), followed by Hispanics (Mean=1.62) and Asian and Pacific Islanders (Mean=1.25), while non-Hispanic whites had the lowest mean (Mean=.96) (Table 4-5).

To determine which of the four groups were statistically different from each other, follow-up Mann Whitney U tests were conducted to test each pair of racial groups. There was a statistically significant difference in number of risk factors between non-Hispanic whites and Hispanics (z = -7.619, $p < 0.001$) , non-Hispanic whites and non-Hispanic blacks ($z = -9.155$, $p < 0.001$), non-Hispanic whites and Asian and Pacific Islanders ($z = -3.722$, $p < .001$), Hispanics and Asian and Pacific Islanders ($z = -3.802$, $p < .001$), and Non-Hispanic Blacks and Asian and Pacific Islanders (344.59; $z = -4.860$, $p < .001$). There was not a significant difference in number of risk factors between Hispanics and non-Hispanic blacks.

Table 4-5. Mean Number of Risk Factors (Excluding Race)

Race/Ethnicity	Number	Mean	Std. Deviation
Non-Hispanic White	279	.96	.93
Hispanic	360	1.62	1.12
Non-Hispanic Black	540	1.67	1.10
Asian/Pacific Islander	258	1.25	.98

Inactivity Predictors

Characteristics of exercisers (≥3 hours per week) and non-exercisers (<3 hours per week) including age, race, income college type, campus, gender, family history of diabetes and BMI were examined (Table 4-6). A chi-square test indicated that there is a significant difference, χ^2 (1) = 17.422, $p < .001$, between the sexes as men report more activity than women. There were also significant differences between the race/ethnicity groups in regards to exercise, χ^2 (4) = 23.523, $p < .001$. Asian students were the least likely to meet exercise guidelines, closely followed by blacks and Hispanics, while white students were the group most likely to report three or more hours a week of activity. Students with higher incomes were more likely to be active (χ^2 (1) = 8.467, $p = .004$), as were those born in the U.S. (χ^2 (1) = 27.026, $p < .001$).

Table 4-6. Demographics of Students Not Meeting Exercise Recommendations			
	Number	**Percent**	**P-Value** Chi-Square Test
All Students	453	29.7%	
Gender			*<.001*
Female	366	33.2%	
Male	83	21.3%	
BMI			.426
< 25	266	29.0%	
≥ 25	162	31.0%	
Race			*< .001*
White	52	18.7%	
Hispanic	111	31.0%	
Black	181	33.4%	
Asian/Pacific Is.	88	34.5%	
Age			.572
≤ 24 years	321	29.6%	
≥ 25 years	119	31.1%	
Campus			*< .001*
Hunter	208	25.6%	
Medgar Evers	136	34.5%	
Hostos	108	38.4%	
College Type			*.003*
Four-year	344	28.5%	
Two-year	108	38.4%	
Income			*.001*
< $60,000	329	32.3%	
≥ $60,000	56	20.4%	
Family History			.097
Yes	124	33.6%	
No	329	29.1%	
Born In U.S.			*.001*
Yes	211	25.1%	
No	236	37.2%	

Significant differences in activity patterns were also found on the three campuses (χ^2 (3) = 21.504, $p < .001$). At Hunter, 73.5% of students met exercise guidelines, at Medgar Evers and at

Hostos 62.7% and 60.7% respectively reported exercising three or more hours per week. When the students were categorized by college type, those at four-year institutions were found to exercise more than those at a two-year college ($\chi^2(2) = 11.319$, $p = .003$). Frequency statistics for individuals with a family history of diabetes compared to those without a family history indicated that, while not significant, those with a family history engaged in more activity. These variables were entered into logistic regression models to determine the independent predictors of inactivity. The dependent variable was inactivity (< 3 hours/week) the predictor variables were age, gender, race/ethnicity, income, family history, campus, college type, BMI and place of birth. The full model containing all predictors was statistically significant (χ^2 (9, n = 1,155) 61.755 $p < .001$), indicating that the model was able to distinguish between respondents who are exercisers and those who are non-exercisers. The model as a whole explained between 5.2% (Cox and Snell R square) and 7.4% (Nagelkerke R squared) of the variance in the exercise variable. As shown in Table 4-7, three predictor variables in the logistic regression model were statistically significant. Specifically, the variables race, gender and immigrant were able to distinguish between those who met exercise recommendations and those who did not.

Table 4-7. Inactivity Predictors

	Odds Ratio	95% C.I.	P-Value
Age Group	.770	.552-1.08	.126
Female	1.92	1.39-2.66	*<.001*
Race/Ethnicity	1.15	1.01-1.30	*.030*
Income	.927	.858-1.00	.056
Family History	1.30	.963-1.75	.087
Campus	1.11	.930-1.32	.246
College Type	1.35	.941-1.95	.102
BMI	.976	.822-1.16	.781
Immigrant	1.74	1.33-2.28	*<.001*

Summary

The CUNY Student Health Survey revealed that close to 40% of all students were at high risk for diabetes. Those identified at high risk were significantly more likely to attended a two-year college, be older than 24 years of age and have a yearly household income of less than $60,000. Additionally, non-Hispanic blacks had the highest number of risk factors followed by Hispanics and Asian and Pacific Islanders; non-Hispanic whites had the lowest number. Significant differences between the race/ethnicity groups in regards to activity levels were also found. Asian students were least likely to meet exercise guidelines, closely followed by blacks and Hispanics, while white students were the group most likely to report three or more hours a week of activity. Both male and native-born students were significantly more active than their female and foreign-born counterparts.

CHAPTER FIVE
Findings: Diabetes Risk Perception, Risk Factor Knowledge and Self-Efficacy

Diabetes Risk Perception

The aims of this study were to evaluate the perceptions of diabetes risk, the level of diabetes risk knowledge, and the presence of self-efficacy within the population of CUNY students. Of the 541 students identified as being at high risk for diabetes, 39% were optimistic and felt that they were less likely to develop the disease than others. These students were identified as under-estimators, those who were optimistic about their likelihood of not developing diabetes, but were actually at high risk. The under-estimators were compared to the realistic-estimators, who were also identified as high risk, but were pessimistic and stated they were more likely to get diabetes than others. Those who over-estimated their risk were not analyzed in this study. The characteristics of the under-estimators are listed in Table 5-1.

Logistic regression was performed to assess the effect of individual characteristics on the likelihood that respondents would be realistic or under-estimators. The model contained eight independent variables (age, gender, race/ethnicity, place of birth, college type, family history, BMI, income). The full model containing all predictors was statistically significant (χ^2 (8, n = 461) = 22.898 p = .003), indicating that the model was able to distinguish between respondents who are under-estimators and those who are realistic-estimators. The model as a whole explained between 4.8% (Cox and Snell R square) and 6.6% (Nagelkerke R squared) of the variance in the under-estimator variable. Three predictor variables in the logistic regression model were

Table 5-1. Characteristics of Under-Estimators			
	Number	**Percent**	**P-Value** Chi-Square Test
Gender			*.025*
Male	60	47.24%	
Female	148	36.18%	
BMI			.999
< 25	71	38.4%	
≥ 25	132	38.4%	
Race			*.027*
White	10	52.6%	
Hispanic	65	39.4%	
Black	85	33.9%	
Asian/Pacific Is.	43	49.4%	
Age			.482
≤ 24 years	136	37.9%	
> 24 years	68	41.2%	
Campus			.770
Hunter	86	41.3%	
Medgar Evers	68	36.4%	
Hostos	56	38.9%	
College Type			.950
Four-year	154	38.9%	
Two-year	88	38.9%	
Income			.885
< $60,000	170	40.0%	
≥ $60,000	22	40.0%	
Family History			*.037*
Yes	88	34.4%	
No	123	43.2%	
Born In U.S.			*.002*
Yes	108	33.0%	
No	100	46.3%	

statistically significant, as shown in Table 5-2. Specifically, gender, place of birth and family history were able to distinguish between the two groups. Those with a family history were more likely to be realistic-estimators, as were those born in the United States and women.

Table 5-2. Predictors of Under-Estimating Diabetes Risk			
	Odds Ratio	**95% C.I.**	**P-Value**
Age Group	1.00	.641-1.56	.995
Male	1.81	1.15-2.84	*.010*
Race/Ethnicity	.947	.739-1.21	.670
Born in U.S.	.476	.319-.709	*<.001*
Income	1.00	.543-1.85	.991
No Family History	1.55	1.05-2.23	*.029*
BMI	.992	.658-1.49	.968
College Type	.805	.485-1.33	.401

Diabetes Risk Factor Knowledge

The risk knowledge variable was created by assigning one point to each correct response to the 10 risk factor questions. Correct scores were summed to create a composite 'risk factor knowledge score'. Rates of awareness regarding established diabetes risk factors such as, race, age, diabetes during pregnancy and the presence of a family history, were extremely low. In fact, out of a possible score of 10, the mean score for the sample was 2.9. However, most students were able to identify the two most important and modifiable risk factors; 78% recognized inactivity and 68% recognized obesity as increasing diabetes risk (Table 5-3). Recognizing the presence of a family history as a major risk factor for developing diabetes was less common (36%) among the sample as a whole, but more frequent among those with incomes less than $60,000 ($p$ = .001), those younger than 25 years of age (p = .003) and Asian and white students (p < .001). Those who reported a positive family history of diabetes were more likely to know that having a blood relative with the disease greatly increases one's risk, but the difference was not significant.

For college type, students from a four-year college had a higher mean (3.05) than students from a two-year college (2.28); although, students from Medgar Evers, a four-year college actually had a lower mean test score than students from Hostos, a community college (Table 5-4).

For age group, students younger than 25 years of age had a higher mean (3.08) than students 25 years and older (2.58). For birthplace, individuals who were born in the United States had a higher mean (3.15) than individuals who were not born in the United States (2.66). For income, individuals who made more than $60,000 per year had a higher mean (3.40) than individuals who earned less than $60,000 per year (2.99).

Table 5-3. Students Responding Correctly: *Increases or raises risk*.

Risk Factor	Number Correct	Percent Correct
No regular exercise	1079	78.0%
Being overweight or obese	930	67.0%
Having a blood relative with diabetes	495	35.6%
Being 65 years of age or older	303	21.4%
Having diabetes during pregnancy	278	19.5%
Being Black or African-American	225	15.7%
Being Hispanic or Latino	178	12.6%
Being American Indian	47	3.4%
Being Asian	19	1.4%

Mann Whitney U tests and a Kruskal-Wallis test were used to determine if there was a significant difference in knowledge scores depending on age group, income, college type, birthplace, gender, family history and race/ethnicity. There was a statistically significant difference in knowledge scores depending on college (z = -5.188, p < .001), age group (z = -

4.954, $p < .001$), birthplace ($z = -4.695$, $p < .001$), income ($z = -3.387$, $p = .001$), and ethnicity ($\chi^2(3) = 34.892$, $p < 0.001$). There was not a statistically significant difference in knowledge score depending on gender or family history.

Table 5-4. Diabetes Risk Factor Knowledge Test Score by Campus

	Number	Mean	Std. Deviation
Hunter	820	3.43	1.95
Hostos	286	2.34	2.09
Medgar Evers	410	2.28	2.30
Total	1516	2.92	2.15

To determine whether any of the four ethnic groups were statistically different from each other, follow-up Mann Whitney U tests were conducted to test each pair of racial groups. There was a significant difference between non-Hispanic whites and Hispanics ($z = -3.930$, $p < .001$), non-Hispanic whites and non-Hispanic blacks ($z = -5.038$, $p < .001$), non-Hispanic blacks and Asian and Pacific Islanders ($z = -3.992$, $p < .001$) and between Hispanics and Asian and Pacific Islanders ($z = -2.982$, $p = 0.003$). There was not a statistically significant difference in risk factor knowledge scores between non-Hispanic whites and Asian and Pacific Islanders or Hispanics and non-Hispanic blacks (Table 5-5).

Table 5-5. Diabetes Risk Factor Test Score by Race/Ethnicity

	Number	Mean	Std. Deviation
Non-Hispanic White	279	3.40	2.02
Hispanic	360	2.75	2.06
Non-Hispanic Black	540	2.67	2.25
Asian/Pacific Islander	258	3.23	1.97
Total	1437	2.92	2.14

The data were also examined to determine if students were able to accurately identify the effect that their own race has on diabetes risk (e.g. do Asian students know that being Asian

greatly increases one's risk for diabetes, do black students know that being black greatly increases one's risk for diabetes)? The chi square test for independence was significant (χ^2 (3) = 180.963, $p < .001$, Cramer's V = 0.363), indicating that there was a relationship between ethnicity and whether or not a participant answered the risk based on ethnicity item correctly, for their own race. Out of the groups that were at risk based on their ethnicity, the non-Hispanic black group had the highest percentage of individuals who knew that their race increased their risk of diabetes (22.8%) and Asian and Pacific Islanders were the least likely of the major racial/ethnic groups to perceive the risk associated with their race (2.4%). The American Indian group was not included in the analysis due to sample size restrictions (n = 7) (Table 5-6).

Table 5-6. Students Responding Correctly to Risk Associated with Their Race

Ethnicity	Number	Percent Correct
Non-Hispanic Black	114	22.8%
Hispanic	48	14.0%
Asian /Pacific Islander	6	2.4%
American Indian	0	0.0%

Last, the risk knowledge data were examined to ascertain a relationship between risk perceptions (under-estimator/realistic-estimator) and risk knowledge score. This was accomplished using a Mann Whitney U Test. There was a significant difference in knowledge scores between the two groups. Participants who under-estimated their risk had lower knowledge scores (M = 2.71) than participants who realistically estimated their risk (M = 3.10; z = -2.166, p = 0.03) (Table 5-7).

Table 5-7. Diabetes Risk factor Test Score and Risk Perception			
	Number	Mean	Std. Deviation
Under-Estimator	211	2.71	2.20
Realistic-Estimator	330	3.10	2.15
Total	541	2.94	2.18

Self-Efficacy

Logistic regression was performed to assess the relationship between self-efficacy and the predictor variables race/ethnicity, income, college type, gender, age, place of birth, BMI and family history. The self-efficacy variable was created using the question that asked participants to indicate their agreement with the statement, "If I am going to get diabetes, there is not much I can do about it." Less than 14% (n=199) of the students agreed with the statement, and thus were classified as having low self-efficacy. The full model containing all eight predictors was not statistically significant (χ^2 (8) = 5.73, p >.05), indicating that the model was not able to distinguish between participants who had high versus low self-efficacy.

Summary

Approximately 40% of students with three or more known diabetes risk factors believed that they were less likely to develop diabetes than others. These students, who did not recognize their diabetes risk, were significantly more likely to be male, be born outside the United States, score lower on the diabetes risk factor test and not report a family history of the disease. On average, the participants were able to identity only three of 10 known diabetes risk factors. The two most recognized risk factors were inactivity and excess weight. Few students were aware of the increased risk of diabetes among non-white populations and Asian students were the least likely group to perceive the risk associated with their race. Eighty-six percent of the sample was

considered to have high self-efficacy in regards to preventing diabetes. However, there was no difference in the characteristics of those with high and low self-efficacy.

CHAPTER SIX
Findings: CUNY Students' Barriers to Eating Well and Being Active

Introduction

For this component of the study, focus group methodology was used to address three major research questions: 1) what are the barriers that student's face which limit their ability to eat well 2) what are the barriers that student's face which limit their ability to engage in physical activity and 3) what are the institutional level (CUNY) changes are needed to minimize the barriers identified in this study and enable students to make healthy choices while on campus? The demographics of the students who participated in this study are described in Table 6-1.

The data generated from this study are summarized below according to the major themes expressed across all of the five focus groups. A social-ecological model was used to interpret the data. Barriers to eating well and engaging in physical activity on campus were identified at the intrapersonal, interpersonal, and environmental levels as were strategies proposed by students to overcome barriers and enhance the campus environment to promote a healthy lifestyle. Table 6-2 highlights the major themes and subthemes and indicates their frequencies.

Table 6-1. Focus Group Demographics		
	Number	**Percent (Mean)**
Gender		
Male	10	19%
Female	43	81%
Race		
Non-Hispanic White	7	13%
Non-Hispanic Black	18	34%
Hispanic	13	25%
Asian	13	25%
Other	2	3%
Age		
18-24 years	30	57% (23.4)
25-59 years	23	43% (35.3)
College Type		
Two-year	20	38%
Four-year	33	62%
Born in U.S.		
No	25	47%
Yes	28	53%
Married		
No	44	79%
Yes	7	17%
Residence		
Dormitory	1	2%
Off-Campus (alone/spouse)	19	36%
With Parents/Relatives	33	62%
Weight Change Since Starting College		
Lost $\geq$ 5 pounds	12	22%
Gained $\geq$ 5 pounds	6	11%
Gained $\geq$ 10 pounds	6	11%
Weight Status		
Underweight	3	6%
Normal	27	51%
Overweight	13	24%
Obese	10	19%
Health Insurance		
No	15	28%
Yes	38	72%

Table 6-2. Focus Group Themes			
Themes **Subthemes**	**Level of Influence**	**Groups Mentioning Subtheme**	**Number of Exemplars**
Barriers to Physical Activity			
lack of time	intrapersonal	5	24
unaware of facilities	environmental	5	12
limited gym access/inconvenient	environmental	5	10
lack of motivation	intrapersonal	4	12
lack of social support	interpersonal	4	11
uncomfortable at gym/lack of instruction	intrapersonal	4	4
Barriers to Eating Well			
cost prohibitive	environmental	5	32
lack of availability of healthy foods	environmental	5	26
excessive exposure to unhealthy foods	environmental	5	17
lack of nutrition/health knowledge	intrapersonal	5	16
stress	intrapersonal	5	13
lack of time/inconvenient	intrapersonal	5	13
free water not available	environmental	4	16
peer pressure/lack of social support	interpersonal	4	13
taste/not satisfying	intrapersonal	4	10
Student Proposed Interventions			
require nutrition/health/cooking classes	environmental	5	21
increase availability of healthy options	environmental	5	20
require physical education classes	environmental	5	20
social marketing campaigns/signage	cues to action	4	19
limit/ban unhealthy food/beverages	environmental	3	12
intramurals/campus activities/classes	environmental	4	8
allow use of all CUNY gyms	environmental	3	5
restrict elevator use	environmental	2	5

Barriers to Physical Activity

Intrapersonal

The most prominent theme in all groups in regard to physical activity challenges were lack of time and internal motivation. The students cited their hectic schedules, which included academic obligations, jobs, family responsibilities and laziness as the major obstacles to their efforts to exercise.

"Who has the time, not only to exercise, but to look good after?"

"I didn't say I didn't have time to exercise, I just don't do it, I'll be honest, I'm lazy."

"We do so much, just no time in the day."

Interpersonal

Lack of social support was also seen as a barrier to exercise. A frequent theme was the perception that students were more likely to go to the gym if they went with a friend or if group activities were available. However, most had no knowledge how to access group events such as intramurals, fitness classes and sports activities or if these options were even available on their campus.

"Going to the gym is kinda boring… need more group stuff you can do with your friends… nothing like that on campus, people would make time to do fun exercise."

"I think people are always looking for a buddy. Are you going to the gym?"

"I'd rather go to a class where there's a bunch of people, gym doesn't work for me, cause after a while I'm kind of like and just leave."

Environmental

Less than one-third of the students had ever worked out in the campus gym and even fewer used it regularly. Many were unaware of the policy regarding gym use and expressed confusion about where the gym was located, how to access the facility or if there was a fee involved. The

majority of those who had used the gym did so only because they were enrolled in a physical education course.

The experiences of those who had used campus exercise facilities were mixed. Some students stated that the gyms are overly crowded, small or have limited hours of operation that were inconvenient; while others were very pleased with the campus facilities. One group indicated that the campus fitness center could be an intimidating place, particularly for those who had never used a gym before and for women who were uncomfortable exercising with men. Lack of qualified staff or trainers was also cited as a concern by this group. Generally, the students from the community colleges expressed less satisfaction with the gyms on their campus compared to the students form the senior colleges.

The students reported little use of the stairs while at school. The main reason was laziness or habit, as most students cited that the elevators were often slow and inconvenient. On the larger campuses, (Queens College and Lehman College) the geographic layout of the campus "forced" students to walk long distances.

"One thing I know in York [college], it's closed when school is not in session, the gym is not accessible, the pool is not accessible".

"I think our campus [Queens College] has a lot of green areas and we have the gym, a really good gym, we have a pool, we have a lot of space to work out, but mainly the problem is that the students need more encouragement or they need more motivation, constantly, so that they can do it. Because the resources are there."

"The other thing is ladies use the aerobic room and most of the guys are in the weight room so the ladies are like hesitant to go into the weight room with the guys."

"One thing that has helped me is having a gym on campus, a big help!"

"I have a friend of mine who went to Queens and then transferred to York, she didn't know that York had a gym. So she would still go to Queens and be like $5.00, $10.00 to go to the gym. I'm like York has a gym."

"I was in there (Hostos) two semesters and I didn't know the pool was there."

"But I just don't' know what to do. So I'll get on a bike for ten minutes and then I just walk out and be bored and it's kind of pointless."

Barriers to Eating Well

Intrapersonal

Lack of time for cooking and shopping were frequently mentioned as individual barriers to eating well. Students also readily and consistently, without prompting, noted a close relationship between overeating and stress often citing the many demands and roles they juggled daily. The flavor of food, both in terms of the bad taste of healthy food and the good taste of less healthy food and the importance of satisfaction derived from food flavor and preventing hunger were mentioned by many as reasons students do not eat healthier.

"Because most of the time it's because we don't have time. We don't have time to make good food. We don't have time to go there and purchase good food. Or we don't have time in between classes to take the necessary steps we need to be more healthful, even if it's just taking the stairs. Sometimes it's not that you don't want to. It's that you don't have the opportunity. That one minute might save you in other ways that you may not know."

"I get so upset by amounts that don't fill you up. I mean you have to serve something that's going to fill you up, because I think that's what most students need. They don't want to be hungry in an hour."

"… what's the point of having a $7.00 little sushi tray, when they give you this big burger that's coming out of the bun, and it's cheaper, and it taste better."

"Just as somebody who often wants to make her lunch and doesn't have the time, my healthy option is usually the soup, but the thing is that often the soups are so popular … they're often out, so if you go a little bit after lunch time, or sometimes I come at 12:00 and they'll be gone."

"The food choices around campus are horrendous."

"When I started [college], I was hungry, between classes I was just hungry and the only food that was cheap for me to afford and to eat was the junk food and then I just bought that and it tasted good and it satisfied me for a couple of hours. I was like very happy, but then later on I saw weight gain, I was being sick, I didn't like myself at all then. I was just like I have to change my diet or the way I eat."

"Yeah, when I'm stressed and studying for finals, I don't care what I eat. And I don't even feel like I'm satisfied or full, because it's just like – because stress is so overwhelming that like I don't even feel that I'm full."

"With me, it's time. Because you have work, you have school. By the time you get home it's 11:00 at night. So I find myself eating like in between, anything I can just grab to go, you know. You don't have the time to sit at home and be over the stove for two hours preparing a well-balanced meal."

Another theme that emerged was the feeling that students, who were not majoring in nutrition, did not have the knowledge necessary to recognize a healthy diet. It was felt that this was due to a lack of nutrition education and learning about food and health form unreliable sources. When asked where they though most students learned about food, the media was the most common response, either advertisements, programming like Dr. Oz or Oprah and even the children's television show Barney. Parents were also often mentioned as sources of nutrition information. Very few participants felt they learned anything significant in either primary or secondary school regarding how to eat well. In one group, it was agreed that, in fact, elementary schools set a bad example by serving lunches of poor nutritional quality. Several students, who were not nutrition majors and who took a nutrition course as an elective, reported that it resulted in a profound change in their eating habits.

"What do students know about nutrition? Friday night it's Dominos, the 555 deal, so that's pretty much it."

"A lot of students don't know how to count calories. They don't know the difference between saturated fat, unsaturated fat and things as such"

"I wasn't really like thinking before. But I took that [nutrition]class, now I'm very conscious of like the calories that I take."

"I've dropped 20 pounds, so now I cook all my food at home. That's why, I make the extra effort to walk all the way to the grocery store because I'd rather cook and know what I'm putting into my food and I've learned this all because of the nutrition course."

Interpersonal

Participants noted that the behavior of their friends and families often influences what and when they eat and that social situations, like going out to lunch, were associated with overeating and consuming unhealthful food. Some attributed this to the perception that healthy foods are not tasty or filling enough, and although they would prefer to eat better, they succumb to the external social pressures to eat what their peers are choosing.

"I'm on the swim team and everybody on the swim team eats junk food, except for me. Well I've probably eaten it sometimes, like the other day we were going to the beach and you know one of my friends is talking about going to Popeye's to get some fried chicken and biscuits. I don't want to be rude and disrespectful and say I don't want fried chicken. Do you guys get what I'm saying?"

"And then my friend goes like well I'm hungry and I need to eat something and I have a minimum amount of dollars, so it's McDonald's."

"I think peer pressure is the most important thing. Like when you see all of your friends are like eating one food, so you don't want to be like, uncommon."

Environmental

As oppose to the barriers to physical activity, which were mainly interpersonal or intrapersonal, three environmental barriers, high cost, lack of tasty healthier foods on campus and an abundance of high fat and calorie choices were seen as the most significant barriers to eating well across all groups. The students spoke of the high monetary costs associated with healthy eating behaviors both on and off campus and most participants stated they consider the cost when purchasing food. The consensus of the students was that price and taste are the most important criterion used for food selection. Additionally, they felt that not only was healthy food more expensive there was a lack of healthy choices in cafeterias and vending machines.

"…because when you go to the cafeteria the things are quite pricey. And it's always like deep fried or battered and I don't even know how they afford it, I mean the young students, you get a

salad bar, and for some reason it be $6.00 or $7.00 a pound, plus tax. I can't afford it, and I have a job. I don't know how kids afford it."

"They [the cafeteria] have a meal you can get for like $4.75, you get chips, a drink, a sandwich and French fries, but the salad is like $10.00."

"The vending machines infuriate me. I get so angry when I stand in front of the vending machine and I'm like wow, my healthiest option is Wheat Thins, but they have high fructose corn syrup."

"Like I understand that maybe I'm in the minority and I'm the only one that wants to get something healthy from the vending machine. But it's not there for me. Why can't we have… if we have an ice cream vending machine, you know those vending machines that will pump up… Why can't we have one that has baby carrots? You know like why can't there be both? I mean it's only fair, I think. Because, I live in fear of not bringing enough food with me to school."

"I know a lot of students they don't like the food from this college [Queens] at all, they say it's overpriced."

"I have a really hard time finding food because I'm always looking for halal, and we have a halal section, but when I go there and look at the meat, I feel so disgusted I want to throw up, forget about eating that meat. Like the quality of the halal section is so bad. They have just three or four things, like rice and then like meat and sometimes vegetables, you never want to eat that food if you look at the meat. So it's really hard for me most of the time, maybe I'll buy sushi because I think, not all of the time, sometimes the sushi looks fresh, and if I buy salad it's just full of lettuce and it costs $5.00 or $6.00."

"Everything depends on how hungry you are and how much you have in your pocket."

Participants also felt that the abundance of unhealthful food served on and around campuses contributed to overeating and made it difficult to eat healthfully and maintain a desired weight. Students accepted these choices off campus but some felt that CUNY should do more to improve access to "safe" choices on campus. Lack of convenience presented a strong barrier for some participants; basically the consensus was it was just cheaper and easier to eat unhealthful options as they neither had the time or resources to seek out better choices.

"… there are not a lot of places that serve salads [off campus], there's one place, but it is expensive. I mean pizza, Chinese, Dunkin Donuts. That's what is across the street [from campus]."

"I didn't use the meal plan because it's so expensive. If you ask me the price I don't know, I just know it was just too expensive, I would rather go out to the supermarket and buy something on my own, but it is a little bit difficult going to the Associated Supermarket, I have to carry my shopping cart, only carry a limited amount of food with me, because I have to drag it up the stairs, so it's just I feel a little restricted and that's why as you walk down the hallway [in dormitory] you smell like chicken nuggets, French fries, a lot of fried foods, you can just smell the grease."

"As far as nutrition goes, like in our school's neighborhood it's big [problem] because I can't think of anywhere in five miles to get a salad, like I think a salad is way, way down, near Third Avenue or something like that."

"… as soon as you walk in the school, you take about twenty steps into the school, there's a hotdog machine. There's no fruit you know, but outside the school you can go down the block and you know probably go to the juice stand. But it's expensive so the student is going to stop and get that hot dog for a $1.75 you know."

"I tried to change [after taking a nutrition class at Hostos], but it's so hard with the surroundings. Like now they built a Burger King and a Popeye's right across the street from the school, McDonald's is two blocks away. There's a soul food spot and a Chinese store across the street from there."

An overreaching theme across all focus groups was that free water was difficult, if not impossible to find on campus. No student believed that tap water was available in their campus cafeteria and most felt that there were very few clean working water fountains on campus. Several students expressed the desire to refill water bottles, but could not find a place to do so. Although bottled water was readily available it was considered expensive or not a good value compared to soda.

"They [water coolers] are more convenient 'cause water fountains are so…nasty."

"…most of the water fountains don't work. So I find myself spending like $3.00 a day, $3.00 or $4.00 and I would… you know save my water bottle and refill if I could. Sometimes I hit the third floor in the B building, the teacher's advisement, they have water fountains there."

"In Queen College you don't know where the fountains are, it's like a hunt. No seriously, it is like a hunt for it."

Student Proposed Interventions

Improve Activity Opportunities

Some students though that their campus needed better fitness facilities because of overcrowded and/or inadequate facilities; but, most felt the gyms were adequate. It was suggested, and most agreed, that students should be allowed to use the gym on any CUNY campus. Participants in one of the groups strongly felt that having a personal trainer or instructor would enable more students to exercise and that students would be willing to pay a nominal fee for a trainer. Also, additional opportunities (e.g., intramural sports, group events and activity classes) and increased social support would help students become more physically active. In two of the groups, many participants thought that restrictions should be put on elevator use to force the use of stairs.

"If I'm a CUNY student, I should be able to go to any location. I should be able to go here today and if I want to go to Bronx [College] tomorrow, I should be able to. So that's something I think and that should be across the board that we should be able to use all [CUNY] facilities"

"They have a gym, but they don't have, what they don't have is a personal trainer, somebody that could tell you what you're doing wrong and what you're doing right."

"Also at the gym, they should have like classes ... like abdominal or like spinning"

"I think CUNY will have to start to mandating things. Like the elevator, so you have to walk."

Required Physical Education, Health or Nutrition Course

Although the consensus was that both nutrition and physical education classes would be extremely beneficial, no agreement was formed regarding whether these classes should be mandatory. About half of the participants felt that a nutrition course should be required and more than half felt that physical education should be as well. Those that disagreed objected mainly because of the extra cost that they would incur for the class and the additional time needed to put

it into their schedule. All agreed that nutrition or health should be a choice to fulfill a core science requirement.

"Why we have to take two cultural diversity classes, for core, and history and philosophy, all of them almost the same? Not even one health class? Because if you are not healthy, you're not going to be able to be productive later."

"Maybe Brooklyn College could replace geology with nutrition."

"Make it [PE] a graduation requirement. The only reason I even know where the gym is, because I had to take a class."

"Well, I don't see why a basic level health class isn't part of the core curriculum."

"I mean, personally I think it would be really great if nutrition was required. There are so many required classes. You could just fit in a nutrition class."

"…if we have a nutrition class required, maybe it will open people's minds and then get them thinking to eat healthier"

Social Marketing

Most participants did not express any usefulness for positive health messages. It was clearly felt that focusing on negative health outcomes was a much more powerful way to convince students to eat better or get more activity. It was suggested that describing the results of current bad habits in gruesome detail would be most effective. Indeed, several students mentioned how social marketing campaigns such as the Department of Health's soda/fat posters and anti-tobacco television commercials changed their habits.

"Graphic images, like that soda advertisement where it's… the department of health and it's like fat being poured into a glass. That freaked me out in the train. I haven't drank a soda straight up in a whole year after that because I was like… oh my God, ain't that scary."

"But it raised awareness, it got the job done because I have a son that's about to be off to college and it's like he sees that and he's ma, I would never smoke and the commercial with the lady with missing fingers and stuff. Like you need to make it an issue for people to see, you'll surprised the things that people just don't know, you know, and if you told them you're like you see like she said, once she took the class she was like wow, I'm not going to eat this or I'm not going to drink this. I think it just needs to be in people's face like constantly."

"I think Department of Health and the Truth Campaign is working because of the amputees they show. There was one case they had the babies like how many babies die per year because of second-hand smoking. I think those have a really big impact on people and also I personally love the terrifying advertisements to quit smoking. A few years ago they had that commercial on TV where it was like an artery and they were squeezing the, whatever it was out and I loved it…it was like see, this is what I'm saying, stop smoking and I think that if we could do that somehow with nutrition and obesity, it causes me to look, it causes people to watch. You know it catches your eye. It sticks out in your memory."

"…like some people need it to be drilled into their head. If you do this, you're going to die. Like you're going to suffer the consequences, and people need a wakeup call. …maybe they need something a little more extreme. Like the smoking ads … I know that stopped me from smoking."

Improve Access to Healthy Food

Across all focus groups, participants spoke of the unavailability of free water. The consensus was that if water was free and convenient, students would drink less soda. As whether soda and other unhealthy foods should be banned on campus there was no agreement reached. There was more support for eliminating soda than unhealthy food but many felt that you could not take away the choice.

"You cannot eliminate it [unhealthy food] from the country, but at least at CUNY, let us start with CUNY."

"Well I don't see what's wrong with taking unhealthy options away. Like why does it have to be there? People are going to eat what's in front of them. So if you're serving bad food at the cafeteria they're going to eat it. But guess what, if you're serving good food at the cafeteria, they're going to eat that too. So why make the bad food choices available? I mean you got a controlled environment there. CUNY can control what's in there. It's within their control. They can make only healthy food choices available if they want to."

"No, we are adults and should be able to drink whatever we want. How are you going to tell me I can't have a soda. I'm in college and it's my choice you should let people choose what they want".

"We got soda machines on every floor. Every floor there's a soda machine. They should have water machines."

Summary

Our findings indicate that environmental barriers, are not perceived as the main obstacles inhibiting activity in CUNY students. Across all focus groups, interpersonal and intrapersonal factors, primarily lack of time, but also lack of motivation and lack of social support are the reasons most students cite for lack of exercise. Many mentioned that they would be more likely to go to the gym if they went with a friend or had the opportunity to participate in social events that required physical activity. These findings are supported by the student health survey, in which 55.9% students report that lack of time and 28.0% report lack of motivation as the reason why they do not exercise. The students reported little use of the stairs while on campus; neither safety nor inaccessibility, two common reasons for taking the elevator, were mentioned as reasons. Although students indicated that individual factors are the primary reasons for inactivity, the students did believe that the university could do a great deal to help students incorporate exercise into their busy schedule.

In contrast, the campus environment did emerge as the primary theme for poor food choices Students spoke of a high monetary costs associated with healthful eating, specifically that their limited budgets determined their food choices and often forced them to go off campus to eat inexpensive foods such as hot dogs, burgers and pizza. Participants also felt that the abundance of high fat and calorie foods served at university cafeterias, unavailability of free water and ready access to fast-food restaurants contributed to overeating and made it difficult to maintain an ideal weight. Additionally many spoke about the effects of stress, external social pressures to eat and about what they felt was a widespread lack of food and nutrition knowledge among most students.

CHAPTER SEVEN
Discussion

Introduction

Close to 40% of CUNY students have three or more known risk factors for diabetes and an additional 30% have at least two. The well-established socioeconomic determinants of health, education (two-year versus a four-year college) low income and being black, Hispanic or foreign-born, were associated with higher risk. No new predictors of diabetes risk emerged from this study. It is important to note that the number of actual risk factors may be considerably higher for several reasons. First, age was not counted as a risk factor and more than 5% of all students were at the age which would be considered a risk factor. Second, family history did not include grandparents. As this was a young sample, many students likely have parents that have not yet reached the age at which diabetes is likely to develop or to be diagnosed so family history may have been under-reported. Last, information regarding hypertension, a known risk factor for diabetes, was not available and therefore not included in the risk calculation.

One of the major findings of the qualitative component of this study was that, despite a very diverse sample of students, there were many similarities, and few differences, among them regarding their knowledge, attitudes and behaviors related to healthy eating and physical activity.

Diabetes Risk Factors

Our findings of traditional college-age students (18-24 years of age) in regards to the diabetes risk factors: BMI, tobacco use, sugar-sweetened beverage intake and inactivity are comparable to those of the 2008 NYC Community Health Survey.[190] While the trends among the races and

gender are the same, CUNY students are leaner and smoke less than their non-CUNY counterparts. Physical activity and sugar-sweetened beverage intake were measured differently in these two surveys, so direct comparisons with our data should be made with caution.

Table 7-1. Prevalence of Selected Risk Factors by Race, 18-24 Year Olds[190]

	BMI ≥25		Smoking		SSB Intake		Inactivity	
	CUNY	NYC	CUNY	NYC	CUNY	NYC*	CUNY	NYC^
Non-Hispanic White	21.2	35.9	16.0	22.0	29.8	44.0	20.6	22.4
Hispanic	36.5	38.1	8.3	17.2	55.5	59.4	30.6	23.2
Non-Hispanic Black	39.7	50.5	7.0	20.0	60.4	60.2	33.4	20.6
Asian/Pacific Islander	20.8	NA	6.0	NA	41.2	30.9	35.3	28.6

*Answered more than one to: How many 12 oz. sugar-sweetened beverages (sodas, iced tea, sports drinks, etc.) they drink per day on average?
^Answered no to: During the past 30 days, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening or walking for exercise?

Many of the major themes that emerged regarding the barriers to eating well and being physically active have been previously reported by other researchers. Although students stressed that individual factors are the primary reasons for inactivity, the students did believe that the university could do a great deal to help students incorporate exercise into their busy schedule. Additionally, only 17.3% of respondents to the student health survey indicated that they engaged in a physical activity on campus during the past semester. This indicates that the environment may play a greater role in inactivity than students realize. It is possible that in our individualistic society people will always start with personal blame and personal responsibility. Their willingness to propose institutional changes also suggest they recognize environmental barriers and potential solutions, despite the fact that it seemed easier for them to blame themselves for being unmotivated, lazy and unable to exercise.

In 2009, Nelson et al. found that important influences on dietary intake and physical activity among college students included: unhealthful food availability on campus, eating because of stress, negative experiences using campus recreation facilities, lack of time/time management, no self-motivation and little social support for exercise.[69]

Although there were many similarities to other studies, there were some notable differences. Alcohol related eating is cited in the literature as a reason for poor food choices including both eating late at night after alcohol was consumed, as well as eating before going out to allow themselves to consume more alcohol.[69] This was never mentioned in any of the CUNY focus groups. When probed about alcohol use on campus, students did not believe it to be a significant problem; although, they recognized that it may be. As one student explained, CUNY students do not generally socialize with each other after classes, as would students living together on campus, so they really don't know to what extent alcohol or drugs are being used or abused.

Safety and poor weather, two common barriers to exercise, are cited in the literature as reasons for inactivity;[69] but these themes did not emerge among the CUNY students. Strong et al. found that socializing was considered a higher daily priority than exercising or eating healthfully[54] and Clusky et.al reported that students described their unstructured free time as being both a hindrance and a help to healthy habits.[99] The participants in both Greary's and Nelson's focus groups reported boredom as a reason for weight gain.[69,70] In contrast, while CUNY students did express social pressure when choosing where to eat, the consensus was that they had no free time to be bored and had very little time for socializing; for them, it was jobs, family responsibilities, school work and commuting time that interfered with eating well and being active.

Also, in contrast to this present study, the price of food and unavailability of free water did not surface often as constraints to healthy eating in previous work. This is likely due to the fact that students living on campus have prepaid meal plans and thus have ready access to a wide variety of food and water. They do not have the stress of a limited food budget nor do they need to take time from their studies to shop and prepare food for themselves and their families, as do most CUNY students who are poorer.[144] *These finding make it clear that the needs of CUNY students are very different from the more traditional students living on campuses throughout the country.*

In regards to exercise, our findings support what has been previously published. Women, Asians, those will lower incomes and less education are less active. To the best of our knowledge, the finding that college students born outside the country are less active than their native-born counterparts is a new finding. It has been previously reported that immigrant children and teenagers are less active that American-born children. Data from the 2003 National Survey of Children's Health of 68,288 children ages six to 17 years of age found that foreign-born children were 39% more likely to be physically inactive, 26% less likely to exercise regularly and 42% less likely to play sports than their native-born counterparts.[191] The lower levels of physical activity found in immigrant children may be attributed to cultural differences, including an increased emphasis on reading and other educational activities. Immigrant parents may also discourage their children's participation in sports because of fear of bullying, language barriers and safety concerns. A small qualitative study found that Hispanic students born outside the United States were less likely to have participated in competitive sports or vigorous exercise in the past because they were less likely to have family members who were role models for physically active lifestyles than native-born black women. Foreign-born women were more

likely to believe that certain vigorous physical activities were "unfeminine".[82] *Our findings provide evidence that disparities in physical inactivity and sedentary behaviors identified in immigrant children likely persist into young adulthood.*

Risk Perception

According to the health belief model the higher the perceived susceptibility to a condition is the higher the likelihood of taking action to prevent that condition. If this is the case, students at risk for diabetes may be more likely to change their behaviors if they recognize their susceptibility to the disease. It is likely that even generic health promotion campaigns will have a greater effect on those who acknowledge their vulnerability compared to those who do not believe that they are at risk.

This study revealed that approximately 40% of those students with three or more self-reported risk indicators do not perceive their personal risk of diabetes to be different from other students. It is tempting to speculate that the students did not accurately perceive their diabetes risk because of youthful optimism. However, this does not seem to be the case as there were no statistical differences detected between the perceptions of older and younger students. It should be noted that the students' responses to the question of how they perceived the likeliness of getting diabetes may represent one of two things: 1) The respondents' perceived risk of getting the disease in the short term or 2) their perceived risk of having diabetes at some point in their entire lifetime. Either way, a general perception of risk was obtained and the data represent risk quantification we consider worthy of analysis.

In the present study we found that those students who are aware that they are more prone to diabetes than their peers are more likely to be female, born in the United States and have a

family history of the disease. A greater proportion of black students (p = .027) were more realistic predictors than their white, Hispanic and Asians counterparts, but when entered into a multivariate regression model race did not remain significant.

Excess body weight has been reported to be associated with greater self-perceived risk of developing diabetes.[192] This was true in the present study as well; overweight and obese students were more likely to believe that they would develop diabetes than their normal weight counterparts (Table 7-2). Additionally, students with a known family history of diabetes were more likely to believe that they would develop diabetes than those students who did not report a family history. In support of these findings, Harwell et al.[193] found that family history is the factor most significantly associated with the perceived risk of developing diabetes in adults and

Table 7-2. Diabetes Risk Perception and BMI

Risk Perception	BMI <25		BMI ≥ 25		P-Value
	Number	Percent	Number	Percent	Chi-Square Test
Optimistic	519	58%	192	37%	
Pessimistic	377	42%	322	63%	
Total	896		514		<.001

in a second study, that adolescents' knowledge of a father's diabetes was also predictive of greater perceived vulnerability to diabetes.[194]

In contrast, Pierce et al., in their randomized controlled trial, found that the family members of individuals with diabetes underestimate their own risk of developing the disease.[195] Recognizing the presence of a family history as a significant risk factor for developing diabetes was also infrequent among subjects in a study in the sultan of Oman, but more common among the educated and those with higher incomes.[196] A small (n=21) focused interview study, also indicated that a family history of diabetes does not necessarily lead to increased perception of

diabetes risk.[197] Although those with a family history were aware of the diabetes in their family, they did not always associate their family history with increased risk, nor did they worry about getting diabetes.[197]

Graham et al, in a study of 225 African Americans found that individuals' perception of risk for diabetes is frequently and substantially incongruent with their actual risk.[125] More than one third of participants who believed they were not at risk were actually at high risk and 28% were at low (but not zero) risk. Of those who believed they would never get diabetes, 40% were at high risk and 13% were at low risk of getting the disease.[125] In seven other studies in which subjects' perceived risk was compared to the researchers' estimated risk, it was found that between 40%-89% were under-estimators, those who believed that they were not likely to get diabetes when in fact they had a greater than average chance of developing the disease in their lifetime (Table 2-4).

Table 7-3. Diabetes Risk Perception by Race/Ethnicity for All Students

	Optimistic		Pessimistic		P-Value
	Number	Percent	Number	Percent	Chi-Square Test
Non-Hispanic White	154	61%	100	39%	*<.001*
Hispanic	166	46%	192	54%	
Non-Hispanic Black	222	43%	294	47%	
Asian and Pacific Islander	150	59%	104	41%	
Total	692	51%	690	49%	

While the associations between the above mentioned factors and risk perception were found, the amount of variance accounted for by these factors in this study was in most instances small. I would postulate, therefore, that a complex combination of cultural, demographic and

environmental issues determines the differences and similarities in attitudes towards diabetes risk. Although these students represent many distinct groups, they all live in same city and attend the same university. This shared environment may be a strong influence on their perceptions and behaviors accounting for the small amount of variance among groups. Additionally, risk perception is subjective and is probably not entirely modulated by knowledge or other measurable characteristics. It is more likely based on experiences and emotion and therefore factors not measured in this study, such as the proximity of a loved one with the disease, may account for perception.

One factor, important to the CUNY population, is place of birth. Differences between American born students and those born outside the country were revealed in this study. Foreign-born students were significantly less active, scored lower on the diabetes risk factor knowledge test and were less likely to recognize that they were at risk for diabetes. These differences remained significant when controlling for both race and income.

One of the most striking findings from this study was the gap in perceived versus actual risk among Asian students. It has been calculated that the odds of diabetes in Asians Americans are generally 30-50% greater than their white counterparts; despite, having substantially lower BMI.[11] The data indicate that this group does not recognize their risk, as almost 60% of all Asian students stated that they are less likely to get diabetes than others their age (Table 7-3) and approximately 50% of Asians at high risk for diabetes did not acknowledge their risk compared to 33% of blacks and 39% of Hispanics (p >.001) (Table 7-4).

Table 7-4. Diabetes Risk Perception by Race/Ethnicity for High Risk Students					
	Under-Estimator		Realistic-Estimator		P-Value
	Number	Percent	Number	Percent	Chi-Square Test
Hispanic	68	39%	106	61%	*.018*
Non-Hispanic Black	90	33%	180	67%	
Asian and Pacific Islander	45	50%	45	50%	
Total	203	38%	331	62%	

Four possible explanations for the Asian white disparity in diabetes risk have been proposed:

- Asians appear to be more genetically predisposed to develop diabetes compared to their white counterparts[11]
- chronic stress related to immigration and acculturation could contribute to insulin resistance[11]
- Asians are known to have a greater ratio of fat mass to lean body mass than whites at any given level of BMI[198]
- Asians Americans are less likely to be physically active than non-Asians.[199]

The above factors have lead to the development of different BMI standards for this population: 18.5-23.9 normal, 24-26.9 overweight and >27obese.[198] Applying theses standards to the Asian students at CUNY would increase those at high risk for diabetes from 39.6% to 40.7%.

Both Asian and non-Asian CUNY students alike, were unaware of the high risk of diabetes among Asians. Almost 20% of students surveyed believe that being Asian actually lowers diabetes risk and less than 2.0% of students responded correctly that being Asian greatly increases the risk of diabetes. This is not a surprising finding. In a study of primary care physicians, a group trained to recognize chronic disease risk factors, only 27% of white physicians and 56% of Asian physicians knew that being Asian increased one's risk of developing diabetes.[120]

It is conceivable that this lack of awareness is related to the development of diabetes in this group at a body weight considered "normal" by conventional standards. Excess body weight is

the most visible risk factor for diabetes. Asians in general, and in the CUNY population, weigh less than their non-Asian counterparts and thus may not be viewed as at risk. Additionally, although diabetes is spreading more rapidly in Asia than anywhere else in the world and China is now considered the epicenter of the diabetes epidemic with 92.4 million adults with the disease, there is poor public awareness and limited opportunities for diagnosis in most of Asia.[200] For example, more than 60% of those with diabetes are estimated to be undiagnosed in China. As the majority (54%) of Asian students are immigrants, this low diagnosis rate in their homeland may lessen their perception of risk.[200]

CUNY students who self-identified as Asian were also the least likely to exercise three or more hours per week. This is consistent with the literature as findings indicate that Asians, both female and male, are less likely to engage in vigorous physical activity in college and Asian women in particular are also inactive in high school.[74] Several important clinic trials have identified increased activity as the behavior change mostly likely to prevent diabetes or delay its onset.[201-203] It is therefore necessary to understand the levels of physical activity among CUNY students in order to target interventions to the least active groups. Physical inactivity is also of particular interest from a public health perspective because it is more readily modifiable than obesity. However, as Asians, women in particular, may have less exposure to exercise and sports prior to college,[74] different strategies may need to be employed to engage this high risk population in an active lifestyle during college and throughout life.

Diabetes Risk Factor Knowledge

Our data clearly show that few of the students surveyed were knowledgeable about well known diabetes risk factors. It is important to note that the non-modifiable risk factors are least

known, as the majority of students were able to identify excess weight an lack of exercise as being risk factors for diabetes. Blacks received the lowest scores on the diabetes risk factor knowledge test, but the majority of all students could not identify risk factors that have been commonly accepted. For example, a significant number of students did not recognize the risk a family history of diabetes, race, age and history of gestational diabetes pose to the individual's future health. Of the 575 students who were at high risk for diabetes, 39% did not recognize their risk. These under-estimators had significantly lower diabetes risk factor knowledge scores than their counterparts who acknowledged that they were at risk. *Thus, this study provides evidence that the cause of under-estimating diabetes risk may be, at least, in part due to a lack of sufficient information about risk factors.*

It is this unrealistically optimistic high-risk group that warrants the most attention and need for awareness interventions. Although it may reduce emotional distress, an unrealistic perception may also reduce the likelihood that an individual will actively take preventive actions to reduce the threat. Additionally, an individual who believes that he or she is not at risk may respond differently to health prevention messages than someone who is highly conscious of his or her risk. Stronger efforts must be taken to heighten knowledge and awareness of future health concerns as it has been shown that improved general awareness of risk is associated with greater personal awareness and increased actions to lower chronic disease.[204] It is also important to note that 86% of the students in this study believed that they could take action to prevent diabetes if necessary, indicating that increasing awareness of risk could lead to behavior change. There is a pressing need to develop models of behavior change that are both relevant and effective for emerging adults. Appropriate messages must be tailored to address different beliefs and culturally sensitive programs for all ethnic groups and subgroups need to be developed.

Self-Efficacy

The majority (86%) of respondents in this study were identified as having a high perceived self-efficacy with regards to being able to prevent diabetes; but there were no significant differences found between those with high and those with low self-efficacy. The validity and reliability of the item used to measure self-efficacy is questionable and likely contributed to these findings. While it gives us some insight, the statement "*if I am going to get diabetes there is not much that I can do about* it" leaves much ambiguity about exactly what is being measured. It may, as was intended, identify those who believe that they have the capabilities to take the necessary steps to prevent the disease. However, is also possible that it measured a student's perception that they are not at risk for diabetes. Alternately, it may be a measure of locus of control rather than perceived capability. If there is a perception that diabetes is determined by forces outside one's control, a genetic predisposition for example, agreeing with the statement is not a judgment of one's capabilities or self-efficacy but rather the belief that diabetes is not preventable. There is no all-purpose measure of perceived self-efficacy for diabetes and the number of behaviors that must be managed to prevent the disease make self-efficacy difficult to measure with a single question.

Strengths and Limitations

The use of mixed methods was a strength of this study as it provided not only quantitative information regarding the health behaviors of students; but, also insight into how students perceived there food choices and opportunities for physical activity and it generated much valuable information about factors influencing lifestyle choices. Also adding to the vigor of this research is that the Student Health Survey was completed by a large sample of 1,579 diverse

(60% non-white) students living and attending college in an urban environment. This is in contrast to the majority of research on college health which has been conducted almost exclusively among white students living in dormitories in non-urban locations. The focus groups participants were also diverse and, although neither sample was randomly selected, the demographics of the groups were similar to CUNY as a whole except for gender. The fact that the recruitment process for the focus groups likely resulted in students interested in health participating can also be viewed as strength. It is logical to assume that those seeking a healthy lifestyle would be much more aware of the barriers and enablers that one faces when trying to eat well and stay fit. Thus, these students may have provided more insight than students who were less interested in health issues could have.

This study is limited by the fact that The Student Health Survey was a convenience sample from only three campuses, and therefore, may not be representative of all of CUNY. There are significant differences within the CUNY system. Of the 23 institutions, some are community colleges, some are four-year schools and some have very diverse populations while others are more homogenous. So there are likely to be significant differences among CUNY students, making it impossible to generalize findings form one CUNY school to another, let alone to non-CUNY students. However, the sample was very closely matched to the demographics of the university. Although cross-sectional studies cannot infer causation, this study design was appropriate to achieve its aims of measuring diabetes risk, knowledge and risk perception.

There are also limitations inherent in focus group research; findings cannot be generalized to a larger population because sample sizes are relatively small and not randomly selected as the study participants are often selected based on specific characteristics that are typical of the intended population, yet not necessarily representative of that population. In this case, those

students who were invited to participate were likely interested in health as they were participating in a health workshop; therefore, they may be different from other CUNY students who did not choose to attend the workshop. Thus, it is likely that focus group participants were more knowledgeable about health issues compared to students who did not attend the workshop. Therefore, their responses may be more biased regarding the importance of a healthy lifestyle and thus potentially having an impact on internal as well as external validity. Additionally, students from only 12 of the 23 CUNY institutions participated and less than 20% of the participants were male. Students from other campuses and men may have different experiences and opinions.

Recommendations

Health programs directed at CUNY students should recognize students' perception that their schedules seem to be out of control and behavior change may be seen as an additional and unnecessary burden. Campus interventions will likely have a higher degree of success if the constraints and pressures under which students are attending school are acknowledged and addressed. Programs and policies which encourage incremental and manageable changes in the lives of students need to be designed and students reassured that participation can lead to health benefits without an additional burden on already burdened schedules. The fact that healthy behaviors may reduce stress, a frequently cited problem, is a related and potentially effective selling point for health campaigns on campus. Additionally, teaching skills to overcome barriers identified in this study, such as time management methods, self-motivational techniques and strategies for acquiring and maintaining social support will be much more useful than simply promoting the health benefits of a good diet and physical activity.

Proximity to exercise facilities has been identified as an environmental factor that affects individual decisions to exercise.[76] Even on campuses where open spaces and gym facilities were available and convenient, most students did not report taking advantage of them. In part, this seemed to be due to lack of awareness; therefore, the availability of exercise facilities and activities on each campus need to be more effectively publicized. Additionally, students should have access to all CUNY gyms, not just the one where they attend school, as this may be more convenient for them.

Added opportunities for physical activity such as intramural sports, group events, extended gym hours and access to all CUNY recreation centers could increase social support and may help students become more physically active as group dynamics lead to increased sense of group cohesion that can contribute to adherence and participation. Since were found women to be less active than men and as there are religious prohibitions in some cultures to engaging in co-ed activities, women only gym hours and classes limited to female students may be warranted. It should also be seriously considered that one or more physical education class becomes a requirement for graduation at all CUNY institutions.

To reduce disparities in childhood physical activity, interventions should target not only students from socially and economically disadvantaged families, but also students who have migrated to this country with special attention to women from Asian and Muslim countries where there are gender barriers to activity. Given the health benefits of physical activity, if not addressed the lower activity levels in immigrant will continue to fuel the obesity and diabetes epidemics.

Although nutrition and health knowledge does not necessarily lead to an improvement in food selection and health behaviors, knowledge should be considered an important step in influencing

behavior change, a step, which according to the focus group participants, is needed at CUNY. The American College Health Association's task force to address college health calls for an increase in the proportion of college and university students who receive information from their institution in each of six priority health risk behaviors which include dietary patterns that cause disease.[205] One way to accomplish this is to mandate that nutrition education become part of the university's core requirements. Requiring CUNY students to take a nutrition course guarantees that they are exposed to reliable, practical and helpful information about food, preventing disease and maintaining optimal health during college and beyond. Although, it needs to be emphasized that nutrition education programs or courses need to do more than emphasize factual knowledge. It is necessary to provide the skills to interpret and translate the knowledge into healthy behaviors and even more importantly somehow elicit in students the motivation to change perhaps by evoking emotions and experiences associated with family or one's culture.

As we realize that there are many obstacles to a new requisite, a reasonable alternative would be to include nutrition as an option to fulfill a science or social science core requirement. CUNY students must be educated to improve their health behaviors and decision-making skills. Such guidance has the potential to reach thousands of CUNY students and indirectly their families and friends. Teaching young people to eat well and the consequences of not doing so is a vital step in the fight to reverse the diabetes epidemic and benefits New York City as a whole.

Clearly, more than knowledge and time management skills are required to improve the food choices of CUNY students. The overreaching theme that having a limited disposable income coupled with the high cost and unavailability of healthy options informs us that the university needs to develop a strategy to insure that tasty, nutritious and satisfying meals are not only readily available but affordable for all students. A strategy that implements small price increases

on popular high fat and calorie foods and a modest price reduction on healthier alternatives is a feasible strategy to promote better food choices on campus as decreasing cost increases accessibility. The effectiveness and achievability of cost reduction interventions have been demonstrated in several studies.[157-163] For example, in a study of restaurant purchases it was reported that a 25% price reduction for salads was associated with a doubling in sales,[164] while a 50% price reduction in fruit and salad in a university cafeteria led to a threefold increase in purchases of these items.[165] Price reductions of lower-fat vending machine snacks in secondary schools resulted in an increase in the percentage of lower-fat snack sales and when the price for fresh fruit and baby carrots was cut by 50% in two high school cafeterias, sales of fresh fruit increased four-fold and sales of the carrots doubled.[161] Sales returned to baseline levels with the restitution of usual prices.[161]

Additionally, policies making it easy to obtain free water and more difficult or impossible to purchase sugar-sweetened beverages on campus are warranted. Recent success in Boston's high schools highlights the importance of implementing comprehensive policies and strategies to restrict the sale of sugar-sweetened beverages. Two years after Boston schools banned the sale of sugar-sweetened beverages like sodas and sports drinks, local high school students were consuming significantly fewer sugary drinks (from 1.71 average servings per day in 2004 to 1.38 servings in 2006) in contrast to the average consumption of sugary beverages which did not decline among teens nationwide.[186] This study shows that a very simple institutional policy change can alter student behavior.

Lastly, students who did not recognize that they had three or more risk factors for diabetes must be targeted. These under-estimators need to recognize both the modifiable and non-modifiable risk factors associated with diabetes. While this awareness may not necessarily lead

to changes in eating or activity behavior, it could and it may result in earlier detection and treatment of the disease. The American Diabetes Association has a developed an "Are You At Risk Campaign" which is well suited for this population and should be implement on all campuses.

Table 7-5. Proposed Policy Changes at CUNY

Policy	Level
Nutrition class option to fulfill college core requirement	Intrapersonal
Require physical education class(s)	Intrapersonal
Increase opportunities for group physical activities	Interpersonal
Offer women only exercise classes or gym hours	Interpersonal
Allow students to use gyms on any campus	Environmental
Institute pricing strategies to make healthy choices affordable	Environmental
Require readily available free water in all cafeterias	Environmental
Ban the sale of sugar-sweetened beverages on campus	Environmental
Social Marketing – "Are You At Risk?"	Environmental

Implications for Future Research

This research is a first but important step in assessing and understanding the health perceptions, knowledge and behaviors of CUNY students as well as the positive and negative influences of the campus environment. These data suggest that college students who are knowledgeable about diabetes risk factors are more likely to be aware of their personal risk. However, it was not determined if those who recognized their increased risk for diabetes altered their behavior to diminish risk or what the mediators are between perceived risk and health behaviors. It would be useful to investigate the efficacy of risk factor education programs in

changing both perception and health behavior and whether improvements can be sustained over long periods of time and ultimately reduce diabetes.

In previous work, it was found that perceived barriers to eating healthy had a strong influence on self-efficacy.[206,207] As a follow up study, it would be beneficial to compare the influences of barriers to eating well and physical activity at CUNY to students' perceptions of their ability to prevent diabetes and then determine if removing the barriers increases self-efficacy. This would give us a better understanding of the interaction between interpersonal and environmental barriers and their relationship to behaviors. To accomplish this, a more robust self-efficacy measure is likely needed to distinguish between those who believe that they have the ability to prevent the disease and those who do not. More useful measures of self-efficacy for preventing diabetes should include beliefs about the ability to perform specific health behaviors associated with preventing diabetes (e.g. *I am certain that I can engage in three hours of physical activity each week")*.

Understanding how students make food choices is a prerequisite for nutrition intervention and should be an aim of additional research. The focus group participants overwhelmingly reported that price was often the deciding factor when making a food selection. Money and health are both highly prized, but the two seem to be in conflict when it comes to eating well. Therefore, the economic forces driving eating behavior need to be more fully explored. Price manipulation has the potential to influence healthful eating patterns in entire populations. Several studies indicate that purchases increase after price reductions of healthful food in vending machines cafeterias and restaurants.[160-163] It needs to be determined if this would be the case at CUNY as well.

All of the environmental determinants of health on campus warrant attention and should be a primary focus of future research. Ideally, a longitudinal study which followed two cohorts of students (one attending a college which implemented some or all of the recommendations in Table 7-5 and one which did not) throughout their years at CUNY and beyond would be a good measure of the efficacy and sustainability of the interventions.

Conclusions

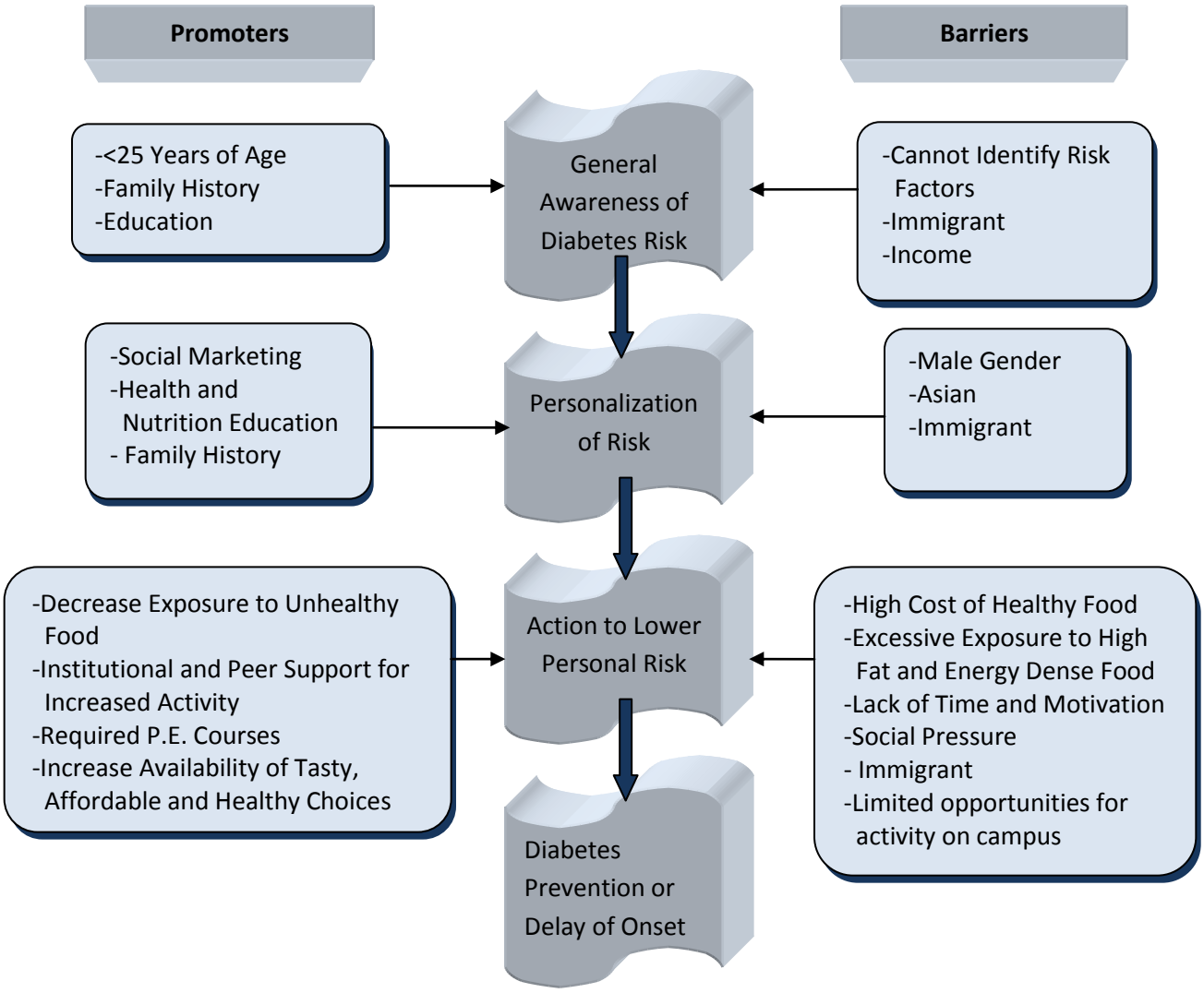
The data from the student health survey and the themes that emerged in the qualitative portion of this study can help guide campus programs and policies designed to reduce the future burden of diabetes in New York City. Multi-level interventions need to be implemented (table 7-5); but no level of intervention should be considered more important, as each tactic has the potential to provide complementary contributions towards improved health. Interventions that center on individual-level mediators of behavior change such as increasing risk perception, nutrition knowledge and self-efficacy, have demonstrated effectiveness and are warranted. However, improved health behaviors are often difficult to maintain over time, therefore individual-level interventions will not be sufficient as it is unlikely that students can garner continued internal motivation, family and peer support and overcome the obstacles to healthy living without continued assistance. (Figure 7-1). Environmental factors contribute to the behavior of individuals, so if one's environment does not change after the individual-level intervention is concluded, behavior change is difficult to sustain. Therefore individual-level interventions need to be linked to permanent institutional changes at CUNY.

The university possess several characteristics making it a good setting to reduce the future burden of diabetes. First, students are a large, readily available and some-what captive

population as they spend a good deal of their time on campus attending class, studying, eating and socializing. Second, CUNY is uniquely positioned to provide effective interventions and supportive environments because they have highly qualified staff necessary for nutrition and health promotion interventions. Third, they have foodservice operations on each campus and can assume the authority to set menu standards. Last, there is a network of fitness facilities and sports programs in place on campuses throughout the city which could easily be expanded or better promoted.

Unfortunately, at a time when CUNY is financially stressed there may be little support for new initiatives. Additionally, there are those who believe individuals are responsible for their own choices and government or institutional intervention is a wrong and a dangerous option, as people should be assuming, not relinquishing personal control over their own health. But diabetes is no longer just an individual concern, it is an epidemic that is ravishing our city. As a publicly funded institution CUNY has a broad social mission and an obligation to not only educate New Yorkers, but do all it can to ensure the health of its students and the future health of the city. CUNY administrators and policymakers must make diabetes prevention a priority for emerging adults of all racial, ethnic and socioeconomic backgrounds.

Figure 7-1. Promoters and Barriers to Diabetes Prevention among CUNY Students



APPENDIX A
Campus Nutrition and Health Initiatives

Carnegie Mellon University, Pennsylvania: Reduced Cost Fitness Classes. Comprehensive programming is offered to the entire university community in the recreation areas of group fitness, accredited physical education and aquatics. Faculty, staff and students are able to participate by purchasing a fitness punch card, 10 punches for $30.00. Each activity or class is one punch.[140]

Clemson University, South Carolina: Peer Health Educator Program. Students enroll in a three credit class, to be trained as peer health educators (PHE). The PHEs work with the health promotion staff to raise awareness and provide education by assisting with presentations and by working on health promotion events. The PHEs serve as a resource for students on a wide variety of psychosocial and wellness issues.[143]

Grand Valley State University, Mississippi: Point-of-Purchase Food Labeling. All food service facilities on campus use the "Just 4U" labeling icons which indicate that an item is low in calories (less than 300 per serving), made with whole grains, locally grown, low fat (less than 3 grams per serving), no salt added or organic. Additionally, a website provides specific nutrition information on all food served. The information is provided by the foodservice vendor.[137]

Miami University, Florida: Point-of-Purchase Food Labeling. Nutrition information is displayed at the University's multiple dining locations. Nutrition fact cards are supplied for each item served. The cards provide nutritional information as well as tools to help students identify low carbohydrate, low calorie, low fat and vegan food items. The information is provided by the foodservice vendor.[208]

Northern Arizona University: Nutrition Counseling. A registered dietitian is available at no cost to students. Parents of students receive a letter describing the service and its benefits.[141]

Notre Dame, Indiana: Point-of-Purchase Food Labeling. In addition to the availability of free nutrition counseling by a registered dietitian, items in the cafeteria are labeled "H" for healthy eating, "V" for vegetarian and "L" for lower in fat, calories and sodium. The information is provided by the foodservice vendor.[138]

Portland State University, Oregon: Monthly Health and Wellness Magazine. A free online subscription to *Student Health 101* is provided to all students. Each issue contains information designed to help students make better decisions while in college and provide them with a better understanding of the health and wellness challenges that they face.[209]

Southern Illinois University Carbondale: Student Advocacy Program. Assistance from a registered nurse helps students understand their newly diagnosed or chronic illness, and explore financial resources to reduce major reasons for non-adherence to treatment. The program assesses a student's eligibility for financial assistance when he or she is having difficulty paying medical bills and prescription drug expenses.

The program has enabled students to stay in school when they otherwise might be forced to withdraw by helping them to cope with chronic conditions like diabetes, HIV, asthma and physical disabilities. Also available, for a $6.00 fee, are healthy eating and weight control classes.[210]

Syracuse University, New York: Healthy Mondays. This public health initiative encourages people to commit every Monday to the behaviors and actions that will end preventable disease in the United States. Each Monday, the University offers free fruit, massages, herbal tea, fitness classes and Zen meditations. Healthy Mondays also offers disease prevention/health promotion, peer nutrition education and counseling to residence hall floors, Greek houses, and other campus groups.[211]

University of Southern California: Healthy Eating Class. Students can join a small group (no more than four people) in a confidential and supportive class led by a professional health educator and dietitian. Current eating habits, healthy portion sizes and eating on a budget are discussed and individualized meal plans and referrals are provided when appropriate.[142]

Western Carolina University, North Carolina: **Vending Machine Labeling.** Students wishing to purchase healthy choices from vending machines can look for a logo which identifies healthy items.[139]

APPENDIX B
Nutrition, Health and Physical Education Course Requirements at CUNY

College	Borough	College Type	Nutrition or Health Course Required	Nutrition or Health Fills a Requirement	Physical Education Required
Baruch College	Man-hattan	four-year	No	No	No
Borough of Manhattan CC	Man-hattan	two-year	Yes: Health for **some** majors[a]	Yes: Health for **some** majors[b]	No
Bronx CC	Bronx	two-year	Yes: Health for **some** majors[c]	Yes: Health for **some** majors[d]	For **some** majors[e]
Brooklyn College	Brooklyn	four-year	No	No	No
College of Staten Island	Staten Island	four-year	No	No	Yes[f]
Hostos CC	Bronx	two-year	No	No	No
Hunter College	Man-hattan	four-year	No	No	No
John Jay College	Man-hattan	four-year	No	No	Yes[g]
Kingsborough CC	Brooklyn	two-year	No	No	No
LaGuardia CC	Queens	two-year	No	No	No
Lehman College	Bronx	four-year	No	No	No
Medgar Evers College	Brooklyn	four-year	No	No	No
NYC College of Technology	Brooklyn	2/four-year	No	No	No
Queens College	Queens	four-year	No	Yes: General Nutrition[h]	Yes[i]
Queensborough CC	Queens	two-year	Yes: Health Education[j]	No	Yes[k]
The City College of New York	Man-hattan	four-year	No	No	No
York College	Queens	four-year	No	No	Yes[l]

Appendix B: Notes

[a] HED 100 *Health Education* (2 credits) is required for some majors including: business administration, accounting and child care/early childhood education. Course description: This introductory course to health education takes a survey approach. It aims to develop attitudes and habits which will promote good physical, mental and social health. Areas of specialization include alcohol, tobacco and substance abuse education; mental health; sex education; family living, and nutrition and exercise.

[b] HED 100 *Health Education* (2 credits) is an option to meet the general education requirements for a few majors including, computer information systems and computer network technology.

[c] HLT 91 *Critical Issues in Health* (2 credits) is required for education majors. Course description: Intended to develop and encourage critical judgment in vital areas of health, mental health, dependences, human sexuality and nutrition.

[d] Digital arts and media technology students must choose either a physical education course (1 credit) or HLT 91 *Critical Issues in Health* (2 credits) to fulfill requirement.

[e] A one credit physical education course is required for some majors including, engineering, nursing and horticulture.

[f] Successful completion of PED 190 *Fitness for Life* (1 credit) fulfills the general education requirement in physical education. Course description: This course is designed to inform students about current issues and practices in fitness and wellness. It combines theory and practice in lectures and physical activities to enable students to plan for a healthy independent future.

[g] Any 1-3 credit course physical education course satisfies the requirement.

[h] FNS 163 *General Nutrition* (3 credits) satisfies the science requirement. Course description: Fundamental principles of normal nutrition and their application to the selection of adequate diets for individuals and families.

[i] If a student is medically unable to take a physical education course they can take FNES 030, *Fitness Through Diet, Exercise and Weight Control* (3 credits).

[j] Students in many of the Associate degree programs are requires to take HE 101 *Introduction to Health Education* (1 credit) or HE 102 *Critical issues in Health Education* (2 credits). HE 102 course description: A concentrated course of study involving research and discussion of critical health issues dealing with mental health addictions and dependencies, exercise, diet, human sexuality, major diseases there relation to mortality and longevity

[k] Depending on the major either one or two credits of physical education are required.

[l] *Fitness for Living* (2 credits graded p/f). Course description: The relationship of physical activity to health and the quality of life; basic principles of physical conditioning explored with the aid of the Human Performance Laboratory equipment; measurement and evaluation of personal physical fitness levels; design and pursuit of individual training programs; varied physical activity experience to meet the individual student's needs.

APPENDIX C
CUNY Student Health Survey (2008)

1. At which CUNY campus are you enrolled?

   [1]☐ Hunter [2]☐ Hostos [3]☐ Medgar Evers [4]☐ other

2. How many credits have you completed at this college prior to January 1st 2008?

3. How many years have you been enrolled at this college?

4. Indicate what type of student you are: [1]☐ undergraduate student [2]☐ graduate student

4a. What type of program are you in? [1]☐ enrolled in a two year program [2]☐ enrolled in a 4 year program

5. How old are you? What is your date of birth?

6. Sex: [1]☐ male [2]☐ female

7. Please indicate the number of children you have:

8. Marital Status: [0]☐ single/never married [1]☐married /living as married [2]☐ separated [3]☐ divorced [4]☐ widowed

9. Is English your native language? [1]☐ no [2]☐ yes
   - If no, how well do you read and understand English?

   [1]☐ not well at all [2]☐ fairly well [3]☐ very well [4]☐ extremely well

10. Are you Hispanic or Latino? [0]☐ no [1]☐ yes

    - Which one of these groups would you say best represents your race/ethnicity?

    [1]☐ American Indian/Alaska Native [2]☐ African American/Black [3]☐ Pacific Islander /Native Hawaiian

    [4]☐ White [5]☐ Asian (specify) [6]☐ other (specify)

11. Are you an immigrant (born outside of the United States)? [0]☐ no [1]☐ yes

    - If yes, please indicate what country you immigrated from and the length of time you have been in the U.S.

    Country of origin: Length of time in US, in years:

12. What was your annual household income in dollars in 2007?

    [1]☐ less than 10,000 [3]☐ 20,001 to 40,000 [5]☐ 60,001 to 80,000 [7]☐ 100,001-120,000

[2]☐ 10,001 to 20,000 [4]☐ 40,001 to 60,000 [6]☐ 80,001 to 100,000 [8]☐ 120,001 or more

13. Where do you live?

[1]☐ Bronx [2]☐ Brooklyn [3]☐ Manhattan [4]☐ Queens [5]☐ Staten Island [6]☐ Westchester County

[7]☐ Suffolk County [8]☐ Nassau County [9]☐ New Jersey [10]☐ In Hunter Dormitory [11]☐ other

14. What zip code do you currently reside in?

The next series of questions ask about your health and physical activity.

15. What is your current weight in pounds?

16. What is your height (e.g. 5 feet & 6 inches)?

18. In a **typical week**, how much time do you spend walking? Include the time you spend walking for exercise and all other walking that you do such as walking to and from the bus, classes or the store.

[0]☐ none [1]☐ less than 1 hour [2]☐ more than 1 hour less than 2 hours

[3]☐ more than 2 hours less than 3 hours [4]☐ more than 3 hours less than 4 hours [5]☐ 4 or more \ hours

19. In a **typical week**, how much time per week do you engage in exercise? (Exercise refers to physical activities such as jogging, dancing, running, bicycling, weight training, or any other activities which cause at least light sweating or at least a slight increasing in breathing.)

[0]☐ none [1]☐ less than 1 hour [2]☐ more than 1 hour less than 2 hours

[3]☐ more than 2 hours less than 3 hours [4]☐ more than 3 hours less than 4 hours [5]☐ 4 or more hours

20. Where do you typically exercise? **(check the one you use most often)**

[1]☐ at your college [2]☐ outdoors [3] ☐ at a gym [4] ☐ at home

[5]☐ not applicable, I don't exercise [6]☐ other (please specify)

21. Which of the following is the **main reason** that prevents you from exercising more?

[1]☐ lack of time [2]☐ lack of places to exercise in your neighborhood or school [3]☐ lack of motivation

[4]☐ cost [5]☐ not applicable, I feel I exercise enough [6]☐ other (please specify)

22. During the past semester, did you engage in a physical activity on campus? [0]☐ no ☐ yes

- If yes, please indicate what you did.

[1]☐ a physical education course [2]☐ used the campus gym [3]☐ member of a sports team

[4]☐ dance or yoga class [5]☐ intramurals [6]☐ other, please specify

23. This semester, on average how many times **a week** do you climb two or more flights of stairs on your campus?

[0]☐ 0 times [1]☐ 1-2 times [2]☐ 3-5 times [3]☐ 6-9 times [4]☐ 10-15 times [5]☐ more than 15 times

24. How satisfied are you with the availability of places to engage in exercise on your campus?

[1]☐ very unsatisfied [2]☐ somewhat unsatisfied [3]☐ satisfied [4]☐ somewhat satisfied

[5]☐ very satisfied

25. During the past semester, did you ever ride a bicycle to school? [0]☐ no ☐ yes

- If yes, on average, how often did you ride a bicycle to school?

[1]☐ 1 time a week [2]☐ 2 times a week [3]☐ 3 times a week [4]☐ 4 or more times a week

26. Would you like to ride a bicycle to school? [0]☐ no [1]☐ yes ☐ I do ride to school

- If yes, what prevents you from riding a bicycle to school? (check all that apply)

[1]☐ I do not own a bicycle [2]☐ I live too far from campus [3]☐ the streets are not safe to ride

[4]☐ there is no secure place to leave a bike [5]☐ I am physically unable to ride [6]☐ other, please specify

27. Do you have your own doctor or other health provider? [0]☐ no [1]☐ yes

28. Are you currently covered by any health insurance? [0]☐ no [1]☐ yes

-If yes, indicate the source of your primary health insurance or HMO.

[1]☐parent's policy [2]☐ spouse's policy [3]☐ employment benefit [4]☐ VA benefit [5]☐ Medicaid

[6]☐ individual policy with a private health insurer [7] ☐ policy purchased as a student at this college

[8]☐ Medicare [9]☐ SSI [10]☐ Family Health Plus [11] ☐ other (please specify)

29. Where do you normally go for healthcare?

[1]☐ campus health center [2]☐ hospital clinic [3]☐ neighborhood/community health center

[4]☐ hospital emergency room [5]☐ private doctor [6]☐ other (please specify)

30. In the last year, how many times did you visit your campus health center?

[0]☐ 0 times [1]☐ 1 time [2]☐ 2 times [3]☐ 3 times [4]☐ 4 times [5]☐ 5 times [6]☐ 6 or more times

31. Does anyone with diabetes live in your household now? [0]☐ no [1]☐ yes

32. Indicate how many of the following members of your family have been diagnosed with diabetes by

placing the appropriate number next to each category.

[1] parents _____ [2] brother(s) _____ [3] sister(s) _____ [4] child _____

33. Do you currently care for anyone with diabetes in your family or household? [0]☐ no [1]☐ yes

34. How available do you think healthy food such as fresh fruits, vegetables, and low-fat products are on your campus?

[1]☐ very available [2]☐ quite available [3]☐ somewhat available

[4]☐ somewhat unavailable [5]☐ quite unavailable [6]☐ very unavailable

35. How often do you eat food purchased on campus (from cafeteria or vending machines)?

[0]☐ never [1]☐ 1 times a week or less [2]☐ 2-3 times a week [3]☐ 4-5 times a week [4]☐ > 5 times a week

- If you answered never or 1 times per week or less, which of the following are the reasons that you rarely eat on campus **(check all that apply)**.

[1]☐ the food is too expensive [2]☐ the food is unhealthy [3]☐ the food does not taste good

[4]☐ I prefer to bring my own food [5]☐ I am not on campus at meal time

[6]☐ it is not convenient for me to use the cafeteria [7]☐ other (please specify):

36. How often do you currently eat fruit in a typical week? (a serving = 1 piece fresh fruit or ½ cup canned fruit)

[0]☐ never [1]☐ 1-2 times a week [2]☐ 3-4 times a week [3]☐ 5-6 times a week

[4]☐ 1 time a day [5]☐ 2-3 times a day [6]☐ more than 3 times a day

37. How often do you currently eat vegetables in a typical week? (a serving = 1 cup raw or ½ cup cooked vegetable)

[0]☐ never [1]☐ 1-2 times a week [2]☐ 3-4 times a week [3]☐ 5-6 times a week

[4]☐ 1 time a day [5]☐ 2-3 times a day [6]☐ more than 3 times a day

38. How often do you currently eat whole grains in a typical week such as: 1 slice 100% whole wheat bread, ½ cup whole wheat pasta, non-instant oatmeal, brown rice, or 100% whole grain cereal?

[0]☐ never [1]☐ 1-2 times a week [2]☐ 3-4 times a week [3]☐ 5-6 times a week

[4]☐ 1 time a day [5]☐ 2-3 times a day [6]☐ more than 3 times a day

39. On the average, how many cigarettes do you smoke per day?

[0]☐ I never smoked [1]☐ I quit smoking [2]☐ 5 or less [3]☐ 6 to 10

[4]☐ 11 to 15 [5]☐ 16 to 20 [6]☐ 21-40 [7]☐ 41 or more (two packs)

40. During the past semester, how often did any health condition cause academic problems such as failure of a test, incomplete assignment, insufficient study time, missed deadlines and assignments, or absence from class?

[1]☐ never [2]☐ rarely [3]☐ occasionally [4]☐ somewhat often [5]☐ very often [6]☐ almost all the time

41. Would you participate in a group exercise program at your school if available? [0]☐ no [1]☐ yes [2]☐ not sure

42. Would you participate in a weight management workshop at your school? [0]☐ no [1]☐ yes [2]☐ not sure

43. Would you participate in chronic disease management workshops for students or family members with chronic Diseases held at your school? [0]☐ no [1]☐ yes [2]☐ not sure

45. The following questions ask about your eating habits in a typical week in the past year.

a. How often do you eat a meal cooked outside your home (from a take-out or sit-down restaurant)?

[0]☐ Never	[1]☐ Rarely *(less than 1 x a week)*	[2]☐ Sometimes *(1-3 x a week)*	[3]☐ Often *(4-6 x a week)*	[4]☐ Very Often *(every day)*

b. How often do you eat high fat foods such as fried chicken/fish, fried plantains/yucca/potatoes/onions, pizza, egg rolls, gyros, bacon, sausage, salami, bologna, hot dogs, whole milk, creamed soup, cream, mayo, oil, butter, margarine or cheese?

[0]☐ Never	[1]☐ Rarely *(less than 1 x a week)*	[2]☐ Sometimes *(1-3 x a week)*	[3]☐ Often *(4-6 x a week)*	[4]☐ Very Often *(every day)*

c. How often do you eat cake, cookies, pastries, donuts, muffins, pie, chocolate, candy or regular ice cream?

[0]☐ Never	[1]☐ Rarely *(less than 1 x a week)*	[2]☐ Sometimes *(1-3 x a week)*	[3]☐ Often *(4-6 x a week)*	[4]☐ Very Often *(every day)*

d. How often do you buy snacks from school vending machines?

[0]☐ Never	[1]☐ Rarely *(less than 1 x a week)*	[2]☐ Sometimes *(1-3 x a week)*	[3]☐ Often *(4-6 x a week)*	[4]☐ Very Often *(every day)*

e. How often do you eat food from your school's snack bar or cafeteria?

0☐ Never	1☐ Rarely *(less than x a week)*	2☐ Sometimes *(1-3 x a week)*	3☐ Often *(4-6 x a week)*	4☐ Very Often *(every day)*

f. How often do you drink regular (*not diet*) soda, fruit drink/punch, Kool-Aid or other sweetened beverages a day? (1 *can of soda = 12 oz., 1 bottle = 20 oz.)*

0☐ Never	1☐ Rarely *(less than 24 oz a week)*	2☐ Sometimes *(25-48 oz a week)*	3☐ Often *(49-100 oz / a week)*	4☐ Very Often *(> 100 oz / week)*

g. How often do you eat fast food such as Burger King, Subway, KFC, Taco Bell, Dunkin Donuts, Wendy's or McDonalds?

0☐ Never	1☐ Rarely *(less than 1 x a week)*	2☐ Sometimes *(1-3 x a week)*	3☐ Often *(4-6 x a week)*	4☐ Very Often *(every day)*

h. How often do you drink 16 ounces or more of water?

0☐ Never	1☐ Rarely *(less than 1 x a week)*	2☐ Sometimes *(1-3 x a week)*	3☐ Often *(4-6 x a week)*	4☐ Very Often *(every day)*

44. Do you think CUNY should ban the sale of unhealthy foods on campus? 0☐ no 1☐ yes 2☐ not sure

46. Some campuses, in other universities, offer a variety of health services to their students. Of the following, which **three** do you think are most important for this campus to offer?

1☐ weight loss/weight management workshops 2☐ sex education/family planning services

3☐ alcohol abuse prevention programs 4☐ quit smoking programs 5☐ disease management programs

6☐ violence prevention programs 7☐ other (please specify):

47. Which choice best reflects your opinion about each statement?	Strongly Agree	Agree	Disagree	Strongly Disagree
a. If I am going to get diabetes, there is not much I can do about it.	1☐	2☐	3☐	4☐
b. I think that my personal efforts will help control my risks of getting diabetes	1☐	2☐	3☐	4☐
c. People who make a good effort to control the risks of getting diabetes are much less likely to get diabetes	1☐	2☐	3☐	4☐
d. Compared to other people of my same age, I am less likely than they are to get diabetes.	1☐	2☐	3☐	4☐

48. We would like you to think about people in the general public and **NOT** about your own personal risk of getting diabetes. Which statement most closely reflects your view of how each characteristic affects their risk for diabetes?	Decreases or lowers the risk	Has NO effect on risk	Increases or raises the risk, *somewhat*	Increases or raises the risk, *a lot*	I Don't know
a. Being Asian American	0☐	1☐	2☐	3☐	4☐
b. Being Caucasian (White)	0☐	1☐	2☐	3☐	4☐
c. Eating a healthy diet	0☐	1☐	2☐	3☐	4☐
d. Being Black or African-American	0☐	1☐	2☐	3☐	4☐
e. Being American Indian	0☐	1☐	2☐	3☐	4☐
f Being Hispanic or Latino	0☐	1☐	2☐	3☐	4☐
g. Having a blood relative with diabetes	0☐	1☐	2☐	3☐	4☐
h. Being 65 years of age or older	0☐	1☐	2☐	3☐	4☐
i. Exercising regularly	0☐	1☐	2☐	3☐	4☐
j. Having had diabetes during pregnancy	0☐	1☐	2☐	3☐	4☐
k. Being overweight or obese	0☐	1☐	2☐	3☐	4☐
l. Eating a diet high in sugar	0☐	1☐	2☐	3☐	4☐

49. Would you participate in health screenings if your school provided them free? [0]☐ no [1]☐ yes [2]☐ not sure

50. Do you think the campus cafeteria should post the calorie/fat content of its menu? [0]☐ no [1]☐ yes [2]☐ not sure

51. Have you ever been told by a doctor or other health professional that you have diabetes, pre-diabetes or sugar in your blood?

[0]☐ no

[1]☐ yes

[2]☐ yes, but only during a past pregnancy

[3]☐ yes, but only now since I am currently pregnancy

[4]☐ I don't know

If you answered NO, I DON'T KNOW, or YES DURING A PAST PREGNANCY to question 51 you are FINISHED with the survey, thank you for your time.

If you answered YES or YES DURING A CURRENT PREGNANCY to question 51, please continue with the survey.

52. How old were you at the time of diagnosis of diabetes? ____ years of age.

53. What type of diabetes do you have?

[1]☐ type 1 [2]☐ type 2 [3]☐ pre diabetes [4]☐ gestational diabetes [5]☐ I don't know

54. Do you currently test your own blood sugar? [0]☐ No [1]☐ Yes **(if no skip to question 55)**

- If yes to question 54, indicate how often you test your blood sugar.

[1]☐ 1-3 times a week [2]☐ 4-6 times a week [3]☐ 1 time a day [4]☐ 2-3 times a day

[5]☐ 4 or more times a day

- If yes to question 54, indicate what your typical fasting blood sugar level has been for the past year. (fasting = in the morning before you have any food).

[1]☐ 110 or less [2]☐ 111- 130 [3]☐ 131-150 [4]☐ 151-170 [5]☐ greater than 170

[6]☐ I never test in the morning before a meal.

- If yes to question 54, indicate what your typical 2 hour after meal blood sugar level has been for the past year.

[1]☐ 140 or less [2]☐ 141- 160 [3]☐ 161-180 [4]☐ 181-200 [5]☐ 201- 250 [6]☐ greater than 250

[6]☐ I never test two hours after a meal.

- If yes to question 54, Indicate how often your blood sugar is less than 70 or you have symptoms of hypoglycemia (low blood sugar).

[0]☐ never [1]☐ 1-2 times a week [2]☐ 3-4 times a week [3]☐ 5-6 times a week

[4]☐ 1 time a day [5]☐ 2-3 times a day [6]☐ more than 3 times a day

55. How well do you believe your blood sugar is controlled?

[1]☐ very well controlled [2]☐ fairly well controlled [3]☐ poorly controlled 4☐ not at all controlled

[5]☐ I'm not sure if my blood sugar is controlled or not

56. A hemoglobin A1c (HbA1c) blood test indicates what your blood sugar has been for the last 2 to 3 months. In the past year, how often did you go to the doctor or lab for an HbA1c test?

[0]☐ never [1]☐ 1 time a year [2]☐ 2 times a year [3]☐ 3 times a year [4]☐ 4 times a year or more

57. If you ever had your HbA1c measured, what was your last HbA1c level?

[1]☐ 6.5% or less [2]☐ 6.6 - 7.5% [3]☐ 7.6 - 8.5% [4]☐ 8.6 - 9.5%

[5]☐ 9.6 - 10.5% [6]☐ greater than 10.5% [7]☐ I don't remember [8]☐ have not been tested

58. Indicate if you currently take any of the following medications for diabetes. (**check all that apply**)

[1]☐ insulin **-** if yes, do you use an insulin pump? [0]☐ no [1]☐ yes

[2]☐ Byetta

[3]☐ Symlin

[4]☐ an oral diabetes pill(s)

[0]☐ I do not take any medications for diabetes

59**.** This question asks about meal planning.

- Do you currently follow any specific calorie level? [0]☐ no [1]☐ yes **-** If yes, how many calories?

- Do you understand the food exchange lists system? [0]☐ no [1]☐ yes

- Do you understand carbohydrate counting? [0]☐ no [1]☐ yes

- Please check any special diet you currently follow:

[0]☐ none [1]☐ high protein [2]☐ low protein [3]☐ low fat [4]☐ low carbohydrate

[5]☐ high fiber [6]☐ low salt [7]☐ low sugar [8]☐ low calorie [9]☐ other

60. Have you ever been told by a doctor or other health professional that you have any of the following medical conditions resulting from diabetes? [1]☐ no ☐ yes

- If yes, **check all that apply:**

[2]☐ retinopathy (eye problems) [3]☐ blurred vision [4]☐ protein in urine [5]☐ nephropathy (kidney problems)

[6]☐ neuropathy (nerve problems) [7]☐ high blood pressure [8]☐ frequent infections [9]☐ other (please specify)

61. In the past year indicate if you have seen any of the following health care providers regarding the management of your diabetes **(check all that apply)**:

[1]☐ my primary care physician

[2]☐ an endocrinologist

[3]☐ a nurse practitioner

[4]☐ a registered dietitian

[5]☐ OB/GYN

[11]☐ other (please specify)

[6]☐ a diabetes education program

[7]☐ a podiatrist

[8]☐ an eye doctor

[9]☐ a certified diabetes educator

[0]☐ I did not go to a health care provider in the past year

APPENDIX D
Focus Group Survey

1. At which CUNY campus are you enrolled?

2. How many credits have you completed at this college as of December 31st 2010?

3. How many years have you been enrolled at this college?

4. What is your major?

5. Indicate what type of student you are: [1]☐ undergraduate student [2]☐ graduate student

6. What type of program are you in: [1]☐ enrolled in a two-year program [2]☐ enrolled in a four-year program

7. What is your date of birth?

8. Sex: [1]☐ male [2]☐ female

9. Please indicate the number of children you have:

10. Marital Status: [1]☐ single/never married [2]☐married /living as married [3]☐ separated [4]☐ divorced
[5]☐ widowed

11. Is English your native language? [1]☐ no [2]☐ yes
- If no, how well do you read and understand English?

[3]☐ not well at all [4]☐ fairly well [5]☐ very well [6]☐ extremely well

12. Are you Hispanic or Latino? [1]☐ no [2]☐ yes
- Which one of these groups would you say best represents your race/ethnicity?

13. [1]☐ American Indian/Alaska Native [2]☐ African American/Black [3]☐ Pacific Islander /Native Hawaiian
[4]☐ White [5]☐ Asian (specify) [6]☐ other (specify)

14. Are you an immigrant (born outside of the United States)? [1]☐ no [2]☐ yes
- If yes, please indicate what country you immigrated from and the length of time you have been in the U.S.

Country of origin: Length of time in US, in years:

15. What was your annual household income in dollars in 2009?

[1]☐ less than 10,000 [3]☐ 20,001 to 40,000 [5]☐ 60,001 to 80,000 [7]☐ 100,001-120,000
[2]☐ 10,001 to 20,000 [4]☐ 40,001 to 60,000 [6]☐ 80,001 to 100,000 [8]☐ 120,001 or more

16. Where do you live?

[1]☐ with parents or other relatives in apartment/house [2]☐ with spouse/partner in apartment/house
[3]☐ alone in apartment/house [4]☐ with roommate(s) in apartment/house [5]☐ campus dormitory
[6]☐ other, please specify

17. What zip code do you currently reside in?

18. What is your current weight in lbs?
19. What is your height (e.g. 5 feet & 6 inches)?

20. Since starting college has your weight changed? [1]☐ no [2]☐yes [3]☐ I don't know

21. If yes to question 18, how has your weight changed?

[1]☐ I lost 1 to 5 pounds [2]☐ I lost 6 or more pounds [3]☐ I gained 1 to 5 pounds [4]☐ I gained 6 to 10 pounds

[5]☐ I gained 11 to 15 pounds [6]☐ I gained 16 to 20 pounds [7]☐ I gained 21 to 25 pounds [8]☐ I gained 26 or more pounds

22. Do you have your own doctor or other health provider? [1]☐ no [2]☐ yes

23. Where do you normally go for healthcare?

[1]☐ campus health center [2]☐ hospital clinic [3]☐ neighborhood/community health center
[4]☐ hospital emergency room [5]☐ personal doctor [6]☐ other (please specify)

24. Have you seen your doctor or health care provider in the last 12 months? [1]☐ no [2]☐ yes

25. Are you currently covered by any health insurance? [1]☐ no [2]☐ yes
-If yes, indicate the source of your primary health insurance or HMO.

[1]☐parent's policy [2]☐ spouse's policy [3]☐ employment benefit [4]☐ VA benefit [5]☐ Medicaid
[6]☐ individual policy with a private health insurer [7] ☐ policy purchased as a student at this college
[8]☐ Medicare [9]☐ SSI [10]☐ Family Health Plus [11] ☐ other (please specify)

26. Would you say that in general your health is:

[1]☐Excellent [2]☐Very Good [3]☐Good [4]☐Fair [5]☐Poor?

27. Would you say that in general your diet is:

[1]☐Excellent [2]☐Very Good [3]☐Good [4]☐Fair [5]☐Poor?

28. Would you say that in general your current weight is:

[1]☐ a little lower than you would like
[2]☐ much lower than you would like
[3]☐ a little higher than you would like
[4]☐ much higher than you would like
[5]☐ just right

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