

The Association between Residency Status, Social Connectedness,
and Nutrition and Physical Activity Behaviors

among Diverse College Freshmen

by

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ABSTRACT

Objectives

This cross-sectional study sought to assess the eating and physical activity behaviors among in-state and out-of-state college freshmen attending Arizona State University and to determine if social connectedness mediated the relationship between residency status and eating and physical activity behaviors.

Methods

College freshmen from two dormitories were recruited for participation from Arizona State University's Tempe campus. A 128-item survey assessing demographics, college life, eating and physical activity behaviors, and social connectedness was administered. In addition, participants completed up to three days of dietary recall. Multivariate linear regression models, adjusting for age, gender, race, ethnicity, highest parental education, dormitory, Pell grant status, number of dietary recalls, and availability of a weekend day of dietary recall were used to assess the relationships between residency status, social connectedness, and eating and physical activity behaviors.

Results

No associations were observed between residency status and calories, grams and percentage of calories from fat, and added sugar. There was a statistically significant association between residency status and moderate-to-vigorous physical activity (MVPA). In-state students reported 21 minutes less per day of MVPA than out-of-state students did ($\beta=-20.85$; 95% CI=-30.68, -11.02; $p<0.001$). There was no relationship

between residency status and social connectedness. Social connectedness and eating and physical activity behaviors were not associated. Social connectedness did not mediate the relationship between residency status and eating and physical activity behaviors.

Conclusions

In-state and out-of-state students differed in their MVPA; however, this relationship was not mediated by social connectedness. Further studies are needed to confirm the relationship between MVPA and residency status. In addition, more studies are needed to assess the relationship between social connectedness and MVPA.

DEDICATION

This thesis is dedicated to my beloved father, Paul. Throughout my childhood my father bestowed countless lessons upon me. However, the most important lesson he taught me was a lesson he did not realize he was teaching at all. I have never seen an individual battle relentlessly for anything, as my father did in his fight with cancer. My father never gave up; he set his eyes on his goals and never looked back. He is my true inspiration in all that I do and his memory fuels me to push forward in all of my endeavors. This one is for you Dad.

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TABLE OF CONTENTS

	Page
LIST OF TABLES	vi
LIST OF FIGURES	vii
CHAPTER	
1 INTRODUCTION	1
Overview	1
The Purpose of Study.....	4
Research Aim and Hypotheses	5
Definition of Terms.....	6
2 LITERATURE REVIEW	9
College Freshmen	9
Impact on Nutrition and Physical Activity and the Transition to College between In-State and Out-of-State Students.....	11
Social Connectedness and Social Impact on Eating and Physical Activity Behaviors	12
Social Connectedness.....	12
Social Impact on Eating Behaviors	14
Social Impact on Physical Activity Behaviors.....	15
Prevalence and Barriers of Eating Behaviors among College Students	16
Caloric Intake	19
Fat Intake.....	20

CHAPTER	Page
Added Sugar Intake.....	21
Prevalence and Barriers of Physical Activity Among College Students	24
Moderate and Vigorous Physical Activity	24
Summary	26
3 METHODS	27
Study Design	27
Measures.....	27
Residency Status	28
Social Connectedness.....	28
Dietary Intake.....	29
Physical Activity	30
Sociodemographics	30
Statistical Analysis	31
4 RESULTS	34
Descriptive Characteristics	34
Unadjusted Results.....	36
Social Connectedness Scale.....	37
Adjusted Results.....	40
5 DISCUSSION	43
Residency Status on Eating and PA Behaviors.....	43
Residency Status on Social Connectedness	44

CHAPTER	Page
Social Connectednessw on Eating and PA Behaviors	45
Strengths and Limitations	46
Summary	47
 6 CONCLUSION	 49
REFERENCES.....	50
 APPENDIX	
A INSTITUTIONAL REVIEW BOARD APPROVAL FORM FALL 2014	63
B INSTITUTIONAL REVIEW BOARD APPROVAL FORM SPRING 2015	65
C WEB-BASED SURVEY	67

LIST OF TABLES

Table	Page
1. Participant Demographics by Residency Status (n=163)	34
2. Eating and Physical Activity Behaviors by Residency Status (n=163).....	35
3. Psychometrics (Item-Rest Correlations and Cronbach’s Alpha) of the Social Connectedness Scale	37
4. Psychometrics (Item-Rest Correlations and Cronbach’s Alpha) of the Modified Social Connectedness Scale	38
5. Multivariate Mediation Analyses Assessing if Social Connectedness Mediates the Relationship between Residency Status and Eating and Physical Activity Behaviors.....	40

LIST OF FIGURES

Figure	Page
1. Multivariate Mediation Assessing the Relationships amongst Residency Status, Social Connectedness, and Eating and Physical Activity Behaviors.....	4
2. Multivariate Mediation Assessing the Relationships amongst Residency Status, Social Connectedness, and Eating and Physical Activity Behaviors.....	33
3. Multivariate Mediation Assessing the Relationships amongst Residency Status, Social Connectedness and MVPA.....	42

CHAPTER 1

INTRODUCTION

Overview

The transition period from high school to college can be daunting for incoming students,¹⁻⁴ as students must learn how to cope with new individual, social and environmental demands.^{1,5} Incoming freshmen may have the opportunity to assert their independence and make decisions on their own without parental guidance. For example, college freshmen have the opportunity to choose which foods and beverages they want to consume or how to spend their time. College students' risky health behaviors (including poor eating and physical activity behaviors) could have an impact on their long-term health,⁶⁻²³ and may differ based on where students lived before college.

Students' residency status (whether they come from in-state or out-of-state) may affect students' transition into college. Out-of-state students are even farther removed from their friends and family. Feeling alone may be a very real phenomenon that these students face. The desire to form close friendships and find their "niche" in a completely new environment has the potential to change out-of-state students' eating and physical activity (PA) behaviors, for better or worse. The desire for social connectedness (i.e., the lack of isolation) could override the need to eat healthy and exercise regularly if it means that a person now feels socially connected. It is unknown how in-state and out-of-state students differ in their adjustment to college life, social connections, and eating and PA behaviors. Research is needed to determine if differences exist, and if they do, to

determine the ways in which they differ so the proper interventions can be developed to help these students.

As college freshmen make the transition from high school to college, students are often faced with the decision to maintain or sever pre-college friendships.^{24,25} The struggle that freshmen face trying to balance pre-college friends with college friends can be an overwhelming and time-consuming task.²⁶ Social connectedness at college could have a profound impact on an individual's adjustment to college²⁷ on emotional,²⁸ and may even have an impact on academic and health levels. Some researchers demonstrated that college students tend to identify lack of social support from friends, as a reason to not engage in healthful behaviors^{2,29,30} yet others report that friends support healthy eating behaviors.³⁰⁻³² Openness to forming friends in college may have the power to alter a person's eating and physical activity behaviors. However, no studies have assessed if overall social connectedness impacts eating and physical activity behaviors in college students.

In older populations, social connectedness has been found to be positively associated with being healthy³³ and with recreational PA.³⁴ Social connectedness was even shown to mediate the relationship between psychological health and physical health in college students.³⁵ Given the association seen in social connectedness and PA in an older population and social connectedness and health in college students, it is possible that a similar association between social connectedness and PA or eating could be observed in a college population; however, no studies have assessed this relationship. Additionally, it is unknown if social connectedness is associated with in-state or out-of-state residency status.

Studies consistently show that the eating habits of college students are relatively poor.^{30,36,37} College students often consume more calories, fat, and added sugars than is typically recommended.^{30,36,37} These poor eating habits may have the power to lead to the unwanted weight gain commonly seen in the college population³⁸⁻⁴⁰ and produce long-term negative health consequences, such as cardiovascular disease, diabetes, and cancer.⁸⁻²² Currently, it is uncertain if residency status and/or social connectedness can place a college student at risk for poor eating behaviors.

Numerous studies have investigated the current PA habits of college students and have consistently found that this population does not engage in enough PA and activity levels decrease throughout college.^{30,41-45} For example, the typical college student participates in PA less than three days per week,⁴¹⁻⁴⁴ at irregular intervals,³⁰ or chooses not to engage in PA at all.^{32,46} Despite the lack of consistent PA during college, it is imperative that college students are physically active. PA is an important aspect of a healthy lifestyle and has been shown to help prevent long-term negative health outcomes, such as cancer.^{6,7,23} It is necessary to better understand factors relating to PA, such as residency status and social connectedness, to better help at-risk students.

To provide a framework for understanding these gaps in the literature, a mediation analysis is suggested. As seen below in the mediation diagram (Figure 1), it is hypothesized that the following relationships are impacting students' eating and PA behaviors: (1) residency status will be associated with eating and physical activity behaviors, (2) residency status will be related to social connectedness, and (3) social connectedness will be related to eating and physical activity behaviors. It is also possible

that social connectedness will mediate the relationship between residency status and eating and physical activity behaviors (4).

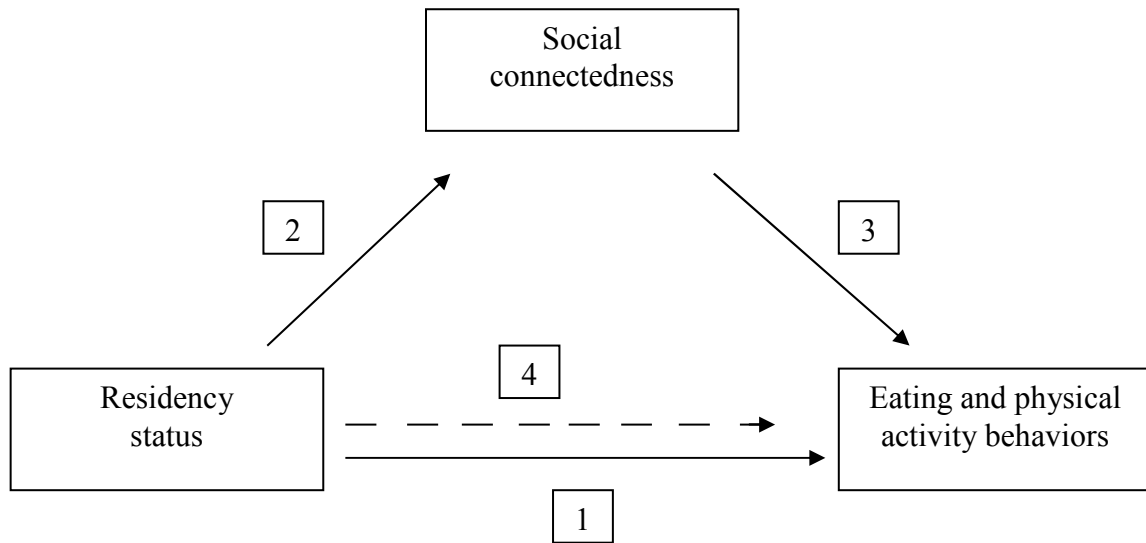


Figure 1: Relationship Being Assessed

This research is important for future interventions that target out-of-state students. If out-of-state students are different than in-state students in regard to their eating and physical activity behaviors and their social connectedness then interventions needs to be implemented on the university level to combat this disparity. Interventions can be implemented to help out-of-state students become connected with each other and with in-state students that most likely have strong local social connectedness.

The Purpose of Study

The purpose of this cross-sectional study was to assess the eating and physical activity behaviors among in-state and out-of-state college freshmen attending Arizona State University and to determine if the relationships between residency status and eating and physical activity behaviors were mediated by social connectedness.

Research Aim and Hypotheses

Study Aim: To determine the association between residency status of students and social connectedness and how these factors relate to nutrition and physical activity behaviors among diverse college freshmen.

Research question 1: What is the relationship between residency status and eating and physical activity behaviors?

H1: Total caloric intake will be different between out-of-state and in-state students.

H2: Total grams of fat and percentage of calories from fat intake will be different between out-of-state and in-state students.

H3: Total grams of added sugars will be different between out-of-state and in-state students.

H4: Moderate-to-vigorous physical activity (MVPA) will be different between out-of-state and in-state students.

Research question 2: What is the relationship between residency status and social connectedness?

H5: Social connectedness will be different between in-state and out-of-state students.

Research question 3: What is the relationship between social connectedness and eating and physical activity behaviors?

H6: Students with lower social connectedness will consume more total calories as compared to students with higher social connectedness.

H7: Students with lower social connectedness will consume more total grams of fat and percentage of calories from fat as compared to students with higher social connectedness.

H8: Students with lower social connectedness will consume more grams of added sugars as compared to students with higher social connectedness.

H9: Students with lower social connectedness will report lower amounts of MVPA as compared to students with higher social connectedness.

Research question 4: Does social connectedness mediate the relationship between residency status and eating and physical activity behaviors?

H10: Social connectedness mediates the relationship between residency status and eating and physical activity behaviors.

Definition of Terms

Residency status: The classification of in-state and out-of-state student status.

In-state residency status (Resident): The student has been and is currently an Arizona resident as classified by Arizona State University.⁴⁷ This type of student has most likely been living in Arizona with their parents or guardians for an extended period of time.

Out-of-state residency status (Non-Resident): The students is a permanent resident of a state other than Arizona.⁴⁷ This type of student most likely moved to Arizona to attend college.

Social Connectedness: Experiencing companionship, but not necessarily social support, in the absence of isolation and loneliness.³³

Added sugars: Sugars that are not naturally occurring in a food item. Added sugars can be added manually by the consumer or found in processed and prepared foods and drinks.
16,48,49

Friendsickness: A relationship struggle that incoming freshmen college students face when they leave their established friendship networks.²⁴

Nutrient dense: Food items that contain high amounts of vitamins and minerals while remaining low in calories and that have been shown to have health benefits.⁵⁰

Solid fat: Fats that are solid at room temperature due to the high nature of saturated and/or *trans* fatty acids.¹⁶ For example, butter, coconut oil, shortening and margarine.¹⁶

Saturated fats: Solid fats that are commonly found in meat and fried foods.⁵¹
Saturated fats can be found in high fat cheese, high fat meats, whole-fat milk, and ice cream.⁵¹

Trans fatty acids: Solid fats found both naturally in foods and after food processing. *Trans* fats can be made during food processing as a result of hydrogenation where liquid fats are turned into solid fats.⁵² *Trans* fats can be found in: frozen pizzas, fast food, and meat.⁵²

Sugar-sweetened beverages (SSBs): Drinks that contain added sweeteners, such as fruit drinks, sports drinks, energy drinks and sweetened tea.^{37,53,54}

Weight status: The classification of obese and overweight status.

Overweight: An adult that has a BMI 25.0 - 29.9 kg/m².⁵⁵

Obese: An adult that has a BMI > 30.0 kg/m².⁵⁵

CHAPTER 2

LITERATURE REVIEW

College Freshmen

The transition from high school into college can be a very stressful time period for incoming freshmen^{1,2} and many find it hard to adjust.^{3,4} This is a time period where college students have the opportunity to assert their independence, “break away” from their parents, have the freedom to form new habits,¹ make opinions of their own and develop into who they want to be^{5,6} as they are exposed to new experiences and opportunities. The transition to college is a time of leaving friends and family behind to embark on a new experience. However, as incoming freshmen begin this new journey, they are faced with new challenges such as forming new friendships and choosing which foods and beverages to consume. For example, while in high school, a student’s parents may have purchased food items that the student did not care for but were expected to eat anyway. In college, students have the opportunity to make food selections on their own without parental control. In addition to making their own food selections, students are learning time management, prioritization,² adjusting to a new schedule and learning how to deal with college level courses.

How well a student adjusts to college can be crucial to their success and happiness. Students who have poor emotional health (eg. depressed, stressed, fatigued, pessimistic) do not adjust as well^{3,24,28} and tend to withdraw and never graduate college.⁵ In turn, the students that are better able to cope with stress and adapt to college life are more academically successful than those that do not.¹ Also, the transition into college can

be a time period for loneliness,^{24,26} friendsickness,²⁶ and homesickness⁵⁷ as students are faced with the task of forming new friendship networks.¹ However, college students that are optimistic and form close friendships may experience less stress than those that do not.²⁸

During the transition to college, incoming freshmen have the opportunity, possibly for the first time, to make their own decisions regarding eating and PA behaviors. Research has shown that college students have poor eating and PA behaviors. The implications of poor eating³⁶ and PA behaviors⁵⁸ could lead to unwanted, unexpected weight gain, which is prevalent among this population.³⁸⁻⁴⁰ These risk behaviors⁴⁴ along with weight gain⁵⁹ have the potential to carry over into adulthood. Therefore, it is imperative to study the college population's eating and PA behaviors and how these behaviors are associated with social connectedness.

In this literature review, the consumption of calories, fat and added sugars will be discussed. Calories, fat and added sugars are included because college students tend to consume calories,^{36,37} fat⁶⁰ and added sugars³⁷ at levels that exceed the recommended intake, which could lead to weight gain^{10,11,59,61} and various chronic diseases such as obesity, hypertension, and cardiovascular disease.^{11,13,16,17,62} Having a better understanding of the factors (in this case, residency status and social connectedness) that impact incoming freshmen's eating and physical activity behaviors will provide guidance for improved health promotion for this population.

Impact on Nutrition and Physical Activity and the Transition to College between In-State and Out-of-State Students

To the author's knowledge there has been no previous research on how residency status affects health, let alone nutrition and physical activity behaviors. Most of the literature on the impact of non-residency students centers on international students and their adjustment to college life in a new country rather than a citizen moving from one state to another. One particular study that assessed international students' adjustment to college life found that international students who have more domestic friends than co-national or multi-national friends have lower levels of homesickness and higher levels of satisfaction.⁵⁷ It could be assumed that domestic students have access to a greater social network within the geographic area than would students from a different country. Therefore, these friends could introduce the international students to even more friends which could explain the increases in satisfaction and contentment with their new surroundings. These findings could be extrapolated to students who are coming from a different state to a new university. It could be suggested that local students may have access to more social networks than non-residents and will be better adjusted and not as heavily influenced by their peers to change their eating and PA behaviors than they would if they were from out of state. Research examining the healthy immigrant effect (HEI) states that those coming from another country are healthier than those not immigrating.^{63,64} Perhaps this same paradox can be seen with out-of-state students who are traveling to a new state. It could be that out-of-state students are healthier and choose to leave their home state whereas in-state students decide to stay in state. However, research needs to be conducted on this topic to decipher any correlation.

It is also possible that in-state and out-of-state students differ depending on where they decide to go to college. College students that choose to attend college in-state may be inherently different from students that choose to attend college out-of-state. Tuition can be a major factor when deciding on colleges to apply to and tuition rates are regionally different throughout the United States.⁶⁵ For example, Northeast schools have higher non-resident tuition rates whereas schools in the West have lower non-resident tuition rates.⁶⁵ Private, very selective and top ranked institutions tend to attract more non-resident students than their counterparts.⁶⁵ Affluent students may have the opportunity to attend college out-of-state, while other students are not able to afford an out-of-state college. If college students differ from the very start on where they choose to attend college that fuels the notion that in-state and out-of-state students may be different groups of individuals. It is possible then that these students could be different in other facets of their lives such as eating and PA behaviors.

Out-of-state students are farther away from family and friends than their in-state counterparts and feelings of loneliness could be pervasive in this population. The need for out-of-state students to form close relationships and find their place in a new city could be compelling enough to have out-of-state students change their eating and PA behaviors. The need for close friends could take precedence over healthful eating or engagement in PA. It is not known if there are differences between in-state and out-of-state students and their adjustment to college, friendship formations and eating and PA behaviors. Research is needed to determine if differences exist, and if they do, to determine the ways in which they differ.

Social Connectedness and Social Impact on Eating and PA Behaviors

Social Connectedness

College is a significant transition period for young adults. During this transition period, students are often faced with forming new friendship networks while struggling to keep old friendship networks. This dichotomy can have profound impacts on an individual in terms of their adjustment, coping skills, mental health, and perhaps their dietary and physical activity behaviors. In the process of friendship making and once these friendships are formed, these friends have the ability to heavily impact the health choices, and behaviors that an individual chooses for him/herself.^{31,66}

The struggle on how to handle pre-college friendships is a very real feeling for incoming college freshmen.²⁴ While some college students feel a need to maintain their friendships back home, others are ready to move on and sever those ties.²⁵ However, one study found that most college students reported experiencing friendsickness to some degree and the strongest predictor was worrying about losing old friends.²⁴ Students that were very concerned and preoccupied with maintaining their pre-college friendships did not adjust as well to college on a variety of dimensions.²⁴ Students that experienced friendsickness were more likely to feel lonely in social groups, had a large number of friends in their network prior to attending college and made regular trips back home.²⁴ Students were also more likely to experience friendsickness if they had a negative self-esteem toward college friendships or a negative self-esteem toward social acceptance.²⁴

As the first semester and year of college progress, pre-college friend social networks change. Friends that frequently communicate do not undergo changes in their pre-college friendship during their first year of college whereas those that seldom

communicate experience a decline in their relationship.²⁶ Surprisingly, students that attended college near their closest friends tended to report a higher cost for friendship during their second semester.²⁶ This could be due to the struggle an individual faces with keeping old friends and making new friends when their closest friends were nearby. Students may feel the need to juggle two distinct social networks and feel torn between the two.

The formation of new friendships in college can be substantially beneficial. The more open a student is to new friendships the more likely they are to form higher quality friendships and higher quality friendships are associated with better adjustment to university life.²⁷ Students that indicated their social support networks increased throughout the semester also reported smaller increases in stress and depression.²⁸

Social Impact on Eating Behaviors

Friends appear to impact eating behaviors in the college-aged population. Friends⁶⁶ and social settings with friends and peers³¹ have an effect on food choices which can be healthful or unhealthful. The negative impact that friends can have on each other's eating behaviors are extensive. One qualitative study showed that students indicated that their friends were not interested in a healthy lifestyle²⁹ and that they had a lack of social support to make healthy food choices.² Students also mentioned that social eating, including snacking, and late night eating were barriers to healthy eating in college.² Friends can also expose each other to try unhealthful food and beverage products for the first time. Attila and associates reported that over half of college students that tried energy drinks for the first time were with their friends.⁶⁷ Paxton and colleagues

found that friends, as a source of influence, having friends concerned with thinness, being teased by peers and body comparison were all linked with dietary restraint.⁶⁸

At the same time, friends may have a positive influence and contribute to healthful eating. Deshpande and colleagues found that cues to action as recommended by friends to eat healthy were predictive of the importance of consuming a healthful diet.⁶⁹ Students indicated that having social support was a motivator for healthy eating.⁷⁰ There may be some gender differences in the positive impact that social support has on eating behaviors, as Greaney and colleagues reported that female students indicated more so than males, that their friends lent them the social support they needed to make more healthful food choices.³¹ It remains unknown whether students seek out friends with similar eating behaviors or rather they make friends and then adapt to their friends' eating behaviors.⁷¹⁻⁷⁶

Social Impact on Physical Activity Behaviors

Friends have the power to impact PA. In social situations, other people's behaviors had an impact on individual PA choices.³¹ Friends may have a positive influence, such as introducing a friend to a new workout, sports, or other type of physical activity, being a motivator and encouraging their friends to do physical activities with them. However, friends may also have a negative influence. For example, friends may model sedentary behaviors and choose to do other activities in place of physical activity, while pressuring their peers to do the same. The following section presents the literature on how social factors impact young people's PA.

Friends have the ability to discourage PA behaviors amongst their friends, both intentionally and unintentionally. Students report that they have a lack of social support² and that their friends are not interested in a healthy lifestyle.²⁹ Students also claim that it's difficult to work out alone and their friends are not willing to be workout buddies.²⁹

Friends have the opportunity to be a positive influence and encourage PA. Students that have high support from friends are more likely to be motivated⁷⁰ and engage in PA.^{30,32} College students state that they are more likely to frequent a gym if they have a friend to go with.³¹ However, there may be gender differences in how social support affects PA. Wallace and colleagues found that male students are more likely to be physically active with friend social support, whereas female students are more likely to be physically active with family social support.⁴⁶ On the contrary, Greaney and colleagues found that females more so than males indicated that their friends lend them social support to exercise more often.³¹ It is unknown whether students select friends that enjoy the same activities as them or if they find friends and then engage in the activities that their friends do (sedentary and PA behaviors alike).^{76,77}

Prevalence and Barriers of Eating Behaviors among College Students

An excess intake of fat¹⁶ and added sugar^{48,49} has been linked to cardiovascular disease, among other chronic diseases.^{16,48} Excess fat and added sugar intake in turn leads to excess caloric intake. Over one-third of calories from the average American's diet comes from solid fats and added sugars alone.¹⁶ If one-third of calories is spent on non-nutritive food that means two-thirds of calories remain to consume nutrient dense food that can provide Americans with health benefits.

Generally, the eating behaviors of college freshmen are high in calories, fat, and added sugars. A student's average intake of calories, fat, and added sugars often exceeds their needs.^{30,36,37} Some sources where these high calorie, fat, and sugar items are acquired are unique to college students. For example, students have access to buffet style dining centers on campus, which no other population has access to. The demographic differences in terms of calorie, fat and added sugar consumptions are also explored along with the many social, environmental, and personal factors that impact the behaviors and choices of college students.

Students often have to follow a strict budget and cost, lack of money, and looking for the cheapest food available are popular reasons why college students are not eating healthfully.^{2,31,70,78} Undergraduates report a lack of time and the need for quick, convenient meals.^{2,70,78} Even when they do want to eat healthfully, college students state that there are a lack of healthy options available on campus,^{2,29,70,78} and not having transportation to a grocery store has also been identified as a major factor that inhibits healthy eating.²⁹

College students have access to numerous places where they can obtain meal and snack items, such as: dining centers, cafes, vending machines, convenience stores, and even their own dorm rooms. One of the most common places that college freshmen eat is at the dining halls. However, dining halls are a frequently listed barrier to healthful eating by college students. Students report feeling the need to get their money's worth at the 'all you can eat' dining centers and eat whether or not they're hungry.^{2,70,78} Also, research has found that students perceive the types of foods served on campus to be too high in fat, unappealing,²⁹ unhealthy, and more like fast food rather than home cooked food.⁷⁰

Even if students choose not to eat in the dining halls they still face a number of other barriers when choosing to eat elsewhere. The very dorm the student lives in, along with their dorm room or suite is another common place for unhealthy eating to occur. Shockingly, the average college student has an average of 47 food and beverage items in their room including salty/savory snacks, cereal/granola bars, main dishes, and desserts/candy.⁷⁹ Students report that lack of adequate cooking facilities⁷⁰ and the addition of microwaves² in their dorms as reasons why they do not eat healthfully.

In continuance with unhealthy food choices, college students are notorious for not eating vegetables⁷⁸ or fruits on a daily basis.^{30,78} Unfortunately, most college students eat less than three fruits and vegetables per day⁴⁴ with less than one-third managing to eat the recommended five fruits and vegetables per day.⁴¹ The literature is mixed on whether different demographics predict fruit and vegetable intake. Some report college women have the best fruit and vegetable intake,⁷⁸ while others found that men have better intake,⁶⁰ and still others have found no differences in gender.⁴⁴

Meal and snack times along with the types of meals and snacks that are consumed appear to change at the start of college and persist throughout the college years. The consumption of breakfast or rather lack thereof, remains an issue among the college population. Over half of college students report consuming breakfast on a regular basis.^{30,66} However, breakfast is commonly the most skipped meal of the day.^{78,80} It also appears to be the loneliest meal of the day, with over two-thirds of students consuming breakfast alone.^{81,82} Most students appear to eat lunch and nearly every student eats dinner.⁶⁶ Dinner time may operate as a social gathering with nearly half of students eating with friends.^{81,82} In between their meals, college students engage in a great deal of

snacking with nearly two-thirds of students snacking one to two times per day,⁷⁸ possibly to make up for the meals they skip throughout the day.

The literature is mixed on how college students view healthful eating. Davy and colleagues suggests that the majority of college students believe that they consume a healthful diet,⁸¹ whereas other researchers found that most college students believe that students perceive that students eat healthfully when objective analyses show that they do not.²⁹ Some research has indicated that college students lack motivation to live a healthy lifestyle.^{29,78} In research conducted by LaCaille and associates, college students indicated that they may be willing to change their eating habits if certain conditions are met, such as unwanted weight gain.⁷⁰ College students may also not understand the link between healthful eating and long-term health benefits. Deshpand and colleagues found that if men do not believe that healthful eating will keep them healthy they are not going to eat healthy and that women are only interested in eating healthfully if they perceive a future illness they could acquire as serious.⁶⁹

Caloric Intake

Increased caloric consumption can lead to increased weight gain,⁵⁹ which can lead to an overweight or obese status. Once a person is obese, the condition is difficult to reverse.⁵⁹ It is imperative to prevent this weight gain from occurring in college students, which can carry-over into adulthood and lead to long-term negative health consequences. It is widely known that weight gain is associated with various chronic health diseases, such as cardiovascular disease,¹⁸ diabetes,^{19,20} and cancer.²¹

Students' eating and drinking habits suggest they ingest more calories than they actually need. Students report consuming higher quantities of food and eating for long periods of time at buffet style dining centers.³⁶ One study showed that the average college student returns to their dorm room where they harbor a staggering 23,000 calories in food and beverage products.⁷⁹ In turn, younger students have a higher intake of sugar sweetened beverages (SSBs) than older students³⁷ with the average caloric intake per day from SSBs at over 500 calories.³⁷ This increased consumption of food and high amount of calories from sugary beverages alone suggests that college students increase their caloric intake without there also being a simultaneous metabolic need for an increased consumption of calories.³⁶

There appears to be a gap between the caloric needs and the actual caloric intake of college students. The calorie needs of sedentary college students is roughly 2,400 and 1,800 calories per day with needs increasing as high as 3,200 calories and 2,400 calories per day with an active lifestyle for men and women, respectively.⁸³ It is unknown how increased calorie consumption is tied to friendships in this population. Further, it is unknown how and if this impacts out-of-state students more severely than in-state students.

Fat Intake

Diets high in solid fats (saturated and *trans* fatty acids) are common in the college population as suggested by the foods they choose to consume. A diet high in solid fats is of particular concern because of the health implications that can arise from these fats. High fat diets (specifically *trans* and saturated fats) have been linked with cognitive

decline,²² dementia,²² cardiovascular disease,^{16,17} and diabetes.⁶² There can be long-term health consequences if the association between high fat intake among college students and their friends are unanswered.

Some popular foods for college students that are high in solid fats would include: pizza, burgers, potato chips, and French fries.^{80,84} Men tend to consume higher amounts of fat in their diet as compared to women.^{42,44,80,85} There also appears to be gender differences in terms of which high fat food items men and women choose to consume. Women enjoy ice cream, candy^{78,84} and cookies⁷⁸ while men tend to indulge in fast food.^{29,42,44,78,80,85}

Butler and colleagues showed what appeared to be a decrease in the grams of fat that college students consumed over the course of a semester.⁶⁰ However, there was an increase in the percentage of fat in their diet by the end of first semester. This suggested that students are eating roughly the same amount of calories, but the percentage of fat in the diet is increasing while the percentage of carbohydrates and protein in the diet are decreasing.⁶⁰ This could indicate that students are not eating more healthfully at all, but rather making more unhealthy food choices as they progress throughout college.

The AMDR for fat is 20-35% of total calories for college-aged students.¹⁶ However, saturated fats alone represent 20% of the American diet when it should be limited to less than 10% of a day's total calories¹⁶. College students admit to consuming diets too high in fat.⁸² Yet surprisingly, half of college students are not limiting their intake of fatty foods³⁰ and the average college student stores nearly 25g of fat in various food items in their dorm rooms.⁷⁹ It remains unknown how excess fats (especially *trans*

and saturated) are consumed in connection with social networks. More importantly, it is unknown if out-of-state students are at a higher risk for consuming these foods items.

Added Sugar Intake

Excess amounts of added sugar in the diet can have many adverse health outcomes. Added sugars have been associated with metabolic syndrome,¹³⁻¹⁵ weight gain seen in overweight/obesity,^{10,11} undesirable blood lipid levels,⁸⁻¹¹ and hypertension.¹¹ Undesirable blood lipid profiles (eg. high LDL cholesterol, low HDL cholesterol, and high triglycerides) have been linked with cardiovascular disease.^{8,16} Also, the liver metabolizes fructose¹⁴ and the overconsumption of added sugars has been linked with fatty liver disease⁸⁶ and may lead to non-alcoholic fatty liver disease.¹⁵ There have been a couple studies that investigated the link between added sugars and mortality. Tasevska and colleagues found that added sugars from solid foods are linked with CVD mortality for both men and women.⁴⁸ Yang et al. found that added sugars in beverages increased the risk of CVD mortality⁴⁹ whereas Tasevska and colleagues found this only to be true in women.⁴⁸ Also, added sugars from solid foods were associated with cancer mortality in women.⁴⁸ This is important outcome information for college-aged students. College students tend to consume high amounts of added sugars and if this consumption persists into adulthood many undesirable health outcomes may develop.

Added sugars can be found in many popular drinks and snack items that are consumed by college students. Added sugars can come in the form of high fructose corn syrup, white and brown sugar, fructose sweetener, and corn syrups among others.¹⁶ These added sugars are often presented in SSBs including, soda, fruit drinks, energy drinks,

sports drinks and sweet tea, however, they are also found in snack foods, desserts, and candy.¹⁶

On a daily basis, the majority of college students will drink some kind of SSB^{37,53} and nearly three-quarters of students have SSBs, of some variety, in their dorm room.⁷⁹ Overall, sodas appear to be the most popular drink amongst college students followed by fruit drinks and sweet teas.³⁷ Research has shown that college men may be more likely to consume SSBs,^{37,87} especially soda.⁷⁸ Racial differences have been observed in the quantity and types of SSBs consumed. Some researchers have found that white college students drink less SSBs than other students.^{37,53} Also, fruit drinks appear to be the most popular form of SSBs amongst black college students, with half consuming non-juice fruit drinks on a daily basis.³⁷

Energy drinks appear to be a unique type of SSB in that college students drink them to fulfill a variety of purposes with nearly one-quarter³⁷ to one-half⁸⁸ of students drinking them at least on a monthly basis. Commonly reported reasons that students drink energy drinks are for increased energy, to mix with alcohol, studying,^{67,88} insufficient sleep, completing a school project, and driving for long periods of time.⁸⁸ The more situations that a student tended to use energy drinks, the more likely they were to consume three or more in any one given situation.⁸⁸ The “need” for energy drinks in this population appears to drive their SSB consumption. This could impact their daily caloric intake and have profound negative implications on their health status later on in life.

The 2010 Dietary Guidelines for Americans suggested limiting added sugars to 5-15% of the total calories consumed in a day.¹⁶ For example, if a person is following a 2,000 calorie diet that would mean that 100-300 calories can come from added sugars, or

in other words 25-75 grams of added sugar. The majority of college students agree that they consume too much sugar.^{81,82} However, it remains unknown how added sugar intake and social connectedness are tied together. Further, it is unknown how added sugar consumption differs between in-state and out-of-state students.

Prevalence and Barriers of Physical Activity among College Students

PA intensity and frequency change over the course of a person's lifetime. These changes include personal preferences to the types of PA a person enjoys as well as changing barriers that impact PA levels. This section will discuss the recommended amounts of intensity and frequency of PA as well as the actual amounts of intense PA and the frequency at which PA is engaged in amongst college students. Demographic differences regarding intensity and frequency will be discussed as well.

Moderate and Vigorous Physical Activity (MVPA)

Low levels of PA or not engaging in PA at all can lead to weight gain.^{31,58} Participating in PA has been associated with a decrease in mortality of various chronic diseases,^{7,23} such as cancer.^{6,23} Wen and colleagues found that those who were physically active had a decreased mortality from cancer, stroke, cardiovascular disease, diabetes, and ischemic heart disease; the more physically active a person was, a greater decrease in mortality was observed.²³ This is of particular concern to college students, where the majority of the literature indicates that PA decreases from high school to college and throughout college.^{32,78,89} Research has shown that younger students tend to be involved in aerobic,^{38,41,66} strength training,³⁸ stretching, and vigorous PA⁹⁰ more so than older

students. These changes in PA habits that occur throughout college may extend into adulthood. If college students continue to lead sedentary lives, they could be putting themselves at further risk for developing chronic diseases later on in life that could potentially have been prevented by living an active lifestyle.

The body of literature regarding intensity of PA suggests that there are gender differences in the types of PA that college men and women choose to engage in. College men prefer strength training,^{38,78,85} weight lifting^{43,91} and vigorous/ high intensity exercise.^{31,32,44,78,85,90,91} College men are also more likely to play team sports^{32,60} and be involved in competitive sports.⁷⁸ However, the body of literature differs when it comes to aerobic activities. Some researchers suggest that college men prefer aerobic exercise^{38,41} while others claim that college women prefer aerobic exercise.^{32,43,78} In general, college males may be more likely to be physically active than college females.^{32,60}

The United States Department of Health and Human Services recommends that adults (including college students) participate in 150 or 75 minutes of moderate or vigorous PA weekly, respectively.⁹² It is recommended that all forms of aerobic activity need to be performed for a minimum of 10 minutes at a time and spread throughout the week.⁹² The average college student spends less than three days per week engaging in PA⁴¹⁻⁴⁴ with approximately half of college students not engaging in PA at all,^{32,46} or at irregular intervals.³⁰ However, there may be gender differences in the decline of PA. Buckworth and Nigg found that as women got older there appeared to be a decrease in the days per week that they engage in PA.⁹⁰ However, Huang found that PA decreased equally amongst both male as female students as they get older.⁴¹

The decline in PA that is observed in college students could be partly to blame on the different environmental and personal barriers that they face during college. Students report that the fitness centers⁷⁰ themselves are the main problem due to a crowded gym,^{2,29} lack of transportation to the gym, outdated equipment,²⁹ having to wait in line, and feeling that the gym is intimidating.² Students also report that a lack of time, motivation,^{2,70,78} willpower,⁷⁸ not having time management skills, not being able to prioritize, and not being able to deal with stress² are reasons why they do not exercise. It remains unknown how social connectedness and MVPA are connected, especially among out-of-state students.

Summary

This literature review has explained the importance of studying college freshmen with differing residency statuses along with the role that social connectedness could have on health behaviors. College students have suboptimal dietary and physical activity behaviors that may put them at risk for chronic diseases. Although there are many studies on the eating and physical activity behaviors of college freshmen, further research is needed to understand if there is a relationship between in-state and out-of-state students and eating and PA behaviors; residency status and social connectedness; and social connectedness and eating and PA behaviors. It is also unknown if social connectedness works through residency status to mediate the relationship between residency status and eating and PA behaviors.

CHAPTER 3

METHODS

Study Design

This was a secondary data analysis of a larger cross-sectional study assessing the mechanisms by which social networks impact dietary habits and physical activity behaviors of college freshmen living in dormitories. Participants were drawn from a convenience sample of college freshmen (mean age=19.0±0.6; 64% female; 49% white, non-Hispanic) living on the Arizona State University Tempe campus. All participants were recruited from two dormitories during the fall 2014 and spring 2015 semesters. Participants were compensated up to \$50 and \$30 to participate in the fall and spring data collection, respectively. The Arizona State University Institutional Review Board (IRB) approved all study protocols.

Measures

Participants completed a 128-item survey assessing college life, social relationships, eating behaviors and physical activity behaviors, including items on, residency status and social connectedness. The survey took approximately 25-30 minutes to complete. In addition to the survey, participants completed up to three online ASA24 24-hour dietary recalls (one weekend and two weekdays). The average of the 24-hour recalls was used for this study.

Residency status

Through several questions, students were asked to report on their residency prior to becoming a freshman. Students were first asked, “Are you an international student?”⁹³ If the response was “Yes” then no further questions were asked in regard to residency status. To assess state residency status, all non-international participants were asked, “Are you a permanent Arizona Resident?” Participants were then asked to provide the city, state, zip code, and duration of time (in years) of their last permanent residence. Students who did report an Arizona residence were classified as “in-state”; all others were classified as “out-of-state”. International students were excluded (n=13).

Social connectedness

Students were asked 12 questions related to their openness to new friendships,²⁷ how they feel toward ASU and making friends,⁹⁴ and their “rootedness” toward their home.⁹⁵ Participants rated social connectedness questions on a four-point Likert scale ranging from strongly disagree to strongly agree. Six questions were asked to assess students’ openness to new friendships: “I am excited at the possibility of making new friends at ASU,” “I want to meet new people with different backgrounds than my own,” “I feel I already have all the friends I need,” “Making new friendships is one of the things I look forward to the most when thinking about starting at ASU,” “I hope to get involved with many activities at ASU so I can meet a lot of new people” and “I already have a lot of good friends, so making new friends at ASU isn’t all that important to me.”²⁷ Students also responded to questions related to friendship formation and attitudes toward ASU: “It’s easy for me to make friends at ASU,” “I like being a student at ASU” and “Overall,

I feel accepted at ASU.”⁹⁴ Participants were then asked three questions related to rootedness: “Friends from my hometown often visit me,” “I am frequently homesick” and “I try to visit home as many times during the school year as I can.”⁹⁵ A scale combining these measures was created (Cronbach’s $\alpha=0.86$).

Dietary intake

In order to obtain information regarding students’ eating habits, the ASA24 self-administered 24-hour recall was utilized. The ASA24 24-hour recall provides an overview of all food and beverage items that the participant ate and drank from midnight to midnight on the previous day. The ASA24 provides images to help participants understand portion sizes so they are able to accurately report the amount that they consumed. The ASA24 is based off of the validated United States Department of Agriculture’s (USDA) Automated Multiple Pass Method (AMPM)⁹⁶ and it is able to estimate intake by utilizing the USDA’s Food and Nutrient Database for Dietary Studies (FNDDS).⁹⁷ For this study, calories, fat and added sugars were assessed as the intake of these items may be related to weight status in college freshmen.^{36,38-40,58} Sensitivity analyses were run to determine calorie cut off levels. Dietary intake was excluded if caloric intake was below 500 or greater than 5,000 calories. Days with suboptimal/unlikely caloric intake levels were dropped. However, a participant was only excluded if they did not have at least one day of adequate dietary intake.

Physical Activity

The Godin-Shepard Leisure-Time Physical Activity Questionnaire was used to assess strenuous, moderate and mild exercise.⁹⁸ Students were asked, “In a usual week, how many hours do you spend doing the following activities: strenuous exercise (heart beats rapidly), moderate exercise (not exhausting), and mild exercise (little effort).”

Examples of strenuous, moderate, and mild exercises were provided to the participants.

Their response options were none, less than ½ hour a week, ½-2 hours a week, 2 ½-4 hours a week, 4 ½ -6 hours a week, and more than 6 hours a week. The variable MVPA was developed by adding the time spent on strenuous and moderate activity.

Sociodemographics

The following demographic information was collected: gender, age, race/ethnicity, highest parental education dormitory, and Pell grant status. Participants were asked, “What is your gender?” with response options: Male, Female, Other (please specify). Participants were then asked, “What is your birthdate?” Participants had a dropdown menu where they selected the month, day and year that they were born.

To better understand the demographics of the diverse races/ethnicities of participants they were first asked, “Are you of Hispanic, Latino, or Spanish origin?” to which the options were: No, not of Hispanic, Latino, or Spanish origin; Yes, Mexican, Mexican Am, Chicano; Yes, Puerto Rican; Yes, Cuban; Yes, another Hispanic, Latino, or Spanish origin (please specify).⁹⁹ Participants were then asked, “What is your race?” with the following response options: White; Black, African Am; American Indian or Alaska Native (print name of enrolled or principal tribe); Asian; Pacific Islander; Some other

race (please specify).⁹⁹ If participants selected “Asian” or “Pacific Islander” they were then prompted with the following question, “Which of the following groups do you affiliate with?” The response options for “Asian” were as follows: Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian (print race, for example, Hmong, Laotian, Thai, Pakistani, Cambodian, and so on).⁹⁹ If participants selected “Pacific Islander” the response options were as follows: Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander (print race, for example, Fijian, Tongan, and so on).⁹⁹ For all race/ethnicity questions participants were allowed to select all applicable options.

Participants were also asked the highest parental education for both parents. The question(s) were: “What is the highest degree or level of education that your (dad/mom) completed?” with the response options of: Some High School (no degree), High School Diploma (or equivalent), Some College (no degree), Associate’s Degree/Trade/Technical/Vocational Training, Bachelor’s Degree, Graduate or Professional Degree, Not Applicable.¹⁰⁰

All participants were asked to indicate in which dormitory they lived and their Pell grant status. Participants were provided a drop down list of all the dormitories on campus from which they could select the dormitory they resided in. In addition, participants were asked, “Are you a Pell grant recipient?” from which they could select: Yes, No, and I don’t know.

Statistical Analysis

Bivariate analyses were conducted between residency status and eating and physical activity behaviors, residency status and social connectedness, and social connectedness and eating and physical activity behaviors. To determine differences between residency status, social connectedness, eating/PA behaviors, and sociodemographics chi-square and t-tests were used. A multivariate mediation analysis was conducted to determine if social connectedness mediates the relationship between residency status and eating and physical activity behaviors, adjusting for age, gender, race, ethnicity, highest parental education, dormitory, Pell grant status, number of recalls, and whether or not they had a dietary recall from the weekend. Step 1 measured the relationship between residency status and eating and physical activity behaviors. Step 2 measured the relationship between residency status and social connectedness. Step 3 measured the relationship between social connectedness and eating and physical activity behaviors. Step 4 measured how social connectedness mediates residency status and eating and physical activity behaviors. In this study, the relationships that were measured can be depicted in Figure 2. Stata 13.1 (StataCorp College Station, Texas) was used for this analysis. Statistical significance was set at $p < 0.05$.

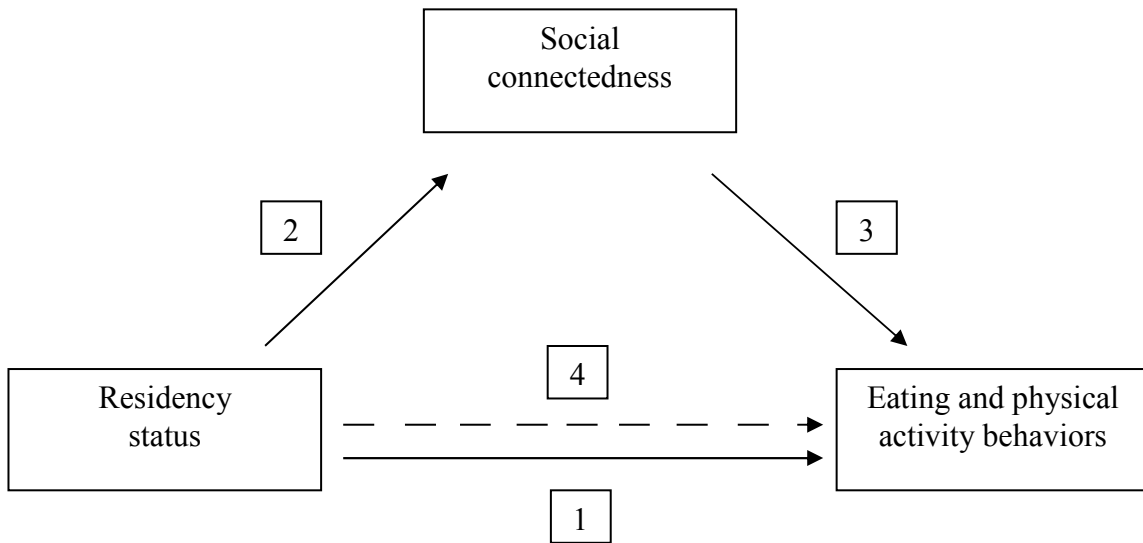


Figure 1: Multivariate Mediation Assessing the Relationships amongst Residency Status, Social Connectedness, and Eating and Physical Activity Behaviors

CHAPTER 4

RESULTS

Descriptive Characteristics

Of the 221 participants consented, 13 international students were excluded and 45 different participants were excluded due to inadequate dietary intake. The final analytical sample for this study was 163 respondents. The mean age was 19.0 ± 0.6 years; the majority of the sample was female (64%) (Table 1). White (non-Hispanic) individuals made up 49% of the total population. Over one-third of the subjects were Pell grant recipients and roughly one-quarter had parents with a Bachelor's degree or higher. On average, participants consumed around 1500 calories, 60g fat, and 75g added sugar on a daily basis. On average, subjects reported engaging in nearly 50 minutes of MVPA per day.

Table 1

Participant Demographics by Residency Status (n=163)^a

<u>Characteristics</u>	<u>All</u> n=163	<u>In-state</u> n=97	<u>Out-of-state</u> n=66	<u>p value</u>
Female, %	104 (64)	66 (40)	38 (23)	0.145
Age, years (SD)	19 (0.6)	19 (0.6)	19 (0.5)	0.205
BMI, kg/m ² (SD)	24.6 (5.6)	25.3 (6.2)	23.7 (4.3)	0.059
Race, %				0.464
White (Non-Hispanic)	80 (49)	45 (28)	35 (21)	
Black (Non-Hispanic)	13 (8)	7 (4)	6 (4)	
Asian	17 (10)	11 (7)	6 (4)	
Mixed/other	26 (16)	18 (11)	8 (5)	
Hispanic, %				0.464
Yes	42 (26)	27 (17)	15 (9)	
Pell Grant Status, %				0.001
Yes	61 (37)	47 (29)	14 (9)	
Dorm, %				0.570
Dorm x	51 (31)	32 (20)	19 (12)	
Dorm y	112 (69)	65 (40)	47 (29)	
Highest degree (Dad), %				0.412
High school diploma or less	53 (33)	34 (21)	19 (12)	
Some college	62 (38)	34 (21)	28 (17)	
Bachelor's degree or higher	40 (25)	22 (13)	18 (11)	
Highest degree (Mom), %				0.087
High school diploma or less	46 (28)	33 (20)	13 (8)	
Some college	69 (42)	36 (22)	33 (20)	
Bachelor's degree or higher	46 (28)	26 (16)	20 (12)	

^aBivariate analyses, using chi-square and t-tests

Unadjusted Results

Unadjusted bivariate analyses for calories, grams of fat, percentage of total calories from fat, added sugar, and MVPA by residency status are listed in Table 2. Of these outcomes, the only significant association was between residency status and MVPA ($p < 0.001$), indicating that out-of-state students exercise more than in-state students. There were no statistically significant differences between in-state and out-of-state students on calories, grams of fat, percentage of calories from fat and added sugar.

Table 2

Eating and Physical Activity Behaviors by Residency Status (n=163)^a

<u>Characteristics</u>	<u>All</u> n=163	<u>In-state</u> n=97	<u>Out-of-state</u> n=66	<u>p value</u>
Calories, kcals (SD)	1540 (731.1)	1478 (658.3)	1641 (830.6)	0.054
Range	501-4465			
Fat, g (SD)	63 (35.8)	60.8 (32.5)	65.7 (40.7)	0.232
Range	4-206			
Fat, % (SD)	36 (9.9)	36 (9.8)	36 (10.0)	0.383
Range	3-71			
Added sugar, g (SD)	75 (59.4)	72 (56.2)	81.0 (64.2)	0.168
Range	0.9-429			
MVPA, min/day (SD)	50 (30.4)	40 (26.1)	64 (30.9)	<0.001
Range	0-103			

^aBivariate analyses, using chi-square and t-test

Social Connectedness Scale

A scale was created to assess levels of social connectedness between in-state and out-of-state students. A step-wise process using the item-rest correlation was used to drop scale items. The item-rest correlation was used to drop because it takes into account the correlation each individual item has with the other items in the scale as well as the scale as a whole. Initially items were dropped if the item-rest correlation was below 0.2. The original item-rest correlations and alpha values are listed for each item in Table 3. The original social connectedness scale yielded a Cronbach's alpha of 0.74. Upon deletion of variables with an item-rest correlation below 0.2, new item-rest correlations were generated. The final social connectedness scale was determined when there were no longer any item-rest correlations below 0.2 (Table 4). A total of 7 of the original 12 items were used to form the final social connectedness scale with a Cronbach's alpha of 0.86.

Table 3

Psychometrics (Item-Rest Correlations and Cronbach's Alpha) of the Social Connectedness Scale

<u>Scale Item</u>	<u>Item-rest correlation</u> <u>(r)</u>	<u>Alpha</u>
Excited to make new friends	0.68	0.68
Want to meet new people	0.62	0.69
I have all the friends I need	0.09	0.76
Making new friends is one thing I look forward to most	0.59	0.69
Hope to be involved in activities to meet new people	0.53	0.70
Making new friends is not important to me	0.22	0.74
It is easy for me to make friends	0.35	0.72
I like being a student at ASU	0.63	0.69
I feel accepted at ASU	0.63	0.69
I am often homesick	0.23	0.74
I try to visit home often	0.07	0.76
Friends from home visit often	-0.05	0.77
Cronbach's alpha for the social connectedness scale		0.74

Table 4

Psychometrics (Item-Rest Correlations and Cronbach's Alpha) of the Modified Social Connectedness Scale

<u>Scale Item</u>	<u>Item-rest correlation</u> <u>(r)</u>	<u>Alpha</u>
Excited to make new friends	0.71	0.83
Want to meet new people	0.66	0.83
Making new friends is one thing I look forward to most	0.62	0.84
Hope to be involved in activities to meet new people	0.55	0.85
It is easy for me to make friends	0.45	0.86
I like being a student at ASU	0.68	0.83
I feel accepted at ASU	0.71	0.83
Cronbach's alpha for the social connectedness scale		0.86

Adjusted Results

Results for the multivariate linear regression models, adjusted for gender, age, race/ethnicity, Pell grant status, dormitory residence, parental education, number of recalls, and whether or not a weekend day was recalled can be found in Table 5. The table displays each relationship that was assessed during each step of the mediation. For example, in step 1, calories, fat (g), fat (%), added sugar, and MVPA are individually assessed in regards to residency status. No associations were observed between residency status and calories, grams of fat, percentage of calories from fat or added sugar. There was a statistically significant association between residency status and MVPA ($p < 0.001$) (step 1). On average, in-state students exercise 21 minutes less per day than out-of-state students ($\beta = -20.85$; 95% Confidence Interval (CI) = -30.68, -11.02) (step 1). No statistically significant relationship was found between residency status and social connectedness (step 2). Nor was social connectedness associated with any of the eating and physical activity variables (step 3). Due to the lack of significant findings in steps 1-3, the mediation (step 4) does not exist. Technically, proceeding past step 1 is not necessary if there are no significant findings, but as an analysis exercise for this thesis all 4 steps were ran.

The multivariate linear regression mediation model for MVPA is displayed in Figure 3. Step 1 assessed the relationship between residency status and MVPA. Step 2 determined the association between residency status and social connectedness. The relationship between social connectedness and MVPA was assessed in step 3. Finally, step 4 determined if social connectedness mediated the relationship between residency status and MVPA.

Table 5

Multivariate Mediation Analyses Assessing if Social Connectedness Mediates the Relationship between Residency Status and Eating and Physical Activity Behaviors^a

<u>Relationships being assessed</u>	<u>Beta value (95% CI)</u>	<u>p value</u>
Step 1^b		
Residency status		
Calories	-91.08 (-311.21, 129.06)	0.415
Fat (g)	-2.12 (-12.58, 8.34)	0.689
Fat (%)	0.43 (-2.64, 3.50)	0.783
Added sugar	3.25 (-15.14, 21.64)	0.727
MVPA	-20.85 (-30.68, -11.02)	<0.001
Step 2^c		
Residency status		
Social connectedness	-0.08 (-0.26, 0.11)	0.410
Step 3^d		
Social connectedness		
Calories	-54.57 (-251.94, 142.80)	0.585
Fat (g)	-2.69 (-12.09, 6.63)	0.565
Fat (%)	-0.41 (-3.16, 2.34)	0.769
Added sugar	-1.99 (-18.46, 14.48)	0.811
MVPA	9.25 (-0.30, 18.80)	0.058
Step 4^{e,f}		
Residency + social connectedness + calories	-95.72 (-316.91, 125.47)	N/A
Residency + social connectedness + fat (g)	-2.34 (-12.85, 8.17)	N/A
Residency + social connectedness + fat (%)	0.40 (-2.69, 3.49)	N/A
Residency + social connectedness + added sugar	3.11 (-15.39, 21.61)	N/A
Residency + social connectedness + MVPA	-20.25 (-30.03, -10.46)	N/A

^aMultivariate regressions adjusted for gender, age, race/ethnicity, Pell grant status, dormitory residency, parental education, number of dietary recalls and whether or not a weekend day was recalled

^bStep 1: Average nutrition and MVPA by residency status

^cStep 2: Average social connectedness by residency status

^dStep 3: Average nutrition and PA behaviors by social connectedness

^eStep 4: Mediation

^fMediation does not exist due to lack of statistically significant results in steps 1-3

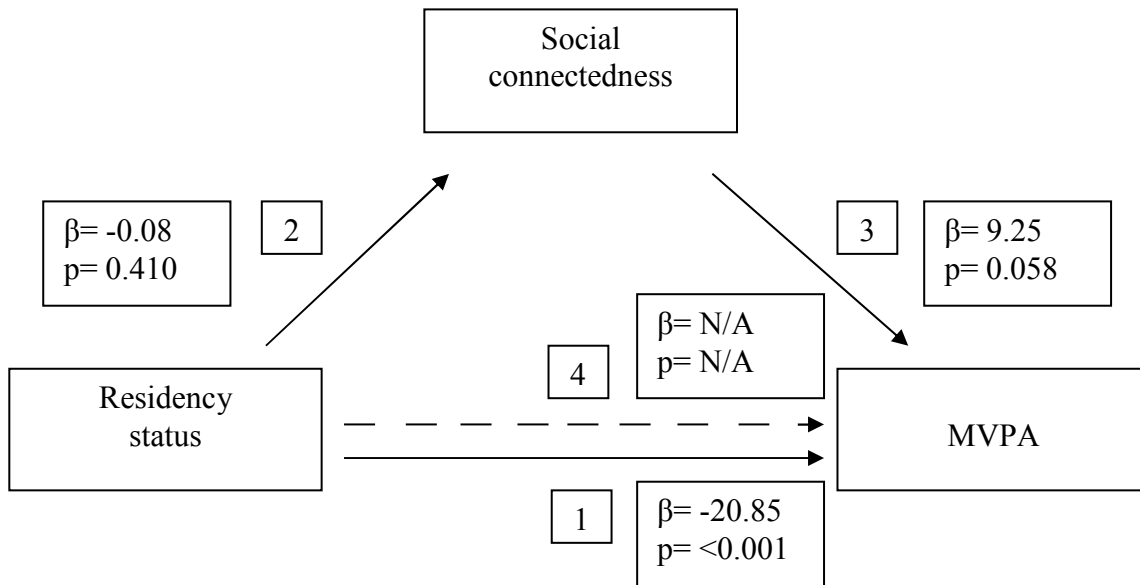


Figure 2: Multivariate Mediation Assessing the Relationships amongst Residency Status, Social Connectedness and MVPA

CHAPTER 5

DISCUSSION

The purpose of this study was to examine if social connectedness mediates the relationship between residency status and eating and physical activity behaviors among college freshmen. No research has explored the possible health factors associated with social connectedness in college freshmen, and more specifically, potential differences between in-state and out-of-state students. This study found no differences in residency status on social connectedness or eating behaviors. In addition, no differences between social connectedness and eating and PA behaviors were observed. However, results showed that out-of-state students engaged in more MVPA than in-state students. These findings can be used for future studies to examine the reasons why out-of-state students are more active and to get in-state students more involved in physical activities.

Residency Status on Eating and PA Behaviors

This study found a statistically significant association between residency status and physical activity behaviors. Out-of-state students engaged in 20 more minutes of physical activity per day compared to in-state students. On average, both in-state and out-of-state students exercised more than the average college population. It is recommended that college students engage in 150 minutes of moderate or 75 minutes of vigorous activity per week.⁹² According to our findings, in-state and out-of-state students were attaining 280 and 420 minutes of MVPA per week, respectively. These findings are not consistent with the current literature that states college students engage in PA at

suboptimal levels.^{42,44} While the current literature indicates PA decline throughout the years, this study examined PA during students' first year of college.^{41,90} Given that this study was comprised of college freshmen, declines in PA could occur during later years in college; however, research is needed to confirm this hypothesis. In addition, the higher amounts of MVPA witnessed amongst the out-of-state students could be likened to the HIE.^{63,64} Perhaps out-of-state students, like migrants from other countries, are healthier and that is why they chose to leave their home and travel move elsewhere.

Results did not show that eating behavior differed between out-of-state and in-state students. Those from in-state did not consume different amounts of calories, grams of fat, proportion of calories from fat, or grams of added sugar than those from out-of-state. These findings indicate that neither group (in-state nor out-of-state) students are at greater nutritional risk. Those coming from out-of-state appear to have similar eating patterns to those that were already residing in-state prior to attending college. On average, students consumed around 1,500 calories, 60g of fat (36% of total calories), and 75g of added sugar. The average college student requires roughly 1,800-2,400 calories to meet needs, according to a study conducted by Britten and colleagues.⁸³ Given the literature, seems unlikely that students, as a whole, are consuming only 1,500 calories daily. However, the majority of studies cited that assessed eating behaviors did not use a 24-hour dietary recall, which could explain the differences in caloric intake observed in this study.^{13,29,30,36,37,42,60,78,80,84,85,87} Notably, these students exceeded the total fat recommendations. In addition, these students' total caloric consumption was composed of > 20% added sugars, well above the 2010 Dietary Guidelines for Americans' suggestion of 5-15%.¹⁶ These findings are consistent with previous studies that report higher

percentages of fat and added sugar consumption in college freshmen.^{36,37} However, it seems unlikely that out-of-state students would have an extraordinarily higher amount of MVPA and not have a concomitant increase in caloric intake. The validity of the recorded caloric intake is questionable and needs to be examined further. The higher than average amounts of MVPA observed in this population should be reviewed in additional studies to confirm results.

Residency Status on Social Connectedness

This study examined the relationship between residency status and social connectedness. Similar studies focused on why students chose the school they did and not on specific health behaviors. Extensive research has also been conducted on the welfare of international students. Previous findings show that international students who make domestic friends have higher levels of satisfaction than students who make more international friends.⁵⁷ This study found that social connectedness was not different between in-state and out-of-state students indicating that those coming from out-of-state do not appear to be at a disadvantage for forming friendship connections than in-state students.

Social Connectedness on Eating and PA Behaviors

Previous research has indicated that there is a relationship between social connectedness and engaging in physical activity amongst older populations.³⁴ The current study sought to explore if this same relationship could be seen in a college population. Levels of social connectedness and MVPA were trending toward significance in college

freshmen ($p=0.058$). The lack of statistically significant findings could be due to low power. Future research should re-examine this relationship with a larger sample size to determine if there is a real difference between social connectedness and physical activity. No differences were found between social connectedness and eating behaviors. Given the association between health and social connectedness in older populations,³³ social connectedness could be associated with other health factors amongst the college population. Further research is necessary to confirm if there is a relationship between social connectedness and health amongst college students.

Strengths and Limitations

There were many strengths of this study. First, no research has been conducted on student residency status on any health outcomes in the literature. Furthermore, no research has been conducted on the association between social connectedness and eating and physical activity behaviors in the college population. Secondly, this study has potential public health and policy implications. Thirdly, the measures used in this study, such as the Godin-Shepard Leisure-Time Physical Activity Questionnaire for assessing PA, were strong.

This study had several limitations. First, the study is cross-sectional. Therefore, only one point in time was assessed and causal inferences cannot be made. Second, this study utilized a convenience sample from two college dormitories in the College of Liberal Arts and Sciences of ASU, indicating results may not be generalizable to other populations. Third, the ASA24 24-hour recall was used to assess diet intake. This method relied heavily upon the memory of the participant to recall everything that they ate and

drank the previous day and in the appropriate portion sizes and may be prone to recall bias. Fourth, reported caloric intake was lower than expected and could be due to the format in which dietary intake was collected. Participants may have found it an inconvenience to complete and may have recorded only enough foods and beverages to merely be compensated for their efforts. Fifth, the data for this study was originally planned to be collected during the first couple weeks of September. However, the study needed to be moved into November after the students had Fall Break. Additionally, a second round of data collection was needed to increase sample size. The additional round of data collection took place at the beginning of the spring semester after Winter break. It is possible that after these students returned to ASU following Fall and Winter Break that they felt more socially connected with their friends from their hometown, which could have impacted how they responded to the social connectedness aspect of the survey they completed. Also, considerable time had passed since school started in August and the initial formation of friendship networks and subsequent social connectedness was not able to be captured.

Summary

Results from this study indicate that there was no relationship between residency status and eating behaviors, residency status and social connectedness, and social connectedness and eating and physical activity behaviors. Furthermore, social connectedness did not mediate the relationship between residency status and eating and physical activity behaviors. This study did show that there is a statically significant relationship between residency status and MVPA. Specifically, out-of-state students

reported higher levels of MVPA compared to in-state students. There was also a trend toward significance between social connectedness and MVPA that needs to be further explored with a larger sample size.

CHAPTER 6

CONCLUSION

The eating and physical activity behaviors of college freshmen are a great public health concern. The behaviors that young adults adopt during these formative years are likely to be upheld throughout their adult years. This cross-sectional study examined a convenience sample from Arizona State University's Tempe campus to assess if social connectedness mediates the eating and physical activity behaviors of college freshmen depending on residency status.

Only one out of the ten hypotheses was upheld. The first three hypotheses stated that there would be a difference between total calories, grams of fat, percentage of fat, and total grams of added sugar between those from in-state and out-of-state. The fourth hypothesis, which stated that there would be varying amounts of MVPA by residency statuses, was upheld. Hypothesis five stated social connectedness would be different based on residency status. Hypotheses six through nine indicated that those with low social connectedness would consume more calories, grams of fat, percentage of calories from fat, and added sugar along with lower amounts of MVPA than those with higher social connectedness. Given that none of the other 3 steps of the mediation were statistically significant, hypothesis ten stating that social connectedness would mediate the relationship between residency status and eating and physical activity behaviors was not upheld.

Further research needs to be conducted to determine why out-of-state students are more physically active than in-state students and if there are other health outcomes that

may be different. It is necessary to determine the means by which this association is occurring. Likely, there are other factors involved in the association between residency status and MVPA and it is imperative to understand what these other factors are and how they impact this relationship. It also seems appropriate that those with higher amounts of activity would consume more calories. Future studies should aim to re-examine if there is truly no association between dietary intake and residency status. There is also a need for the relationship between residency status and MVPA to be examined over an extended period of time. Future research should also further explore the link between social connectedness and MVPA as there was a trend toward significance, likely due to a power issue. If the association between social connectedness and MVPA exists, a major factor will be understood as to why students may or may not become physically active. This association could further the implementation of programs to help students that are not socially connected engage in appropriate MVPA.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL FORM FALL 2014

To: Meredith Bruening

From: Carol Johnston, Chair 
Biosci IRB

Date: 09/09/2013

Committee Action: **Expedited Approval**

Approval Date: 09/09/2013

Review Type: Expedited F7

IRB Protocol #: 1309009596

Study Title: The Role of Friendship Networks on BMI and Behaviors among College Freshmen

Expiration Date: 09/08/2014

The above-referenced protocol was approved following expedited review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. You may not continue any research activity beyond the expiration date without approval by the Institutional Review Board.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Biosci IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Biosci IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL FORM SPRING 2015

APPROVAL:CONTINUATION

Meredith Bruening
SNHP - Nutrition
602/827-2266
Meg.Bruening@asu.edu

Dear Meredith Bruening:

On 8/21/2014 the ASU IRB reviewed the following protocol:

Type of Review:	Modification and Continuing Review
Title:	The Role of Friendship Networks on BMI and Behaviors among College Freshmen
Investigator:	Meredith Bruening
IRB ID:	1309009596
Category of review:	(7)(a) Behavioral research
Funding:	Name: NIH: National Institutes of Health; Funding Source ID: HHS-NIH-National Institutes of Health.
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • ValidationConsentForm--Revised, Category: Consent Form; • ApprovedIRBProtocol, Category: IRB Protocol; • Web-based survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • ValidationFlyer, Category: Recruitment Materials; • ValidationEmail, Category: Recruitment Materials;

The IRB approved the protocol from 8/21/2014 to 9/7/2015 inclusive. Three weeks before 9/7/2015 you are to submit a completed "FORM: Continuing Review (HRP-212)" and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 9/7/2015 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

APPENDIX C
WEB BASED SURVEY

This survey is a set of questions about you and your college life. Please answer each question honestly and to your best ability. Thank you for your time and participation! To begin the survey, please enter the participant ID given to you by the researchers below:

Please provide us with your first and last name along with your email address. Your gift card will be sent over email so please make sure to give us the best email to reach you at.

First name: _____

Last name: _____

Email address: _____

What is your gender?

- Male
- Female
- Transgender

What is your birth date?

Are you of Hispanic, Latino, or Spanish origin? (check all that apply)

- No, not of Hispanic, Latino, or Spanish origin
- Yes, Mexican, Mexican Am., Chicano
- Yes, Puerto Rican
- Yes, Cuban
- Yes, another Hispanic, Latino, or Spanish origin (please specify)

What is your race? (check all that apply)

- White
- Black, African Am.
- American Indian or Alaska Native (Print name of enrolled or principal tribe)

- Asian
- Pacific Islander
- Some other race (please specify) _____

Which of the following groups do you affiliate with? (Check all that apply)

- Asian Indian
- Chinese
- Filipino
- Japanese
- Korean
- Vietnamese
- Other Asian (Print race, for example, Hmong, Laotian, Thai, Pakistani, Cambodian, and so on) _____

Which of the following groups do you affiliate with? (Check all that apply)

- Native Hawaiian
- Guamanian or Chamorro
- Samoan
- Other Pacific Islander (Print race, for example, Fijan, Tongan, and so on)

The next few questions will ask you about your college life.

Are you an international student?

- Yes
- No

Are you a Pell Grant recipient?

- Yes
- No
- I do not know

Are you a permanent Arizona resident?

- Yes
- No

What was your last permanent residence before coming to ASU and how long did you live there for?

City: _____

State: _____

Zip Code: _____

Duration of time (years): _____

Which dorm do you live in?

- Adelphi Commons I
- Adelphi Commons II
- Barrett Honors
- Best Hall
- Hassayampa
- Hayden Hall
- Irish Hall
- Manzanita Hall
- McClintock Hall
- Palo Verde East
- Palo Verde Main
- Palo Verde West
- San Pablo Hall East
- San Pablo Hall West
- Sonora Center
- Vista del Sol
- Dorm not listed (please specify): _____

Please rate how strongly you agree with the following statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree
I am excited at the possibility of making new friends at ASU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I want to meet new people of different backgrounds than my own	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel I already have all the friends I need	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Making new friendships is one of the things I look forward to the most at ASU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I hope to get involved with many activities at ASU so I can meet a lot of new people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I already have a lot of good friends, so making new friends at ASU isn't all that important to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's easy for me to make friends at ASU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Friends from my hometown often visit me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am frequently homesick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I try to visit home as many times during	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

the school year as I can				
I like being a student at ASU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall, I feel accepted at ASU	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Now we are going to ask you about your family.

What is the highest degree or level of education that your dad completed?

- Some High School (no degree)
- High School Diploma (or equivalent)
- Some College (no degree)
- Associate's Degree/ Trade/ Technical/ Vocational Training
- Bachelor's Degree
- Graduate or Professional Degree
- Not applicable

What is the highest degree or level of education that your mom completed?

- Some High School (no degree)
- High School Diploma (or equivalent)
- Some College (no degree)
- Associate's Degree/ Trade/ Technical/ Vocational Training
- Bachelor's Degree
- Graduate or Professional Degree
- Not applicable

In a usual week, how many hours do you spend doing the following activities:

Strenuous exercise (heart beats rapidly) Examples: biking fast, aerobic dancing, running, jogging, swimming laps, rollerblading, skating, lacrosse, tennis, cross-country skiing, soccer, basketball, football, zumba

- None
- Less than 1/2 hour a week
- 1/2 - 2 hours a week
- 2 1/2 - 4 hours a week
- 4 1/2 - 6 hours a week
- More than 6 hours a week

Moderate exercise (not exhausting) Examples: walking quickly, baseball, gymnastics, easy bicycling, volleyball, skiing, dancing, skateboarding, snowboarding

- None
- Less than 1/2 hour a week
- 1/2 - 2 hours a week
- 2 1/2 - 4 hours a week
- 4 1/2 - 6 hours a week
- More than 6 hours a week

Mild exercise (little effort) Examples: walking slowly (to school, to friend's house, etc.), bowling, golf, fishing, snowmobiling, yoga

- None
- Less than 1/2 hour a week
- 1/2 - 2 hours a week
- 2 1/2 - 4 hours a week
- 4 1/2 - 6 hours a week
- 6+ hours a week

Thank you for taking this survey!