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Factors Influencing Healthy Eating and Physical Activity Behaviors of Adolescents in Appalachia

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Factors Influencing Healthy Eating and Physical Activity Behaviors of Adolescents in

Appalachia

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A dissertation

presented to

the faculty in the Department of Community and Behavioral Health

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Public Health in Community and Behavioral Health

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by

Natalie Walker

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ABSTRACT

Factors Influencing Healthy Eating and Physical Activity Behaviors of Adolescents in

Appalachia

by

Natalie V. Walker

This study examined the TPB constructs of attitude, perceived behavioral control, and subjective

norms and their ability to predict healthy eating and physical activity behaviors among

adolescents living in Southern Appalachia. The study also considered the relative utility of

subjective norms and social support in predicting these behaviors. Data for this research were

derived from a larger study, Team Up for Healthy Living, conducted September 2011 through

November 2014 with high school students in the Appalachian region (Study ID: R01MD006200

from the National Institute on Minority Health and Health Disparities). Participants (n=963)

completed a three-part paper survey collecting data about eating habits, physical activity,

sedentary behaviors, weight status, and demographics. Study results indicated more than half of

the study population was classified as overweight (20.7%) or obese (31.4%). They had high

rates of physical activity, low rates of sedentary behavior, and healthy dietary behaviors,

compared to national norms. Approximately, 42.8% reported drinking at least one soda daily

and 42.9% consumed 1-6 sodas over the course of seven days. Multiple linear regression

analysis indicated attitude (Beta = .110, t (824) = 2.83, p < .005) and perceived behavioral

control (Beta = .147, t (824) = 3.14, p < .001) were the strongest predictors of healthy eating

behaviors. For physical activity, the strongest predictors of behavior were attitude (Beta = .186, t

(839) = 5.21, p < .001) and social support (Beta = .347, t (839) = 9.09, p < .001). Comparison of

subjective norms and social support revealed subjective norms were a better predictor of healthy

eating behaviors, and social support was a better predictor of physical activity.   The results of

this study indicate that behavior theories are effective at identifying motivating factors for health

behaviors in unique populations.

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DEDICATION

To Samone, Elisha, Jason, and Ethan

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CHAPTER 1

INTRODUCTION

Childhood obesity rates in the United States have more than doubled in the past 30 years, with rates among adolescents (ages 12-19) quadrupling from 5% in 1980 to 21% in 2012 (Centers for Disease Control and Prevention (CDC), 2012a; Ogden, Carroll, Kit, & Flegal, 2014). Adolescents living in rural communities are 25% more likely to be overweight or obese than their urban counterparts (Lifsey & Mantinan, 2014; National Advisory Committee on Rural Health and Human Services, 2011). They also have lower rates of physical activity and healthy eating (CDC, 2013; South Carolina Rural Health Research Center, 2010; U.S. Department of Health and Human Services (HHS), 2012). As a result, the effects of obesity on the health of adolescents have led to increased risk of early onset of adult health conditions such as cardiovascular disease, diabetes, cancer, and osteoarthritis (CDC, 2012a; CDC, 2011b).

The risk factors for obesity are prominent among the population in the portion of the United States known as Appalachia. The Appalachian region stretches along the eastern part of the United States and includes all of West Virginia and counties in 12 other states including, New York, Pennsylvania, Ohio, Maryland, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Alabama, and Mississippi (Appalachian Regional Commission (ARC), 2014a). Approximately 25 million people live in the Appalachian region, with 42% of the population residing in rural areas (ARC, 2015). Between 2009-2013, eleven of the thirteen states included in the Appalachian region had a poverty rate at or greater than the national average of 15.4% (ARC, 2016). In 2013, the average annual per capita income in Appalachia ranged from 5% to 35% below the national average income of $44,765 (ARC, 2014a). Between

2011-2013, the average unemployment rate in the region ranged from 7.0% to 10.7%, compared to the national average of 8.1% (ARC, 2016).

Adolescents living in rural communities are faced with unique challenges that increase their risk of obesity. They are more likely to be geographically isolated with limited access to basic necessities such as food, health care, and safe housing. A study on rural obesity found approximately 20% of people in rural communities live more than 10 miles from a grocery store (Fountain, 2014). There is limited access to options for physical activity as they are more likely to have to travel long distances to access resources such as safe parks or community recreational facilities (Fountain, 2014). Adolescents who reside in rural areas are also more likely to live in households with low education attainment and a household income at or below poverty level (ARC, 2014; Bolin et al., 2015; Fountain, 2014). From 2009 -2013, the percentage of adults age 25 and over with a high school diploma in the Appalachian Region was 84.6% compared to 86% nationally. Adults with a bachelor's degree or higher was 21.7% in the region; compared to 28.8% nationally (ARC, 2014b). Low education attainment impacts both employment status and household income due to limited options for employment that include seasonal jobs, part-time jobs, and low-wage jobs (Fountain, 2014; Liu, Zheng, Probst, & Pate, 2007; Liu, Bennett, Harun, & Probst, 2008).

Geographic location, poverty, and limited resources all affect access to activities and resources that promote healthy behaviors and reduce the risk of being overweight or obese (ARC, 2014a). In 2013, five of the thirteen states in the Appalachian region reported rates of obesity among adolescents of 15% or higher and another seven states reported obesity rates of 11% to 14% (CDC, 2012a). Recognizing this, interventions have been implemented in community, home, and school settings with the goal of reducing risk factors to help reverse the

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childhood obesity epidemic (Fountain, 2014; Ickes & Slagle, 2013; Smith & Holloman, 2013; Whitlock, O'Connor, Williams, Beil, & Lutz, 2008). Primarily targeted at younger children, most interventions have been implemented in the school setting at the elementary level, with a focus on policy changes related to wellness plans and access. The interventions frequently focus on impacting a specific health behavior, such as increasing water consumption, decreasing consumption of sugar-sweetened beverages, or increasing physical activity (CDC 2014; CDC, 2016; Ickes & Slagle, 2013). While these interventions have been successful at impacting the targeted health behaviors, there is limited evidence of programs that focus on the health behaviors of adolescents in rural communities (CDC 2014; CDC, 2016; Ickes & Slagle, 2013).

A key element in improving health behaviors is knowledge of components necessary for interventions to facilitate success. To aid in the process, behavior theories are often utilized to illuminate the factors influencing individual behavior. Two common models used to assess intent to perform a specific behavior are the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). An extension of TRA, the TPB is often used to document the factors that motivate an individual to engage in a health behavior (Conner, Norman, & Bell, 2002; Riebl et al., 2015). For interventions dealing with childhood obesity, the TPB has been used to develop programs focused on physical activity and healthy eating (Ajzen, 2011; Prestwich et al., 2013).

Considering the long-term implications of obesity on the health of adolescents and their communities, there is a need for interventions to reverse obesity trends. Predicting what factors impact health behaviors is vital to this process. There is limited research that focuses specifically on the health behaviors of adolescents in rural Appalachia as it relates to healthy eating and physical activity (Ickes & Slagle, 2013; Wu et al., 2007, 2009). Of those studies, few look at the

potential impact of external factors, such as social support, on those behaviors. The TPB

constructs focus on the role of subjective norms in predicting behavior (Ajzen, 2011; Madden,

Ellen, & Ajzen,1991). Subjective norms explain an individual's perception of an expectation to

perform a behavior by his or hers' peer group (Ajzen, 2011; Glanz, Rimer, & Viswanath, 2008;

Madden et al.,1991). However, it is documented that physical activity and healthy eating are

behaviors that need external support to be performed (Conner et al., 2002; Courneya, Plotnikoff,

Hotz, & Birkett, 2000; Hamilton, & White, 2008; Saunders, Motl, Dowda, Dishman, & Pate,

2004). Thus, it is important to investigate if there is a difference between subjective norms and

social support to predict healthy eating and physical activity.

<u>Purpose of Study</u>

The TPB provides a theoretical basis to better understand the factors that contribute to the

intent to perform health behaviors among adolescents. Focused on those factors that motivate an

individual to perform a specific behavior, it is widely used to explain a number of health

behaviors. The purpose of this study was to examine the TPB constructs of attitude, perceived

behavioral control, and subjective norms and their ability to predict intent to engage in both

healthy eating and physical activity behaviors among adolescents living in the Appalachian

region. Further, the study considered the relative utility of subjective norms versus social

support in predicting intent to perform these behaviors.

<u>Significance of the Study</u>

The evidence confirms obesity among adolescents is widespread, and effective

interventions are needed to reverse the epidemic. Solutions focused on health behaviors, such as

healthy eating and physical activity, have been targeted toward youth. However, most school-

based interventions have been targeted toward younger children in elementary school settings

(Ickes & Slagle, 2013). Moving toward more autonomous decision making, adolescents are making health related choices that will carry into young adulthood. To promote healthier choices, there is a need for interventions that target the unique needs of adolescents (Elkins, Nabors, King, & Vidourek, 2015; Ickes & Slagle, 2013). Specifically, there is a need to design interventions targeting factors that facilitate healthy behavior choices among adolescents. This research contributes to an existing body of evidence supporting the use of TPB to explain behavior intentions among adolescents. It also contributes to a growing body of evidence to support the use of the TPB to design effective interventions for obesity prevention for adolescents. It provides evidence to support the use of models that include a prominent role for social support, either in place of or in addition to the construct of subjective norms, in predicting behavioral intention. It also adds to a limited body of research focused on effective interventions for an under-represented population in the literature, adolescents in rural Appalachia. Finally, it provides information on the unique characteristics of daily healthy eating and physical activity behaviors of adolescents residing in rural Appalachia.

<div align="center">Definition of Terms</div>

Attitude

Attitude is defined as the individual's personal evaluation of a behavior. An individual's attitude toward a behavior is determined by the beliefs they have about the possible outcomes or attributes of performing the behavior (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008).

Subjective norms (SN)

The perceived social pressure to engage in or not to engage in a specific behavior (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008).

Perceived Behavioral Control (PBC)

Perceived behavioral control is defined as the control one believes he or she has over performing a behavior. Distinct from attitude and subjective norms, perceived behavioral control accounts for factors outside of the individual that may influence behavior. Focusing on the presence or absence of both barriers and facilitators to behavior, perceived behavioral control examines how the individual perceives his or her ability to impact external influences on behavior (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008).

Social Support (SS)

Social Support is defined as perceptions of external assistance, such as comfort, assistance, or information, an individual receives through formal and informal social interactions that influence intention to engage in health behavior (Courneya et al., 2000; Hamilton & White, 2008).

Behavior

Behavior is an individual's observable response in a given situation to a given target. It is a function of compatible intentions and perceptions of behavior control (Glanz, & Rimer, 2008; Montaño & Kasprzyk, 2008).

Behavior Intention

Behavior intention is the perceived likelihood of performing a specific behavior, indicated by how much effort an individual is willing to commit to performing that behavior. Behavior intentions are determined by an individual's attitude toward the behavior and social normative perception of that behavior (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008).

Body Mass Index (BMI)

Body Mass Index (BMI) is used to determine an individual's weight status by dividing a person's weight in kilograms by their height in meters squared. For children, categorization of BMI is age and sex specific and expressed as a percentile (CDC, 2012b)

Overweight in children

Overweight in children is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex (CDC, 2012b).

Obesity in children

Obesity in children is defined as a BMI at or above the 95th percentile for children of the same age and sex (CDC, 2012b).

Theoretical Framework

The theoretical framework used in this study (Figure 1) is the TPB. An extension of the TRA, both theories assert the best predictor of a future behavior is behavior intention, a person's motivation to engage in a specific behavior at a specific time. The main constructs of the TRA, attitude and subjective norms, have a direct impact on decisions to perform behaviors. The TPB adds perceived behavioral control to those constructs (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008). Together, attitude, subjective norms, and perceived behavioral control account for a large portion of the variance in predicting whether a person will perform a health behavior (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008). An additional construct, social support, was compared to the TPB constructs to assess behavior intentions for the health behaviors of healthy eating and physical activity. The constructs were assessed based on the external variables of gender and BMI.
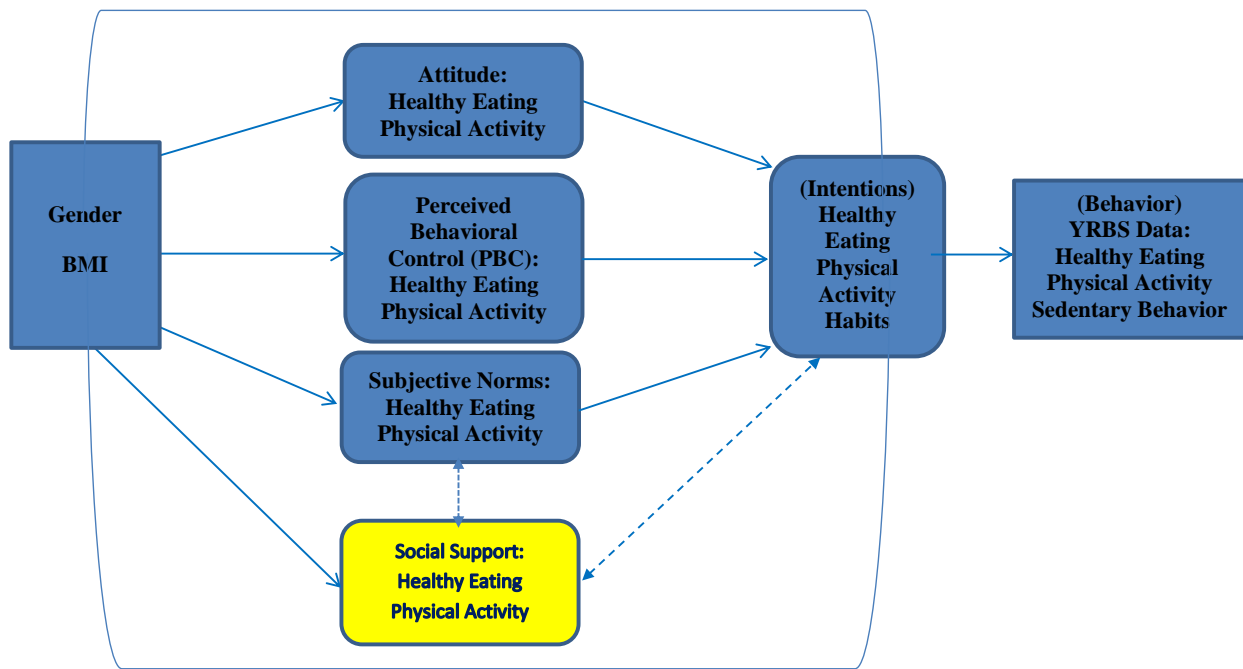
Figure 1. Theoretical Model: Theory of Planned Behavior - A Comparison of Subjective Norm and Social Support

Subjective norms and social support are both measures of social influence. Whereas subjective norms are based on the belief of perceived pressure from others to engage in a behavior; social support describes perceptions of external assistance, such as comfort, assistance, or information, an individual receives through formal and informal social interactions that influence intention to engage in health behavior (Courneya et al., 2000; Hamilton & White, 2008). Health behaviors such as physical activity and healthy eating are heavily influenced by external factors beyond the control of the individual. For this reason, social support has been considered a viable alternative for subjective norms to assess health behaviors (Hamilton & White, 2008). For this study, the hypothesis is centered on the concept that the health behaviors of healthy eating and physical activity will be better explained by the addition of social support to the TPB because of the influence of outside factors to perform them (Courneya et al., 2000; Hamilton & White, 2008).

This research examines specific elements of the TPB and their ability to explain participants' behavior choices regarding healthy eating and physical activity. The primary goal of this study is to test the relationship of the targeted TPB constructs and social support construct in predicting intent to perform health behaviors of healthy eating and physical activity. It also seeks to compare healthy eating and physical activity behaviors of adolescents in rural Appalachia to similar adolescent populations in both Tennessee and the United States.

1) **Question One**: How do the daily habits of health behaviors of healthy eating and physical activity of adolescents in Southern Appalachia compare to both Tennessee and the United States?

2) **Question Two**: What is the relationship between Theory of Planned Behavior constructs of attitude, perceived behavioral control, subjective norms (of), subjective norms (from), and the construct of social support and the intent to perform health behaviors of healthy eating and physical activity for adolescents in Southern Appalachia?

3) **Question Three**: Is there a difference between subjective norms and social support's ability to predict intention for healthy eating and physical activity behavior among adolescents in Southern Appalachia?

Limitations

Although this research may provide additional support for the use of the TPB to predict behavioral intentions of adolescents in the Appalachian region, there are limitations to the research. The first is the homogeneity of the study population. The sample included adolescents from one region in one state in Appalachia. Also, the study population consist of students primarily from one grade (9th grade). Second, the predictor and outcome variable data are based

on self-reported responses. This makes the data vulnerable to both over and under estimates of the behavior by the respondent. However, studies indicate self-reported data regarding health related behaviors for adolescents are of acceptable quality (Brenner et al., 2002; CDC, 2013). Finally, this is a cross-sectional study. This study will examine a single population at one point in time, considering factors already present in the population related to the desired outcome. For this reason, causation cannot be determined for the behaviors of interest.

<div align="center">Assumptions</div>

This study included the following assumptions: (a) the participants responded to the survey accurately; (b) the data collected accurately measured the participants' attitudes, perceived control, subjective norms and social support perceptions as they relate to intent to engage in healthy eating and physical activity; (c) the interpretations of the data accurately reflect the perceptions of the participants.

<div align="center">Summary</div>

The current childhood obesity epidemic has heightened the need to identify tools to aid in the development of effective interventions and policy modifications to reverse present trends. It is essential to identify and understand key factors necessary to successfully intervene and alter behavior in order to promote adherence to more healthful behaviors. Important health behaviors of physical activity and healthy eating have been identified as playing vital roles in both prevention and treatment of childhood obesity. This research seeks to contribute to these efforts by assessing the utility of TPB, a behavioral change model, to both predict and assess behavior change in adolescents. It will provide additional evidence to support the use of theory when designing interventions for adolescents, especially those residing in rural communities like Appalachia and beyond.

CHAPTER 2

LITERATURE REVIEW

Introduction: Section Overview

The purpose of this chapter is to provide an overview of the literature on obesity, health

behaviors of adolescents, the TPB, and social support. The chapter will begin with a definition

of childhood obesity. Next, information will be presented on the behaviors of healthy eating and

physical activity among adolescences. It will conclude with a historical overview of the TPB

and social support and their ability to predict health behaviors of adolescents.

Obesity: Defining Childhood Obesity

The World Health Organization (WHO) defines obesity as abnormal or excessive fat

accumulation that presents a risk to health (2015). The CDC definition states overweight and

obesity are a weight that is higher than what is considered to be a healthy weight for a given

height (2015b). There are several methods used to screen for obesity and assess body fat and

weight status. Some methods are more complex and use specialized equipment to directly

measure body fat. They include densitometer (underwater weighing) and imaging methods such

as dual energy x-ray absorptiometry (DEXA), computerized tomography (CT), and magnetic

resonance imaging (MRI) (Harvard School of Public Health (HSPH), 2015; Hu, 2008). Other

methods, sometimes referred to as field methods, use less expensive and commonly available

tools to assess body composition and include methods such as skinfold thickness, waist

circumference, waist-to-hip ratio, and body mass index (BMI) (HSPH, 2015; Hu, 2008).

The two most common methods used to screen for obesity are waist circumference and

BMI (Lobstein, Baur, & Uauy, 2004). Waist circumference is an indirect measure of abdominal

fat. Waist circumference measures are simple, use low-cost equipment, and have low

measurement error. When compared to DEXA to measure abdominal fat, waist circumference

had a correlation of .83 for girls and .84 for boys ages 3 to 19 (Lobstein et al., 2004).   Analysis

of studies using waist circumference with children ages 5-17 found an association between high

waist circumference and hyperinsulinemia, adverse lipid profiles, and increased risk of obesity in

adulthood (Lobstein et al., 2004). Although waist circumference has shown good associations

with risk factors for obesity, this method does not have accepted cut-off values for classification

of overweight or obese status making it not the best method to assess obesity (Lobstein et al.,

2004).

The most frequently used method to screen for obesity is BMI (CDC, 2015d; Freeman,

Mei, Srinivasan, Berenson, & Dietz, 2008; Lobstein et al., 2004).   BMI is a measure of body

surface area defined as weight in kilograms divided by the square of height in meters. BMI is

also easy to measure, inexpensive to administer, and has been shown to correlate well with direct

measures of body fat (CDC, 2015b; Freeman et al., 2008). When compared to DEXA to assess

total body fat, BMI correlation was .85 for boys and girls ages 5-19. BMI is also a useful

method to classify overweight and normal weight children as it has accepted cutoff for each

category. When compared to DEXA, BMI had true positive rates of .83 for children 10-11 year

olds, .67 for children 12-13 year olds, and .77 for children 14-15 year olds. It had false positive

rates of .13 for children 10-11 year olds and .03 for children 12-13 year olds (Lobstein et al.,

2004).

For children and adolescents, BMI is expressed as a percentile based on growth charts

produced by both the CDC and WHO (CDC, 2015d). Developed by the National Center for

Health Statistics (NCHS) in 1977, CDC Growth Charts were introduced as a clinical tool to

assist health care professionals with assessing if a child's growth was adequate. Used to classify

weight status of children and adolescents ages 2-21, growth charts were created by compiling

key measurements, such as height, weight, and head circumference, to produce a series of

percentile curves that illustrated the distribution of various body measurements in children based

on age and gender (CDC, 2015d). This method was used because the body composition of

children changes as they age and is different between males and females.

The physiological differences between boys and girls have resulted in a variety of

interpretations of how to assess obesity throughout the world (CDC, 2015d; Freeman et al.,

2008; Lobstein et al., 2004). In an effort to standardized BMI's, CDC issued growth charts in

2000, using the terms 'at-risk of overweight' for children and adolescents with a BMI between

85th and 95th percentiles and 'overweight' for children and adolescents with a BMI ≥ 95th

percentile (Dietz, 2015). In 2007, the terms changed, classifying children and adolescents with a

BMI between 85th and 95th percentiles as overweight and children and adolescents with a BMI ≥

95th percentile as obese (Dietz, 2015). The change in terminology caused conflict among

experts, some arguing the screening tool had become a diagnostic tool and could lead to

additional health issues such as eating disorders (Dietz, 2015). Despite the objections, in 2009,

the new terminology was adopted and children are classified into one of four categories based on

age and sex: underweight (less than the 5th percentile), healthy weight (5th percentile to less than

85th percentile), and overweight (85th percentile to less than 95th percentile) and obese (equal to

or greater than 95th percentile) (CDC, 2015d; WHO, 2015).

Obesity: Trends

Global rates of obesity have more than doubled since 1980, with an estimated 1.9 billion

adults age 18 and older classified as overweight or obese. Of those, approximately 600 million

were identified as obese. Approximately 42 million children under the age of 5 met the criteria

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for being overweight or obese in 2013 (WHO, 2015). Within the United States, an estimated one-third or 78.6 million adults are classified as obese (CDC, 2015a). Data from 2008 Behavior Risk Factor Surveillance System (BRFSS) showed five states (Alabama, Mississippi, Oklahoma, Tennessee, and West Virginia) had a prevalence of obesity greater than or equal to 30%, and 32 states had rates of 25% or more (Nguyen & El-Serag, 2010). By 2014, all states in the United States had a prevalence of obesity equal to or greater than 20%, with three states (Arkansas, Mississippi, and West Virginia) reporting rates greater than 35% (CDC, 2015c).

Over the last three decades, rates of obesity have quadrupled among adolescents, increasing from 5% in 1980 to 21% in 2010 (CDC, 2012b). The 2013 Youth Risk Behavior Surveillance System (YRBSS) survey found 13.7% of high school students were obese, and 16.6% were overweight based on self-report of weight and height. Rates of obesity were highest among white males (16.5%) and Hispanic males (19%). Looking at obesity rates by grade level, male students had higher rates of obesity in 9th grade (16.2%), 10th grade (17.2%), and 11th grade (17.6%) when compared to female students in 9th grade (10.2%), 10th grade (10.1%) and 11th grade (11.4%) (Kann et al., 2014). Given the obesity trends for adults, it is important to note the increase in rates of obesity by adolescents as they age.

Identified in the 2008 BRFSS survey as one of five states with a prevalence of obesity equal to or greater than 30%, Tennessee reflects the trends already described both globally and in the United States (Nguyen & El-Serag, 2010). In 2013, 34.7% of adults in Tennessee were classified as overweight and 33.7% as obese. For adolescents, 15.4% were classified as overweight and 16.9% as obese (CDC, 2015c). Although the percentage of overweight adolescents decreased from 16.1% in 2010 to 15.4% in 2013, the percentage of obese adolescents increased just over 1% from 15.8% to 16.9% (CDC, 2015b).

Obesity: Causes

Factors that have contributed to the rise in obesity over the past thirty years include behavioral, environmental, and economic influences (Gurnani, Birken & Hamilton, 2015; Nguyen & El-Serag, 2010). Environmental and behavioral changes related to healthy eating and physical activity are regarded as the major contributing factors to childhood obesity (Gurnani et al., 2015; Nguyen & El-Serag, 2010). It is recommended that adolescents engage in a minimum of 60 minutes (1 hour) of physical activity daily. At least three days per week, they should participate in an activity that includes moderate to vigorous intensity aerobic activity, muscle strengthening, and bone strengthening (CDC, 2015a). The benefits of regular physical activity for adolescents include healthy bones and muscles, reduced risk of obesity and chronic disease, healthy psychological well-being, and academic achievement (CDC, 2015a).

The current trend in physical activity shows an increase in sedentary behavior among adolescents. Specifically, increased screen-time behaviors, such as the use of computers, video games, and television watching. Approximately 34.1% or one-third of high school students in Tennessee indicated they watched television for three or more hours per day on a school day (CDC, 2015a). Studies have found engaging in these behaviors for more than 2 hours daily is linked to elevated levels of blood pressure, cholesterol, and increased risk of being overweight or obese (Herrick, Fakhouri, Carlson, & Fulton, 2014). For Tennessee, data taken from the 2013 YRBSS survey showed 19.6% of high school students had not engaged in at least 60 minutes of physical activity in the previous seven days. Approximately 77.7% of adolescents did not attend a daily physical education class (CDC, 2015a). National data by grade level showed the highest percentage of high school students attending a physical education class daily were 9th graders (42.2%). The percentage of student declines by grade level with 9th graders being significantly

different from 11th (22.3%) and 12th (20.2%) graders. Similarly, the percentage of high school students engaged in at least 60 minutes of physical activity five or more days per week is highest among 9th graders (50.6%) and decreased by grade level, significantly different from students in 11th (44.7%) and 12th (43.9%) grades. In line with the decrease in physical activity, high school student who reported they did not engage in at least 60 minutes of physical activity on at least one day in the previous seven was lowest among 9th graders (12.3%), and increased by grade level, with students in the 12 grade (17.8%) reporting the highest percentage (Kann et al., 2014).

The are several barriers to physical activity for adolescents in rural communities. One major issue is access to areas to be active. Already faced with limited resources for some basic needs, rural communities often have limited options for places they can engage in physical activity. This is further complicated by issues such as the cost of participation, distance, and transportation (Lifsey & Mantinan, 2014). Many communities lack access to public transportation or safe routes that allow individuals to walk or ride a bike. Thus, it is not unreasonable to assume that the best and possibly only opportunity for regular physical activity for adolescents in rural communities is at school. However, data indicate that less than 25% of high school students in Tennessee attended regular physical education classes, highlighting a key barrier to increasing physical activity (Lifsey & Mantinan, 2014).

Attempts to address issues with physical activity in the school setting resulted in the implementation of policies aimed at increasing opportunities to be active during the school day. One policy is mandated physical education class. In Tennessee, all high school students are required to complete .5 credit hour or one physical education class while in high school (Tennessee Department of Education, 2015). This class is typically taken in the 9th grade year during the first or second semester of high school. An additional opportunity for physical

activity is mandated by the Tennessee 90-minute Law. Required by T.C.A 49-6-1021, the goal

is for local school districts to integrate a minimum of 90 minutes of physical activity per week

into the school day for all students in grades K-12 (Tennessee Department of Education, 2015).

Schools are allowed to implement a variety of options to meet this requirement, including

organized activities such as fitness classes or kickball games to designated time for activities

such as walking. The Tennessee 90-muniute law has had limited success at the high school level.

The annual report on compliance from the 2013-2014 school year showed approximately 85% of

all schools in the state of Tennessee reported being in compliance with the law. Rates were

highest among elementary (98%) and middle schools (97%), with 93% of participating high

schools meeting the minimum requirement. By the 2014-2015 school year, the overall rate of

compliance by school systems decreased to 64%. While the elementary schools (98%) level of

compliance remained unchanged, rates among middle schools (90%) and high schools (69%)

decreased (Tennessee Department of Education, 2015). Despite initiatives to increase physical

activity, the data shows current physical education requirements along with broad policy

mandates have not resulted in desired changed in activity rates as the trend of decreased physical

activity continues.

Another major contributing factor to the obesity epidemic is changing eating habits.

Every five years, the United States Department of Agriculture (USDA) in partnership with the

U.S. Department of Health and Human Services develop dietary guidelines for all Americans age

2 and older. Known as the Dietary Guidelines for Americans, the guidelines are developed

based on the best available nutrition evidence, recommendations of nutrition scientists, and

members of the Dietary Guidelines Advisory Committee (United States Department of

Agriculture (USDA), 2010). The 2010 edition recommends individuals age 2 and older should

maintain a balanced diet that incorporates a variety of foods, including daily consumption of fresh fruits and vegetables, whole grains, and lean proteins (Table 1) (USDA, 2010). However, data from the 2013 YRBSS survey showed adolescent dietary habits did not meet the recommendations for healthy eating. For students surveyed in Tennessee, approximately 45.4% reported eating fresh fruit or drinking 100% fruit juices less than once a day. Approximately 45.9% reported they consumed vegetables less than once a day (Kann et al., 2014).

Table 1.

Dietary Recommendations

Food	Servings
Bread, Cereal, Rice, & Pasta	6-11 Servings
Vegetables	3-5 Servings
Fruit	2-4 Servings
Milk, Yogurt & Cheese	2-3 Servings
Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts	2-3 Servings
Fats, Oils, & Sweets	Sparingly

Source USDA, 2010

Adolescents spend a large part of their day at school. As a result, the school environment plays a major role in determining what food they consume throughout the school day (CDC, 2015b). Policy at both the federal and local level provide guidelines that promote healthful behaviors. Providing one, sometimes two, meals per day to students, the contents of the meals are subject to federal regulations that mandate schools meet minimum guidelines for nutrition standards. Providing adolescents with access to nutritious food items during their school day, the policy mandates schools meet calorie limits for both breakfast (450-600) and lunch (750-850) based on grade level. Schools are also required to provide specific food items that include fruits and vegetables with lunch, whole grains, unflavored milk, 100% fruit and vegetable juice, and free water during meals. Comparable guidelines are also provided for food items available to

students as snacks outside of the normal food service (School Nutrition Association (SNA), 2016).

A national survey of the school environment revealed schools still contain factors that do not promote healthy behaviors. Result from the School Health Policies and Practices Study in 2012 found 52.8% of schools sold less nutritious foods and beverages outside of the food service program. Approximately 41% allowed students to purchase soda and other sugar-sweetened beverages from vending machines, school stores, canteens, or snack bars (CDC, 2014). Data from the 2013 YRBSS survey showed 81.8% of participants consumed soda during the seven days before completing the survey (CDC, 2015a). In addition to the availability of less nutritious items, many middle and high schools allow advertising of less nutritious items in the school setting (CDC, 2015c). Targeting children in and out of the school environment, beverage companies in the United States spend billions of dollars each year on marketing aimed at youth ages 2-17. A 2010 study found the average number of television as for sugar sweetened beverages viewed each year was 213 for preschoolers, 277 for children, and 406 for adolescents (HSPH, 2016). The recommended intake of added sugars is less than 10% of total daily calories (USDA, 2010). It is estimated that sugar sweetened beverages account for 11-15% of total daily calories in typical American diet. For adolescents ages 12-19, they account for 13-28% of their daily calories (CDC, 2010). The usual soda today is 20-ounces in volume, yielding approximately 240 calories and 15 to 18 teaspoons of sugar (HSPH, 2016). Research indicates people who consume 12-ounces of a sugary drinks daily are at risk of gaining weight over time. They are also at increased risk of developing type 2 diabetes and heart disease (HSPH, 2016).

Another aspect of nutrition that has a role in the current crisis is food insecurity. Food insecurity is characterized by households with limited access to adequate food due to a lack of

money or other resources (Franklin et al., 2012). Studies reveal that food insecurity often coexists with obesity. Factors that influence the food insecure–obesity relationship among adults include maternal stressors, marital status, and participation in food assistance programs (Franklin et al., 2012; Frongillo & Bernal, 2014). Studies indicate that rates of obesity are highest among families with an income-to-poverty ratio of 100% or less (CDC, 2015c). Research also shows that children in families that had long-term participation in food assistance programs, such as Supplemental Nutrition Assistance Program (SNAP) and emergency food assistance, were more likely to be overweight or obese (Frongillo & Bernal, 2014). Analysis of the eating habits of low-income families revealed that when these families are making decisions about food, they rarely reduced the quantity of food, opting to decrease the quality instead (Center for School, Health, and Education, 2011). For families in rural locations, this reality is further complicated as their food choices are influenced not only by cost but access. Barriers include long distances to grocery stores and limited sources of food such as convenience stores and fast food outlets (CDC, 2015a). What this constellation of factors translates to is families who are food insecure are more likely to swap healthier food options for less expensive energy dense, low nutrient items, such as processed foods, fast food, and sugar-sweetened beverages (Franklin et al., 2012). Thus, to meet their nutritional needs, low-income families are adopting eating habits that increase their risk of obesity and chronic medical conditions such as diabetes and heart disease (Center for School, Health, and Education, 2011; Franklin et al., 2012).

There is also evidence to support social networks as a contributing factor to obesity. (Christakis & Fowler, 2007; Nguyen & El-Serag, 2010; Simpkins, Schaefer, Price, & Vest, 2013). Family and friends play an important role in the choices adolescents make regarding health behaviors. In the home environment, factors such as technology access have contributed

to an increase in sedentary behaviors and are related to an increase in activities such as watching

television, use of electronic devices like phone, video games or computers.   An analysis of

participants in the Framingham Heart Study from 1971-2003 examined the health status of

individuals within a social network. The findings indicated if an individual had a friend that was

obese, his or her chances of becoming obese increased by 57%, by 40% if they had a sibling that

was obese, and 37% if their spouse was obese (Christakis & Fowler, 2007). Another study found

adolescents were more likely to have friends with similar BMIs and similar levels of physical

activity (Simpkins et al., 2013).

There are important findings regarding the role of family to counter the negative effects

of changes in physical activity and dietary behaviors. Research shows a high functioning family

environment has been found to be protective for factors related to adolescent weight, eating, and

physical activity patterns (Berge, Wall, Larson, Loth, & Neumark-Sztainer, 2013). The

researchers defined family function as the structural/organizational properties as well as the

interpersonal interaction of the family. This included problem-solving, communication, roles,

warmth/closeness, and behavioral control. For adolescent girls, higher family functioning was

associated with lower BMI, less sedentary behavior, higher consumption of fruits and vegetables,

and more family meals. For adolescent boys, higher family function was associated with more

physical activity, less sedentary behavior, and more family meals (Berge et al., 2013).

Therefore, the health status and health behaviors of close referent groups such as friends and

family members influence an individual's weight status over time (Gurnani et al., 2010).

Economic growth has also contributed to the rise in obesity rates (Swinburn et al., 2011;

WHO, 2015). Changes to obesity rates were first observed in more affluent urban areas of

countries among upper income men, spreading to lower income rural areas as the trend persisted

(Swinburn et al., 2011). In middle to high-income countries, such as Brazil and the United States, the highest rates of obesity are observed among women who have low-income, low education attainment, food insecurity, and who live in rural areas (Hruschka, 2012; Swinburn et al., 2011). Evaluating obesity trends throughout the world, a study that assessed gross domestic product (GDP) and mean BMI revealed that as economic prosperity of a country increased, so did rates of obesity (Swinburn et al., 2011).

The results of another study highlight the impact of economic growth on childhood obesity rates. Using BMI guidelines from the National Health and Nutrition Examination Survey I (NHANES I) survey, researchers assessed a nationally representative sample of children and adolescents ages 6 to 18-year-olds in the countries of Brazil, China, Russia, and the United States between the years of 1970-1998 (Wang, Monteiro, & Popkin, 2002). Researchers found obesity increased in countries that experienced economic growth. Brazil obesity rates tripled, increasing from 4.1% in 1974 to 13.9% in 1997. The United States rates went from 15.4% in 1974 to 25.6% in 1994. China's rates increased from 6.4% in 1991 to 7.7%. in 1997 (Wang et al., 2002).   Only one county, Russia, experienced a decline in childhood obesity rates of just over 6%, decreasing from 15.6% in 1992 to 9% in 1998 (Wang et al., 2002). In the aftermath of the collapse of the former Soviet Union, Russia underwent major economic changes transitioning from a planned economy to capitalist economy starting in 1992. The change resulted in the elimination or reduction of social service programs including food and fuel subsidies. During this time, Russia experienced high rates of poverty. Over 60% of households with three or more children, 45% of households with one child younger than age 7, and 47.6% of single parent households were below the poverty level (Mroz & Popkin, 1995).   The impact of economic growth is also reflected in changes in several social indicators. They include a population shift from rural to

urban, an increase in non-communicable diseases, lower rates of physical activity, and a nutritional shift from traditional foods to processed energy-dense, low-nutrient foods (Swinburn et al., 2011; WHO, 2015).

Obesity: Consequences

Despite the concerns and objections to assessment of children identified as overweight or obese, the research indicates that the health risks for these children are high, and they are more likely to become overweight or obese as adults (CDC, 2015a; WHO, 2016a; Gurnani et al., 2015; Nguyen & El-Serag, 2010). Obesity is associated with increased risk of developing a number of chronic diseases including diabetes, cardiovascular disease (CVD), asthma, digestive disorders, and cancer. Adolescents who are obese also have an increased risk of developing at least one risk factor for CVD before adulthood, such as high blood pressure or high cholesterol (CDC, 2015a). A study that examined CVD risk among overweight and obese adolescents found 70% already had one risk factor for CVD and 39% had two (CDC, 2015a; Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007;). Data from the NHANES from 1999-2006 found an overall prevalence of dyslipidemia in children and adolescents of 20.3%, increasing to 42.9% in those classified as obese (Gurnani et al., 2015). Other health conditions associated with childhood obesity include breathing problems, joint problems, psychological stressors such as depression, behavior problems, impaired physical and emotional functioning, and early death (CDC, 2015a). A study that examined the association between obesity and risk of death in adults who never smoked found an increase of 20% to 40% for adults who were overweight or obese when compared to healthy weight adults (Nguyen & El-Serag, 2010). Thus, the consequences of changes in health behaviors of adolescents can lead to early development of risk factors for

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chronic diseases resulting in poor health, even early death. However, interventions that help to promote healthier choices could help to prevent negative health outcomes.

An ongoing challenge with obesity is defining what it means to be obese within the population as a whole as well as specific subgroups. This is especially difficult for children and adolescents. Early interventions for childhood obesity focused on assessment and treatment. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services produced a report in 1993 recommending BMI be used to assess and categorize obesity in children and adolescents (Dietz, 2015). The current guidelines define overweight as a BMI that fall between the 85th percentiles to less than 95th percentile and obese as equal to or greater than the 95th percentile for a child's age and sex (CDC, 2012b). Meant to be more of a screening tool and not a method for clinical diagnosis, children that fall into one of these categories are often subjected to extensive health assessments to determine body fatness and risk of chronic disease. The assessment includes activities such as documentation of family medical history, blood pressure, and total cholesterol (Flegal, Tabak, & Ogden, 2006). More often than not, the outcome does not yield any clinical indicators of obesity or the health issues commonly associated with obesity (Flegal et al., 2006). However, the cause for such concern is the long-term risk of health issues (CDC, 2015b; Flegal et al., 2006; HSPH, 2015). The association between children identified as having higher BMI and increased risk of developing health issues such as high blood pressure, cholesterol, and diabetes in adulthood has been well documented (CDC, 2015b; Flegal et al., 2006; HSPH, 2015). The call to action using BMI guidelines as an indicator has resulted in questions as to what the best intervention is given the absence of clinical indicators for health issues associated with obesity among children. While there is support for the relationship between obesity and a variety of causal factors, most lead back to a breakdown in

health promoting behaviors such as physical activity or healthy eating rather than a clinical

diagnosis. For this reason, it is essential that interventions target these behaviors and the key

factors that influence an individual's decision making process related to these behaviors.

<div align="center">Behavior Theory</div>

Behavioral theories provide a systematic way of understanding an event or situation

through a set of concepts and definitions to explain or predict a behavior or situation. They

provide tools that allow researchers and program planners to develop programs and interventions

based on an understanding of behavior (Glanz & Rimer, 2005; Glanz et al., 2008). One of those

theories, the Theory of Planned Behavior (TPB), has been shown to have good predictability for

health behaviors and could assist in identifying key components necessary for effective

interventions (Ajzen, 2011; Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton,

2011). The health behaviors of physical activity and healthy eating are key contributing factors

to both the cause and solution to the childhood obesity epidemic. The ability to predict behavior

intention is important to developing targeted solutions for obesity. An attempt to achieve this

includes the use of TPB.

Theory of Planned Behavior

The TPB is a behavioral change model. It seeks to predict future behavior and explain

the factors that motivate an individual to engage in a specific behavior at a specific time, and in a

specific place. The foundation for TPB grew out of another behavioral change model, TRA

(Conner et al., 2002; Glanz & Rimer, 2005; Montaño & Kasprzyk, 2008). First proposed by

researchers Martin Fishbein and Icek Ajzen (Ajzen & Fishbein, 1980; Armitage & Conner,

2001), the TRA was developed to examine the relationship between attitude and behavior (Ajzen

& Fishbein, 1980). Both the TRA and TPB assert the best predictor of performing a behavior is

behavioral intention, the perceived likelihood of performing a specific behavior, indicated by how much effort an individual is willing to commit to performing that behavior. For the TRA, behavioral intention is determined by two constructs; attitude and subjective norms. The TPB expands on the TRA, adding an additional construct of perceived behavioral control (PBC) (Glanz & Rimer, 2005; Montaño & Kasprzyk, 2008). Together, attitude, subjective norms, and PBC explain behavior intention for the TPB.

     Attitude: Behavior Beliefs. Attitude is defined as an individual's personal evaluation of a behavior. (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008). The underlying influence of attitude is behavior beliefs. Behavior beliefs are defined as an individual's belief about outcomes or attributes associated with performing a behavior (Montaño & Kasprzyk, 2008). If a person holds positive beliefs about the behavior, they are likely to have a positive attitude about performing the behavior, thus increasing the likelihood of engaging in the behavior. The converse is also true. If a person holds negative beliefs about performing a behavior, they are likely to have a negative attitude about performing the behavior (Glanz & Rimer, 2005).

     Martin Fishbein's research helped to define the role of attitude in behavior intentions. Derived from research to better understand the relationship between attitude, intentions, and behaviors, the TRA countered an opinion of the time that attitude did not play a major role in behavior (Fishbein & Ajzen, 1975; Glanz & Rimer, 2005). Fishbein made the distinction between attitudes toward an object versus attitude toward a behavior with respect to that object. This distinction improved the predictability of attitude, shifting the focus to a behavior associated with an outcome instead of a broad opinion of a topic. For example, instead of assessing an individual's attitude about obesity, their attitude about eating fresh fruit or walking for exercise

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is assessed. This approach proved to be a better predictor of behavioral intentions; knowing how an individual felt about an associated behavior rather than broad topics (i.e. obesity) (Glanz & Rimer, 2005).

Subjective Norms: Normative Beliefs. Subjective norms are the perceived social pressure to engage or not engage in a behavior (Courneya et al., 2000; Montaño & Kasprzyk, 2008). Subjective norms are determined by an individual's normative beliefs. Normative beliefs are the perceived expectations of important referent individuals or groups to performing a behavior combined with the individual's motivation to comply with those expectations (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008). There are two forms of subjective norms examined in studies examined the TPB. Subjective norms of referent groups, or descriptive norms, assess the perceptions one has of how important referent groups actually behave. Subjective norms from referent groups, or injunctive norms, assess the perceptions of what behaviors are expected of an individual by referent groups (Courneya et al., 2000; Hamilton & White, 2008).

The inclusion of subjective norms to the TPB allowed for the assessment of social influences. However, subjective norms are limited in the type of social influence it can explain. Its scope is restricted to explaining only the perception an individual has about the expectation of the referent group. But, if the individual has low motivation to comply with this expectation, subjective norms are a poor indicator of behavior intention. Thus, if the goal is to measure intention to engage in physical activity, subjective norms would be a poor predictor for individuals that believe others expect them to engage in physical activity but they have low motivation to comply with those expectations (Glanz & Rimer, 2005; Godin & Kok, 1996; Montaño & Kasprzyk, 2008).

Perceived Behavioral Control: Control Beliefs. Perceived behavioral control (PBC) is defined as the extent to which a person believes he or she controls a behavior (Glanz, & Rimer, 2005; Montaño & Kasprzyk, 2008). PBC is influenced by control beliefs. Control beliefs are the perception of the presence or absence of barriers or facilitators to behavior performance weighted by the perceived power over those factors (Armitage & Conner, 2001; Glanz, & Rimer, 2005; Montaño & Kasprzyk, 2008). The key difference between TRA and TPB is the assumption that a person has control over the behavior of interest. The TRA assumes a person has volitional control of the behavior and is aware of the control. Yet, research indicates that some behaviors, such as healthy eating and physical activity, are not completely under the control of the individual. (Ajzen & Fishbein, 1980; Glanz, & Rimer, 2005; Montaño & Kasprzyk, 2008). Studies have shown the intention to engage in an activity along with an individual's ability effects performance. When there is a behavior over which the individual has complete volitional control, PBC should not play a major role; instead attitude and subjective norms are better predictors. However, when the behavior is not completely under the individual's control, PBC is a moderator between intention and behavior (Armitage & Conner, 2001). A behavior that requires external support to perform changes the perception of ease or difficulty to execute that behavior, altering the perception of control. In this case, PBC is important because this is a low volition behavior or a behavior requiring outside support to perform. The assumption of control is no longer assumed and adding PBC to attitude and subjective norms will improve the predictability.

Efficacy of the Theory. Since its introduction, the TPB has been used to explain a number of health behaviors, including cancer screenings (Godin & Kok, 1996), sexually transmitted infections/sexually transmitted disease screening (Godin & Kok, 1996), physical activity

(Courneya et al., 2000; Hamilton & White, 2008) and healthy eating (Brouwer & Mosack, 2015; Conner et al., 2002). The effectiveness of the theory has been tested a number of times, with researchers assessing the predictability of the theory's constructs of attitude, subjective norms, and PBC along with other constructs such as self-identity (Hamilton & White, 2008), past behavior (Godin & Kok, 1996; Ajzen, Joyce, Skeikh, & Cote, 2011), self-efficacy (Fitzgerald, Heary, Kelly, Nixon, & Shevlin, 2013) and social support (Courneya et al., 2000; Rhodes et al., 2002). A meta-analysis of studies has shown an overall moderate reliability, citing an upper limit of .75 to .80, with most analyses producing average results that range between .40 and .60 (Ajzen et al., 2011). The TPB is a good predictor of behavior and intention, explaining 40% to 49% of the variance in intention and 26% - 36% of the variance in behavior (Ajzen, 1991; Armitage & Connor, 2001; Godin & Kok, 1996; Finlay, Trafimow, & Villarreal, 2002).

Armitage and Connor (2001) conducted a meta-analysis of studies that assessed prospective prediction of health behaviors. The analysis included 186 studies and focused on the constructs of attitude, subjective norms, perceived behavioral control, and behavior intentions. They found the TPB accounted for 27% to 39% of the variance in behavior (Armitage & Connor, 2001). PBC was found to have a good correlation with intention ($r = .43$), accounting for an additional 6% of the variance. The correlation between subjective norms and intention was the weakest ($r = .34$).

Another meta-analysis conducted by McEachan (et al., 2011) examined the TPB constructs of attitude, subjective norms, and PBC as it relates to behavior. This analysis assessed 237 tests from 206 articles and examined the health behaviors of physical activity, diet, safer sex, and abstinence (drugs and alcohol). The analysis found attitude had the strongest correlations of $r = .57$ with behavior intention. Attitude was also the strongest predictor of all health behaviors.

The next construct with the strongest correlation was PBC, r = .54. Subjective norm was the

weakest at r = .40 (McEachan et al., 2011). Together, attitude, subjective norms, and PBC

accounted for 44.3% of the variance in predicting behavior intention and 19.3% of behavior.

Looking at specific behaviors, the TPB produced the best predictability with physical activity

(23.9% variance) and dietary behaviors (21.2% variance). For adolescents, subjective norms was

a better predictor of behavior intentions for adolescents. For dietary behaviors, TPB exaplained

9.6% of variance compared to adults (26.7%). For physical activity, TPB explained 22.2% of

behavior and 49.6% of intention. When assessing physical activity for the overall sample, TPB

predicted 12.1% of variance for objective physical activity and 25.7% of variance in self-

reported physical activity. This was in constrast to overall variance in predicting objective

measures (26.4%) and self-reported measures (14.1%)

Specifically looking at the use of TPB with adolescents, a study examined its ability to

predict physical activity in 590 overweight/obese school age children (Plotnikoff et al., 2011).

Participants completed a web-based survey about their physical activity level over the previous

seven days. Researchers also assessed if weight status made a difference in the predictability.

Plotnikoff (et al., 2011) and colleagues found the TPB constructs of attitude, subjective norms,

and PBC explained 62% of the overall variance in behavior intention. PBC and intention

explained 44% of the variance in physical activity behavior. Looking at the mediator of weight

status, TPB explained 66% of the variance in physical activity intention for overweight

participants and 56% for obese participants. For physical activity behavior, TPB explained 38%

for overweight students and 56% for obese students.

Another study used the TPB to examine exercise intention and behavior of 1,129 8th and

9th-grade students in Louisiana and Pennsylvania. The moderators tested in this study included

geographical region, gender, race and income (Ellis, Kosma, & Downs, 2013).   This study found

that location was a moderator, and each site was assessed separately. Race and income were not

significant moderators for either state. In Louisiana, the only significant moderator for the TPB

was gender. Subjective norms and PBC were the strongest predictors of behavior intention.

Subjective norms had a greater effect on behavior intention for boys, (.36) compared to

girls(.13). For girls, PBC had the strongest effect on behavior intention (.58) compared to a

nonsignificant relationship for boys(. 13). The TPB constructs explained 53% of intention and

28% of exercise behavior for girls and 49% of intention and 20% for exercise behavior for boys.

In Pennsylvania, gender was not a moderator. The most important predictor of intention for boys

and girls was PBC and attitude. The TPB constructs explained 54% of the variance in intention

and 41% in exercise behavior for girls and 53% of the variance in intention and 20% in exercise

behavior for boys.

A study with 6th, 7th, and 8th grade students assessed the TPB with an intervention

focused on preventing diabetes (Muzaffar, Chapman-Novakofski., Castelli, & Scherer, 2014).

For healthy eating, the strongest predictor for the control group was PBC. Pre-intervention PBC

accounted for 25% of the variance, increasing to 43% post intervention. For the intervention

group, the strongest pre-intervention predictor for healthy eating was attitude and subjective

norms, accounting for 34% of the variance.   Post intervention, the strongest predictors were

PBC and subjective norms, accounting for 59% of the variance.   Similar results were also

observed for physical activity. Pre-intervention, PBC accounted for 41% of the variance for the

control group. Both PBC and knowledge accounted for 35% of the variance for the intervention

group. Post intervention, knowledge, and PBC accounted for 64% of the post-intervention

variance. For the intervention group, PBC, attitude, and subjective norms accounted for 70% of

the variance.   With an individual range of 27% to 65% in variance, PBC was the strongest

predictor of behavior. Together, these studies provide evidence to support the use of the TPB to

predict adolescent health behaviors. They also show the theory's ability to identify population-

specific characteristics important to the effectiveness of an intervention.

 Social Support

Social support is component of a larger concept know as social networks. Social

networks are defined as the web of social relationships that surround individuals (Glanz et al.,

2008). With the individual as the focal point, some characteristics of social networks include:

1) Reciprocity – the extent to which resources and support are given and received in a

   relationship

2) Intensity and strength – emotional closeness within the relationship

3) Formality – the extent to which a relationship is embedded in a formal organizational

   or institutional structure

4) Complexity – the variety of functions a relations serves

5) Density – extent to which network members know and interact with each other

Some of the social functions within social networks include: social capital, social influence,

social undermining, companionship, and social support. Social support is defined as the

perception of comfort, assistance, or information an individual receives through formal and

informal social interactions that may influence intention to engage in a behavior (Courneya et al.,

2000; Hamilton & White, 2008). The construct of social support has been studied extensively to

better understand the impact of social interactions on behaviors and outcomes behavior

(Courneya et al., 2000; Hamilton & White, 2008). Serving as a mediator between an individual

and the environment, social support has a unique characterization in that its intended to be

helpful and not negative, excluding other forms of interactions or feedback from social relationships that include criticism, hassling, or undermining. Social support is commonly divided into four types of supportive behaviors or sub-constructs (Clark et al., 1999; Glanz et al., 2008). They include:

1) Emotional – support as an expression of love, empathy, trust, and group belonging

2) Instrumental – tangible aid or service in the form of action, materials, or goods and services provided by an individual

3) Informational – advice, suggestions, feedback, and information provided to improve an individual's life circumstance

4) Appraisal – information provided to an individual that is useful for self-evaluation or assist them in interpreting their situation

Also a measure of social influence, social support differs from subject norms in that it measures perceptions of tangible forms of support to facilitate a behavior opposed to perceptions of observed behavior of others. Going beyond the expectations, it assesses if an individual perceives factors such as access to a gym or literature on healthy food options as support for a desired behavior (Courneya et al., 2000; Hamilton & White, 2008; Okun et al., 2003).

There is support for both constructs in the TPB. A study assessing leisure-time exercise found that social support and subjective norms were both good predictors of behavior intentions and contribute independently to behavior intentions (Okun et al., 2003). The increased focus on the role of social support in behavioral intentions continues, fueled by claims that the TPB does not adequately account for social influences on behavioral intentions. The argument is that the TPB explains volitional behavior or those behaviors a person has control over well but does not accurately explain behaviors heavily dependent on outside support or low-volition behavior

(Courneya et al., 2000; Hamilton & White, 2008,).   This assumption is especially important when assessing low-volitional behaviors such as healthy eating or physical activity. These types of behaviors require assistance from external sources to complete. The greater the influence of external factors, the greater the likelihood that social support could better predict the behavior.

Analysis of studies assessing subjective norms have shown it consistently demonstrated lower correlation with behavior intentions when compared to attitude and PBC (Ajzen, 2011; Armitage & Conner, 2001; McEachan et al., 2011). Its focus on perceived social pressure ineffectively captures the total impact of social influences on behavior (Ajzen, 1991; Hamilton & White, 2008). A study found that attitude, subjective norms, and PBC together explained 45% of the variance in exercise intention, with intention and PBC together explaining 27% of the variance in exercise behavior. As well, attitude and PBC averaged higher correlations than subjective norms (Hagger, Chatzisarantis, &Biddle, 2002a; Hamilton & White, 2008). Another study comparing subjective norms and social support found social support and PBC (.48) explained more variance in behavior intention than did subjective norms and PBC (.31). This same study also found models that included social support were a significantly better fit than models without social support (Rhodes et al., 1995). Finally, another study found that subjective norms were a strong predictor of physical activity, accounting for 34% of the model's variance. However, once social support was added to the model, the variance decreased by as much as 10% and it was no longer a significant predictor (Okun et al., 2003). Thus, the lower influence of subjective norms on behavior intentions, when compared to attitude and PBC, supports the position that behavioral intentions are influenced more by one's attitudes and perceptions of control than perceptions of pressure from others (Hamilton & White, 2008). However, social

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influence is an important factor in behavior intentions. Social support may be a viable addition or alternative to the TPB to better explain social influence on behavior.

<div align="center">Summary</div>

Obesity is a chronic energy imbalance in which both physical activity and dietary intake do not meet the body's need to maintain a healthy weight. Closely associated with lifestyle factors, healthy eating, and physical activity are both health behaviors identified as having key roles in both the cause and solution to the obesity epidemic. Changes in these behaviors over the last three decades have been widely studied and found to be major contributing factors to the increase in obesity (CDC, 2012a; CDC, 2015c; WHO, 2015).   Changing behavior can be difficult. This is where the bridge between theory and action is most impactful. Moving away from the medicalized view of obesity is necessary in order to focus on the social factors that closely influence obesity and the health behaviors that are both contributing factors and solutions.

Traditionally, the prescription for overweight and obesity is changing health behaviors. Becoming more active and eating healthier are the two most important health behaviors known to impact excess weight (CDC, 2015b; HSPH, 2015). However, these health behaviors cannot be executed within an environment that does not promote and support their existence. The TPB provides a mechanism to assess the internal motivation for these health behaviors. However, it is necessary to include in that process a way to assess how external factors impact the decision-making process. A solution to this is the addition of the construct of social support. Accounting for social influence, social support will allow for the assessment of external factors, and strengthen the predictability of TPB. Ultimately, the goal of helping to produce theory-driven interventions with improved outcomes would be achieved.

CHAPTER 3

METHODS

Introduction: Section Overview

Data for this research are derived from a larger study, Team Up for Healthy Living, conducted September 2011 through November 2014 (Study ID: R01MD006200 from the National Institute on Minority Health and Health Disparities). Team Up for Healthy Living used a peer educator model, with college students as facilitators, to deliver an eight-week course on health behaviors to high school students living in five Northeast Tennessee counties in rural Appalachia. Design and methods for the Team Up for Healthy Living project are reported elsewhere (Slawson et al., 2015).

The primary goal of this research was to test targeted TPB constructs (attitude, subjective norms, and perceived behavioral control) and social support ability to predict intent to perform health behaviors of healthy eating and physical activity among adolescents living in five Northeast Tennessee counties in rural Appalachia. This chapter will provide details on the separate instruments used to measure these variables and the statistical analysis used to answer the research questions. The chapter is divided into four sections; participants, data collection, measures, and statistical analysis. Ethical approval for this study was obtained from the Institutional Review Board at East Tennessee State University and from participating school districts.

Participants

Eligible participants included high school students enrolled in Lifetime Wellness classes at the time of intervention. A total of 1,509 students enrolled in 66 Lifetime Wellness classes at ten high schools in five Northeast Tennessee counties participated in the study. The study

population was 51.1% male and 94.3% white non-Hispanic. Typically, the Lifetime Wellness class is a first-year course for high school students in Tennessee. Accordingly, 89.2% of the participants were in the 9th grade and 6.2% were in the 10th grade at baseline. Recruitment occurred in two waves, one in January 2012 and a second in September 2012. Exclusion criteria for the study included: 1) current enrollment in weight management program, 2) presence of a diagnosed eating disorder, 3) presence of any diagnosis affecting weight status, 4) current dietary and physical activity restrictions due to a diagnosis such as hypertension or diabetes, and 5) pregnancy (Slawson et al., 2015). Parental consent and student assent were obtained prior to initiation of the study.

Data Collection

Team Up for Healthy Living was a cluster randomized study. It included high schools from five counties in Northeast Tennessee. A total of 13 high schools were invited to participate in the study based on their rurality and socioeconomic status. Representatives from those schools were invited to a program planning workshop where interested schools were identified. A total of ten high schools agreed to participate in the study. The high schools were stratified by school size and randomly assigned to treatment and control groups. Randomization of schools into treatment and control groups occurred after baseline data were collected.

The study included two waves of intervention, each with an assessment of participants at baseline, three months, and twelve months post intervention. At each interval, the participants' height and weight were measured based on standard protocols, and they completed a three-part paper survey that collected data on a variety of topics including eating habits, physical activity, sedentary behaviors, academics, weight status, and demographics. Data collection was completed at each school. Baseline and three-month surveys were completed during Lifetime

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Wellness classes. Twelve-month surveys were completed at each school on a date and time designated by the school representative. Participants were paid five dollars after they completed the twelve-month survey. For this research, only baseline data from wave 2 were used, as Youth Risk Behavior Surveillance System (YRBSS) measures added to the data collection processes for this wave were the focus of this investigation.

<div align="center">Measures</div>

Predictor Variables (Independent)

The predictor variables include the TPB constructs of attitude, subjective norms, and perceived behavioral control. An additional predictor variable, social support, was also included to assess its ability to predict adolescent health behavior. The TPB constructs and social support are continuous variables and were assessed for both healthy eating and physical activity. The following measures were used to assess these constructs.

Attitude Toward Healthy Eating and Physical Activity. To measure attitude toward healthy eating and physical activity, participants responded to the questions 'For me to be a healthy eater would be…" and "For me, being physically active would be…" using six semantic differential anchors. The options were useful-useless, harmful-beneficial, undesirable - desirable, bad-good, unenjoyable-enjoyable, and boring-interesting. The responses were coded as 1 through 6 with 1 assigned to negative responses and 6 to positive responses. In previous studies, the Cronbach's σ for this scale ranged from .83 to .88 for adolescents 13 to 17 years olds (Baker, Little, & Brownell, 2003; Wu et al., 2009). Analysis of data from wave 2 of the Team-up for Healthy Living study found Cronbach's σ for this construct to be .89 for healthy eating and .93 for physical activity (Unpublished Raw Data, 2015).

Perceived Behavioral Control Toward Healthy Eating and Physical Activity. Perceived

behavioral control (PBC) was measured using an index derived from questions answered about

healthy eating and physical activity. Prompted by the statements, "Suppose you set a goal to

now eat healthy/be physically active", participants were asked to answer the following questions:

1) Can you try hard enough at it? 2) Do you have enough self-discipline for it? 3) Do you have

enough time to work at it? 4) Are you fortunate enough to prefer healthy food/physical active?

Responses were scored on a 5-point Likert-type scale that included response options of

'Definitely Yes', 'Mostly Yes', 'Not Sure', 'Mostly No', and 'Definitely No'. The responses

were coded as 1 through 5 with 'Definitely yes' = 1 and 'Definitely no' = 5. For the Team-up for

Healthy Living study, wave 2, the Cronbach's σ for PBC was .73 for healthy eating and .84 for

physical activity (Unpublished Raw Data, 2015).

Subjective Norms: Perceived Group Norms of/From Referent Groups. Subjective norms

were assessed using an index of eating habits and physical activity of significant others. The

index assessed participant's perceived expectation of others for them to perform a health

behavior as well as their perception of their close friends, family, classmates, and teacher's

engagement in those same behaviors. To assess their perceived expectation from these groups for

them to perform the behavior, participants were asked to respond to the following questions: 1)

My close friends expect me to eat healthy, 2) My classmates expect me to eat healthy, 3) My

teacher expects me to eat healthy, and 4) My parents expect me to eat healthily. For the Team-

up for Healthy Living study, wave 2, the Cronbach's σ for subjective norms 'from' referent

groups were .78 for healthy eating and .81 for physical activity (Unpublished Raw Data, 2015).

To assess the perceived expectation of their close friends, family, classmates and

teacher's engagement in these same behaviors, participants were asked to respond to the

following questions: 1) My close friends eat healthly, 2) My classmates eat healthy, 3) My teacher eat healthy, and 4) My parents eat healthy. The same questions were asked about physical activity. The responses were recorded using a 5-point Likert-type scale ranging from strongly disagree to strongly agree. In previous studies, the Cronbach's σ for this scale ranged from .59 to .62 (Molt et al., 2004; Wu et al., 2007, 2009). For the Team-up for Healthy Living study, wave 2, the Cronbach's σ for subjective norms 'of' referent groups were .67 for healthy eating and .53 for physical activity (Unpublished Raw Data, 2015). Responses for both were scored on a 5-point Likert-type scale that included response options of 'Definitely Yes', 'Mostly Yes', 'Not Sure', 'Mostly No', and 'Definitely No'. The responses were coded as 1 through 5 with 'Definitely yes =15 and 'Definitely no' = 5.

Social Support for Healthy Eating and Physical Activity. Social support for healthy eating and physical activity were measured using a 10- item scale. Sample questions included "I am part of a group of people who have the same attitude about what we should eat" and "There is someone I can talk to about physical activity". The responses were recorded using a 5-point Likert-type. The responses options included 'Never', 'Once', 'Sometimes', 'Almost every day' and 'Every day'. Responses were coded as 1 through 5 with 'Every day' = 5 and 'Never' = 1. The Cronbach's σ for this scale ranged from .60 to .70 (Wu et al., 2009; Wu et al 2007; Molt, Dishman, Saunders, Dowda, & Pate, 2004). Analysis of data from wave 2 of the Team-up for Healthy Living study found Cronbach's σ for this construct to be .74 for healthy eating and .89 for physical activity (Unpublished Raw Data, 2015).

Outcome Variables (Dependent)

Youth Behavioral Risk Surveillance System (YRBSS). The outcome variables for this study were questions taken from YRBSS. YRBSS is an epidemiologic surveillance system

developed by the CDC to monitor health related behaviors among adolescents that lead to health conditions that cause morbidity and mortality in youths and young adults (CDC, 2012c). Developed in 1990, the survey collects data on behaviors related to alcohol and drug use, tobacco use, sexual behaviors that contribute to unintended pregnancy or sexually transmitted infection, unhealthy dietary behaviors, inadequate physical activity, and behavior that contribute to unintended injury and violence. YRBSS conducts surveys every two years with public and private school in the spring semester at the national, state, and local level as well as with territorial and tribal organizations. The system allows for ongoing assessment of these health behaviors with a nationally representative sample to monitor changes over time, program impact, and provides a mechanism to compare different populations (CDC, 20121c).

The questions used for this study come from the 2011 national survey (See YRBSS: Dietary Behavior Items, Appendix B) (CDC, 2012c). They include questions on dietary behavior, physical activity, and sedentary behavior. The YRBSS Dietary Behavior questions measure consumption of items such as fruits, vegetables, milk, and soda. Participants were asked to answer nine questions about their dietary behaviors during the seven days prior to completing the survey. Participants selected a response ranging from seven to eight multiple choice options that included response choices of 0 to 4 or more times per day for consumption of food or beverages, 0 to 4 or more glasses per day for consumption of milk and soda, and 0 to 7 days per week for eating breakfast. The responses were coded as 1 through 8. Responses assigned '1' indicated the participant did not engage in the activity. Responses coded as '7' or '8' indicating they engaged in the activity 4 or more times per day or all 7 days during the week.

The YRBSS Physical Activity and Sedentary Behaviors questions measure participation in physical activities behaviors, including physical education classes, sports, and time spend

doing sedentary activities such as watching television and using a computer (See YRBSS:

Physical Activity and Sedentary Behavior Items, Appendix B). Participants were asked to answer

seven questions about their physical activity behaviors during the seven days prior to completing

the survey. Participants selected a response ranging from four to seven multiple choice options

that included 0 to 5 days for physical education classes, 0 days to 7 days for physical activity, 0

hours to 5 or more hours per day for use of computer or video games, and 0 to three or more

sports teams. The responses were coded as 1 through 8. Responses assigned '1' indicated the

participant did not engage in the activity.

Other Variables

Two additional variables were used in this research. They include gender and BMI.

Studies have shown that as children reach adolescence, there are gender differences in the level

of physical activity and in eating practices. Boys are more likely to be physically active while

girls are more likely to have lower rates of physical activity and higher rates of sedentary activity

(Leech, McNaughton, & Timperio, 2014). In a study using a national sample of children ages 6-

17, the results indicated significant differences in physical activity behaviors between boys and

girls beginning as young as six (Chung, Skinner, Steiner, & Perrin, 2012). As they age, the gap

increases, with less than 5% of girls ages 12-14 meeting recommendations for daily physical

activity (Chung et al., 2012). This change in PA levels is associated with higher BMI when

compared to boys (Leech et al., 2014).

As described in the literature review, BMI is a person's weight to height ratio. It is

calculated by dividing a person's weight in kilograms by the square of height in meters (CDC,

2015a). For adolescents, BMI is age and gender specific. (CDC, 2015a). The research indicates

there are differences in behavior intention to engage in healthful behaviors based on weight

status (Fagan, Diamond, Myers, & Gill, 2008; Leech et al., 2014). Adolescents classified as obese have been shown to be more apt to adopt weight loss measures when compared to adolescents classified as overweight (Fagan et al., 2008). Conversely, higher BMIs are associated with lower rates of physical activity (Fagan et al., 2008). When compared to children classified as underweight and healthy weight, children that were classified as overweight or obese were less likely to engage in sustained moderate to vigorous physical activity. Thus, BMI was selected due to research indicating higher BMIs were associated with differences in intention to engage in healthful behaviors, lower rates of physical activity, and increased risk of obesity (Fagan et al., 2008; Leech et al., 2014).

Participants were asked to indicate their gender on the survey. The height and weight of each participant were recorded by research assistants at each data collection session. For this research, participants were grouped into one of the following categories for weight status based on their BMI scores:

- Not Obese – BMI less than 95th percentile
- Obese – BMI equal to or greater than 95th percentile

<div align="center">Statistical Analysis</div>

Data were analyzed using SPSS statistical software. The predictor variables included in the model were attitude, perceived behavioral control, subjective norms of referent groups, subjective norms from referent groups, and social support. Outcome variables included YRBSS dietary behaviors and YRBSS physical activity and sedentary behaviors. Also included were two control variables, gender and BMI.

The predictor variables of attitude, PBC, subjective norms, and social support were coded as continuous variables. The individual responses to questions were combined to produce one

composite score for each of the variables. The variables for gender and BMI were recoded into dichotomous variables. For gender, female was coded as '0' and male was coded as '1'. BMI was first recoded into the categories of 'not obese' and 'obese'. Participants in the 'obese' category included anyone with a BMI equal to or greater than 95th percentile. For analysis, BMI was recoded again as '0' for 'not obese' and '1' for 'obese'. The overall sample eligible for the study is n=963. However, the sample size for each behavior of interest varied depending on the individual responses to the questions. The samples size for each behavior is provided in the table in the results section.

Research Question One

The comparative analysis used responses to YRBSS questions only. For the YRBSS dietary variables for fruits and vegetable intake (questions 1-6), were recoded according to the CDC guidelines (Kann et al., 2013). Based on daily consumption of fruits and vegetables, any response of '1' or 'did not eat fruits or vegetables' was recoded as '0'. Responses indicating intake 1 to 3 days during a 7-day period were recoded as '.286'. Responses for intake 4-6 days during a 7-day period were recoded as '.71'. The remaining responses were coded as '1' for 1 serving a day, '2' for 2 servings a day, '3' for 3 servings a day, and '4' for 4 servings a day. The responses for six questions that asked about fruit and vegetable intake were summed for each participant to determine the number of daily fruit and vegetable servings. Fruit and vegetable servings were also assessed separately. Daily servings of fruit was determined by combing the responses from the two questions about fruit intake. The daily servings of vegetables were determined by combining the responses to the four questions about vegetable intake. The three remaining questions about healthy eating include daily consumption of soda, milk and breakfast were assessed individually. For physical activity behavior, the YRBSS physical activity and

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sedentary behavior responses were assessed individually. The number of days of physical

activity, number of hours spent playing video or computer games daily, and the number of hours

spent watching television daily were assessed. Results of the analysis are presented as a

percentage of students that engaged in the specified behavior based on gender and/or weight

status. Chi-square statistics are provided for comparison between male and female participants

for daily servings of fruits and vegetables. Confidence intervals at the 95% level are provided

for comparison of data to both the state of Tennessee and national findings from the 2013

YRBSS survey. A full list of the YRBSS questions can be found in Appendix B.

Research Question Two and Three

Multiple linear regression was used to assess the TPB constructs of attitude, subjective

norms, perceived behavioral control and an additional construct, social support, ability to predict

the health behaviors of healthy eating and physical activity among adolescents in Appalachia.

For regression analysis, the YRBSS responses were recoded from 1-8 to 0-7 with 0 indicating the

participant did not engage in the activity. The responses for each category were summed to

create one continuous variable to evaluate healthy eating and physical activity. Three of the

YRBSS questions were reversed coded. They included daily soda consumption (question 7),

daily television watching (question 12), and daily use of video games and computers (question

13). The coding of 0-7, with '0' indicating the participant did not engage in this activity, was

reversed so all responses of '0' became '7' and all responses of '7' became '0'. The behaviors

were reversed coded because they are not considered healthy behaviors. Reverse coding assigns

values consistent with the healthy behaviors being assessed.

Initial analysis was conducted for descriptive statistics on the variables.   Data were

checked for outliers, normality, and linearity assumptions. This included an examination of

histograms, scatter plots, and correlations between predictor and outcome variables. Next, multiple linear regression models were generated to determine how well they predict healthy eating and physical activity. Two models were generated for health behavior; one full model and one reduced model containing only significant predictors from the full mode. The full model was adopted for all behaviors because the TPB constructs are the focus of the research questions. The reduced models were provided for observation only. The level of significance was a p-value of less than .05. The results of the final models and the relationship between the predictor variables and the outcome variables were interpreted. Reported statistics include R, R-Square, F statistic and significance, and standardized coefficients (β).

Summary

The TPB's constructs of attitude, subjective norms, PBC and the additional construct of social support were assessed to determine their ability to predict healthy eating and physical activity among adolescents living in five Northeast Tennessee counties in rural Appalachia. Healthy eating was assessed using responses from YRBSS Dietary Behavior questions. Responses from YRBSS Physical Activity and Sedentary Behaviors questionnaire were assessed for physical activity.

CHAPTER 4

RESULTS

This chapter summarizes the result of the study and statistical analysis. Descriptive statistics are provided for the overall sample. Next, results of the comparison to state and national findings from the 2013 YRBSS survey are reported. The data include BMI, fruit and vegetable intake, sugar sweetened beverage intake, breakfast habits, physical activity, and sedentary behaviors. Finally, the results of multiple linear regression analysis for both healthy eating and physical activity are summarized. Result include descriptive statistics, R, R-Square, F statistic and significance, and standardized coefficients (β).

Demographics

The study participants' results were compared to both the state of Tennessee and national 2013 YRBSS results for dietary behaviors, physical activity, and sedentary behaviors. A total of 965 participants from wave 2 of the Team-up for Healthy Living Study were eligible for this study. Two participants were excluded due to missing body mass index information. The final study sample(n=963) included 469 females and 494 males. Participants were 93.7% white non-Hispanic. The grade level of participants included 89.2% in the 9th grade and 6.2% in the 10th grade at the time of the survey. The average age of participants was 14 years 7 months. BMIs were calculated for each participant. Overall, the study sample had higher rates of BMI classifications of overweight and obese compared to the state of Tennessee and national samples. Approximately 20.7% of the participants had a BMI classification of overweight (BMI between 85th and 95th percentiles) and 31.4% had a BMI that met the criteria for obese (BMI $\geq$ 95th percentile). A chi-square test of goodness-of-fit was performed to compare weight status in males and females of the study sample. Weight status was not equally distributed in the

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population, X^2 (1, N = 501) = 12.93, p < .001. A higher percentage of female students (24.1%)

had BMIs classified as overweight compared to male students (17.4%). A higher percentage

male students (36.4%) had BMIs classified as obese compared to female students (26.0%).

Table 2 shows weight status for study participants, Tennessee and National samples.

Table 2

Weight Status Comparison to 2013 YRBSS Results - Tennessee and National

	Overweight						Obese					
	Female		Male		Total		Female		Male		Total	
n=501	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	24.1[†Ñ]	20.2-28.0	17.4	14.1-20.7	20.7[†Ñ]	18.1-23.4	26.0[†Ñ]	22.0-30.0	36.4[§†Ñ]	32.1-40.8	31.4[†Ñ]	27.2-35.6
Tennessee	16.8	14.2-19.8	14.1	15.1-17.1	15.4	13.3-17.9	13.7	11.1-16.8	20.0	16.5-23.9	16.9	15.1-18.8
National	16.6	15.0-18.4	16.5	15.4-17.7	16.6	15.5-17.8	10.8	9.7-12.1	16.6	14.9-18.4	13.7	12.6-14.9

Source for Tennessee and National Data: Kann et al., 2014
[§]*Study sample is significantly different between males and females*
[†]*Study sample is significantly different from Tennessee sample*
[Ñ]*Study sample is significantly different from national sample*

Research Question One

The overall percentage of daily consumption of five or more servings of fruits and

vegetables in this sample was 19.7% (See Table 3). Analysis of fruits and vegetables separately

revealed participants averaged just 1.4 servings of fruit or 100% fruit juice per day and 1.7

servings of vegetables per day. Further analysis revealed a difference between males and

females in daily fruit and vegetable consumption. A chi-square test of goodness-of-fit was

performed to compare fruit and vegetable servings in males and females. Consumption was not

equally distributed in the population, X^2 (5, N = 922) = 19.50, p < .002. Table 3 shows more

females indicated consumption of 2 servings or less daily. There is a small difference between

the number of males and females who reported not consuming fruits and vegetables, but that

difference increases for daily servings of 3 or more.

Table 3

Healthy Eating - Daily Servings of Fruit and Vegetable Consumption by Gender

n=922	0	1	2	3	4	5	Total
Female	8	159	121	65	28	72	453
Male	12	124	111	62	50	100	469
Total	20	283	232	127	78	182	922
Percent	2.2%	30.7%	25.2%	13.8%	8.5%	19.7%	100%

Approximately 8.4% of study participants reported they did not eat fruit or drink 100% juice the seven days prior to completing the survey. Overall, 14% of the study population consumed three or more servings per day of fruit or 100% fruit drink. Compared to national percentages, the study population consumed fewer servings of fruit or 100% fruit juice than did national samples, with a larger percentage indicating they did not eat these items at all the seven days prior to completing the survey. (See Table 4)

Table 4

Healthy Eating Fruit Comparison to 2013 YRBSS Results - Tennessee and National

n=927	Did not eat Fruit or drink 100% fruit juice						Ate Fruit or drink 100% fruit juice 3+ day					
	Female		Male		Total		Female		Male		Total	
	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	8.1[Ñ]	5.6-10.6	8.7	6.2-11.2	8.4[Ñ]	6.6-10.2	11.6[†Ñ]	8.7-14.5	16.3[Ñ]	13.0-19.6	14.0[Ñ]	11.8-16.2
Tennessee	6.7	5.0-8.9	13.1	10.8-15.9	9.9	8.3-11.8	17.5	14.7-20.7	19.3	16.1-23.0	18.6	16.0-21.5
National	4.0	3.3-4.8	6.1	5.3-7.0	5.0	4.5-5.7	19.9	17.9-22.0	24.0	22.4-25.7	21.9	20.4-23.5

Source for Tennessee and National Data: Kann et al., 2014
[†]Study sample is significantly different from Tennessee sample
[Ñ]Study sample is significantly different from national sample

The percentage of the study sample that reported they did not consume vegetables daily was 5.6%. This is different from the state of Tennessee percentage of 9.0%, indicating a smaller percentage of the study sample reported not consuming vegetables. Participants who reported they ate 3 or more servings of vegetables daily was 20.2%. The 2013 YRBSS survey results found 12.3% of adolescents in Tennessee and 15.7% nationally consumed 3 or more servings of

vegetables daily. A higher percentage of males from the study sample reported consuming 3 or

more servings of vegetables daily. The present sample, therefore, was more likely to report

consuming vegetables when compared to state or national norms. (See Table 5)

Table 5

Healthy Eating Vegetables Comparison to 2013 YRBSS Results - Tennessee and National

	Did not eat vegetables						Ate vegetables three or more times/day					
	Female		Male		Total		Female		Male		Total	
n=923	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	5.9	3.7-8.1	5.3^{†Ñ}	3.3-7.3	5.6†	4.1-7.1	15.4	12.1-18.7	24.7^{§†Ñ}	20.8-28.6	20.2^{†Ñ}	17.6-22.8
Tennessee	7.8	5.9-10.2	10.3	7.9-13.3	9.0	7.4-10.9	11.5	9.9-13.3	12.9	9.7-16.9	12.3	10.4-14.5
National	5.7	4.9-6.6	7.5	6.5-8.7	6.6	5.9-7.4	14.3	12.5-16.3	17.0	15.2-19.0	15.7	14.1-17.4

Source for Tennessee and National Data: Kann et al., 2014
§Study sample is significantly different between males and females
†Study sample is significantly different from Tennessee sample
Ñ Study sample is significantly different from national sample

Approximately 14.3% of study participants reported they did not drink soda in the seven

days prior to the survey. For individuals that reported drinking soda, 42.8% indicated they drank

at least one soda daily. The remaining 42.9% of study participants reported drinking at least one

soda in the seven days prior to completing the survey. Overall, a large percentage of study

participants reported they consumed soda daily. The study sample was significantly different

from both Tennessee and National samples, reporting the highest percentage of individuals

drinking at least one soda daily.   Males from the study sample reported the lowest percentage

not drinking soda. (Table 6).

Table 6

Healthy Eating Soda Comparison to 2013 YRBSS Results - Tennessee and National

| | Did not drink soda | | | | | | Drank soda one or more times/day | | | | | |
| | Female | | Male | | Total | | Female | | Male | | Total | |
n=923	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	$17.7^{Ñ}$	14.2-21.2	$11.0^{§†Ñ}$	8.2-13.8	$14.3^{Ñ}$	12.0-16.6	$40.9^{Ñ}$	36.4-45.4	$44.6^{†Ñ}$	40.1-49.1	$42.8^{†Ñ}$	39.6-46.0
Tennessee	17.9	15.4-20.6	18.5	15.6-21.9	18.2	16.2-20.4	32.4	27.8-37.3	33.3	29.3-37.6	32.8	29.3-36.5
National	24.8	22.3-27.6	19.8	18.0-21.7	22.3	20.4-24.4	24.1	20.9-27.6	29.9	26.4-33.7	27.0	23.8-30.5

Source for Tennessee and National Data: Kann et al., 2014
§Study sample is significantly different between males and females
†Study sample is significantly different from Tennessee sample
Ñ Study sample is significantly different from national sample

It was found that 34.9% of participants drank at least one glass of milk daily. A lower percentage of study participants, 18.0%, reported they did not drink milk daily. Overall, the percentage of study participants that reported drinking at least one glass of milk daily was not significantly different from both Tennessee and national samples. (See Table 7)

Table 7

Healthy Eating Milk Comparison to 2013 YRBSS Results - Tennessee and National

| | Did not drink milk | | | | | | Drank one or more glasses/day of milk | | | | | |
| | Female | | Male | | Total | | Female | | Male | | Total | |
n=926	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	$20.1^{†}$	16.4-23.8	$13.2^{§†}$	10.1-16.3	$18.0^{†Ñ}$	15.5-20.5	28.1	24.0-32.2	$41.4^{Ñ}$	37.0-45.9	$34.9^{Ñ}$	31.8-38.0
Tennessee	35.0	30.3-40.1	22.5	18.8-26.7	28.5	24.8-32.5	24.1	20.0-28.8	39.5	34.7-44.5	32.0	27.8-36.4
National	25.4	23.3-27.6	13.2	12.0-14.7	19.4	17.9-20.9	31.7	28.7-34.8	49.0	46.5-51.4	40.3	37.8-42.8

Source for Tennessee and National Data: Kann et al., 2014
§Study sample is significantly different between males and females
†Study sample is significantly different from Tennessee sample
Ñ Study sample is significantly different from national sample

Approximately 14.8% reported not eating breakfast at all. The study sample was not statistically different from the state of Tennessee or national samples. The percentage of study participants that reported eating breakfast every day was 30.8%. This is significantly different from the national findings of 38.1%. (See Table 8)

Table 8

Healthy Eating Breakfast Comparison to 2013 YRBSS Results - Tennessee and National

n=923	Did not eat breakfast						Ate breakfast on all seven days					
	Female		Male		Total		Female		Male		Total	
	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	15.9	12.5-19.3	13.8	10.7-16.9	14.8	12.5-17.1	26.5	22.4-30.6	34.9	30.6-39.2	30.8 [N]	27.8-33.8
Tennessee	15.7	12.8-19.2	18.6	15.1-22.8	17.3	14.9-20.0	32.2	28.8-35.8	36.1	31.2-41.3	34.1	30.7-37.6
National	13.8	12.2-15.5	13.5	12.0-15.2	13.7	12.3-15.2	33.8	31.5-36.2	42.4	40.4-44.3	38.1	36.5-39.7

Source for Tennessee and National Data: Kann et al., 2014
[N] *Study sample is significantly different from national sample*

Table 9 summarizes reported physical activity. The overall percentage of study

participants who stated they did not engage in at least 60 minutes of physical activity on least

one day in the previous seven days was 6.9%. This was significantly different from the state of

Tennessee (19.6%) and national (15.2%) results.   The percentage of participants that engaged in

at least 60 minutes of physical activity five or more days per week was 51.2%, significantly

higher when compared to 41.4% for the state of Tennessee. (See Table 9)

Table 9

Physical Activity Comparison to 2013 YRBSS Results - Tennessee and National

n=923	Did not participate in at least 60 minutes of physical activity on at least 1 day						Physically active at least 60 minutes/day on 5 or more days					
	Female		Male		Total		Female		Male		Total	
	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	7.7[†Ñ]	5.2-10.2	6.2[†Ñ]	4.0-8.4	6.9[†Ñ]	5.3-8.5	43.0[†]	38.4-47.6	59.2[§]	54.8-63.6	51.2[†]	48.0-54.4
Tennessee	21.3	18.4-24.5	18.0	14.0-22.8	19.6	16.8-22.7	31.3	27.2-35.8	51.3	46.5-56.2	41.4	37.6-45.3
National	19.2	17.3-21.2	11.2	10.1-12.3	15.2	13.9-16.6	37.3	34.6-40.0	57.3	55.5-59.0	47.3	45.3-49.2

Source for Tennessee and National Data: Kann et al., 2014
[§]*Study sample is significantly different between males and females*
[†]*Study sample is significantly different from Tennessee sample*
[Ñ] *Study sample is significantly different from national sample*

Table 10 shows the percentage of study participant engage in regular physical activity in

the school setting. For attendance of a physical education class, 52.6% of participants reported

they attended daily. It is important to note that, in the state of Tennessee, physical education is a class students take during their 9th grade year. The study population consist primarily of 9th graders (89.2%). Approximately 62% of participants reported they played on at least one sports team in the previous twelve months. For the study sample, there was no difference between genders. However, they exceeded state and national percentages for regular attendance of physical education class and playing on a sports team.

Table 10

School Based Physical Activity Comparison to 2013 YRBSS Results -Tennessee and National

	Attended P.E. classes daily						Played on at least one sports team during previous 12 months					
	Female		Male		Total		Female		Male		Total	
n=924	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	54.8^{†Ñ}	50.2-59.4	50.4^{†Ñ}	45.9-54.9	52.6^{†Ñ}	49.4-55.8	60.0^{†Ñ}	55.5-64.5	63.8	59.5-68.1	62.0^{†Ñ}	58.9-65.1
Tennessee	21.2	16.4-27.0	23.3	19.7-27.3	22.3	18.8-26.2	46.5	43.5-49.6	60.4	57.2-63.5	53.5	51.1-56.0
National	24.0	19.3-29.4	34.9	30.8-39.3	29.4	25.1-34.1	48.5	45.9-51.1	59.6	56.9-62.3	54.0	51.6-56.3

Source for Tennessee and National Data: Kann et al., 2014
[†]Study sample is significantly different from Tennessee sample
[Ñ] Study sample is significantly different from national sample

To assess sedentary behaviors, the amount of time spent watching television or playing games on a computer or video game console was assessed. The percentage of study participants who reported playing video or computer games for three or more hours on a school day was 25.7%. Study findings indicated that study participants were significantly less likely to use computers for three or more hours a day, compared to both Tennessee (36.2%) and national (41.3%) norms. Similarly, 22.8% of the study sample reported they watched television for three or more hours on a school day. This was also significantly lower different from both Tennessee and national percentages. (See Table 11)

Table 11

Sedentary Behavior Comparison to 2013 YRBSS Results - Tennessee and National

| | Used computers 3 or more hours/day n=924 | | | | | | Watched television 3 or more hours/day n=923 | | | | | |
| | Female | | Male | | Total | | Female | | Male | | Total | |
	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
Team UP Wave 2	22.7[†Ñ]	18.9-26.6	28.6[†Ñ]	24.5-32.7	25.7[†Ñ]	22.9-28.5	24.0[†Ñ]	20.1-27.9	21.7[†Ñ]	18.0-25.4	22.8[†Ñ]	20.1-25.5
Tennessee	34.0	30.2-37.9	38.4	33.6-43.4	36.2	33.4-39.1	34.4	30.4-38.6	33.9	30.5-37.5	34.1	31.2-37.2
National	40.4	37.5-43.2	42.3	40.2-44.4	41.3	39.2-43.4	32.2	29.7-34.8	32.8	30.5-35.2	32.5	30.4-34.7

Source for Tennessee and National Data: Kann et al., 2014
[†]Study sample is significantly different from Tennessee sample
[Ñ] Study sample is significantly different from national sample

Research Question Two

To answer research question two, a series of multiple linear regression analyses were conducted to determine the predictability of TPB and social support on the health behaviors of healthy eating and physical activity. Regression models were tested for total healthy eating score as well as daily breakfast consumption, and daily intake of fruit, vegetables, milk, and soda. Models tested for physical activity included total physical activity score, number of sports teams, daily physical education class, daily physical activity and strength exercise, and the number of hours spent watching television and playing video or computer games.

Two regression models were generated for every behavior assessed. The full model included all predictor variables of interest. The reduced model included only predictor variables that were significant in the full model. Every full model included, some predictor variables that did not reach significance. However, for this study, the full model was accepted for every behavior because the predictor variables were the focus of the research questions. The purpose of the study was to examine how well the variables as a whole predicted the health behaviors of healthy eating and physical activity and their relationship to each other. The results discussed will focus on the findings from the full models only.

Descriptive statistical analyses were conducted to determine if the data met normality criteria for multiple linear regression. Correlation analysis of variables predicting healthy eating showed moderately high correlations between PBC and subjective norms (Table 12). Correlation analysis of predictive variables for physical activity also indicated moderately high correlations between social support and subjective norms, and PBC and attitude (Table 13). Due to both subjective norms and social support measuring social influences, multicollinearity analysis was conducted. Analysis showed multicollinearity was not present. All tolerance values exceeded .2, and all variance inflation factor (VIF) values were less than 3. Data met all other assumptions for normality. Multiple linear regression analysis was conducted.

Table 12

Predictor Variables Healthy Eating - Means, Standard Deviations, and Correlations

(n=873)	M	SD	Gender	Weight Status	Attitude	PBC	SN (From)	SN (Of)	Social Support
Gender	-	-	1.00	.112[**]	-.115[**]	.011	.018	.094[**]	-.016
Weight	-	-		1.00	.142[**]	-.048	-.063	-.087[**]	-.081[*]
Attitude	27.82	6.62			1.00	.454[**]	.321[**]	.221[**]	.257[**]
PBC	15.29	2.91				1.00	.442[**]	.421[**]	.394[**]
SN (From)	12.82	3.13					1.00	.562[**]	.340[**]
SN (Of)	12.67	2.48						1.00	.347[**]
Soc. Support	23.13	3.59							1.00

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

Table13

Predictor Variables Physical Activity - Means, Standard Deviations, and Correlations

(n=885)	M	SD	Gender	Weight Status	Attitude	PBC	SN (From)	SN (Of)	Social Support
Gender	-	-	1.00	.112**	.079*	.125**	.104**	.129**	.172**
Weight	-	-		1.00	.020	-.109**	-.118**	-.086**	-.019**
Attitude	31.13	6.19			1.00	.533**	.384*	.277**	.430**
PBC	16.35	3.15				1.00	.543**	.438**	.513**
SN (From)	14.43	3.18					1.00	.561**	.543**
SN (Of)	13.47	2.30						1.00	.440**
Soc. Support	20.75	6.74							1.00

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

Healthy Eating

Multiple linear regression analysis was conducted to assess a model for predicting total healthy eating scores for adolescents in Southern Appalachia using total scores for attitude, PBC, subjective norm from referent groups, subjective norms of referent groups, social support, gender and weight status. Basic descriptive statistics are in Table 12. The seven variable predictor model was able to account for 9.6% of the variance in healthy eating behavior, $F_{(7,827)} = 14.27$, $p < .001$, $R^2 = .108$ (Table 14). Gender, PBC, attitude, and subjective norms from referent groups were all significant ($p < .05$). The analysis showed gender was the strongest predictor (Beta = .166, $t_{(827)} = 4.93$, $p < .001$), indicating male students reported higher overall levels of healthy eating behaviors when compared to female students. PBC was the second best predictor of healthy eating behavior (Beta = 1.47, $t_{(827)} = 3.49$ $p < .001$). The two remaining significant predictors were attitude (Beta = .109, $t_{(827)} = -2.81$, $p < .005$) and subjective norms from referent groups (Beta = .094, $t_{(827)} = 2.23$, $p < .026$). The equation for predicting healthy eating = 3.82 + .2.27(gender) - .626(obese) + .113(attitude) + .342(PBC) + .200(SN from) - .039(SN of) + .081(Social Support).

The next model assessed total fruit consumption using average scores for attitude, PBC, subjective norms from referent groups, subjective norms of referent groups, social support, gender and weight status. The seven variable predictor model was able to account for 5.4% of the variance in fruit consumption, $F_{(7,834)} = 6.79$, $p < .001$, $R^2 = .054$. Gender and PBC were significant ($p < .05$). The analysis showed PBC was strongest predictor (Beta = .144, $t_{(835)} = 3.34$, $p < .001$). Gender (Beta = .119, $t_{(835)} = 3.45$, $p < .001$). (Table 14)

For vegetable consumption, the seven predictor model was able to account for 3.8% of the variance in vegetable consumption, $F_{(7,831)} = 4.75$, $p < .001$, $R^2 = .038$. Gender, PBC, and subjective norms from referent groups were significant ($p < .05$). The analysis showed gender was the strongest predictor (Beta = .122, $t_{(831)} = 3.49$, $p < .001$), indicating males consumed more vegetables than females. The next best predictor was subjective norms from referent groups (Beta = .104, $t_{(831)} = 2.39$, $p < .017$) and PBC (Beta = .089, $t_{(831)} = 2.05$, $p < .041$) (Table 14).

Analysis of the regression model for soda consumption indicated the seven predictors explained 7.9% of the variance, $F_{(7,834)} = 10.20$, $p < .001$, $R^2 = .080$ (Table 15). Significant predictors include PBC (Beta = -.120, $t_{(834)} = 2.83$, $p < .005$), attitude (Beta = .126, $t_{(834)} = -3.19$, $p < .001$), gender (Beta = -.363, $t_{(834)} = -2.89$, $p < .004$), and weight status (Beta = .104, $t_{(834)} = 3.00$, $p < .003$). Males were more likely to drink soda than female participants and participants classified as not obese were more likely to drink soda.

The model predicting milk consumption revealed a significant model that explained 4.9% of variance, $F_{(7,834)} = 6.08$, $p < .001$, $R^2 = .049$ (Table 15). Subjective norms from referent groups (Beta = .101, $t_{(834)} = -2.33$ $p < .020$) was significant. The second significant predictor

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was gender (Beta = .201, t (834) = 5.80, p < .000), indicating males were more likely to consume milk daily.

Analysis of the regression model to predict daily consumption of breakfast also revealed a significant model. The results of the regression analyses indicated the model predictors explained 7.7% of the variance, F (7, 830) = 9.84, p < .001, R^2= .077. (Table 15). There were four predictors in the model that were significant (p < .05) attitude, social support, gender, and weight. The strongest predictor of eating breakfast was social support (Beta = .125, t (830) = 3.28, p < .001). Next was attitude (Beta = .112, t (830) = 2.84, p < .005) followed by gender (Beta = .112, t (830) = 3.27, p < .001). The final significant predictor was weight (Beta = -.099, t (830) = -2.34, p < .005). The model indicated that male participants were more likely to eat breakfast than were female participants. It also indicates that participants with a weight status of obese were less likely to eat breakfast.

Table14

Healthy Eating Regression Models: Full & Reduced

	Healthy Eating (Total)		Fruit Only		Vegetables Only	
	FULL	REDUCED	FULL	REDUCED	FULL	REDUCED
N	835	855	842	923	839	900
R	.328	.322	.232	.218	.196	.190
R^2	.108	.104	.054	.047	.038	.036
ΔR^2	.100	.099	.046	.045	.030	.033
F	14.72	24.56	6.79	22.87	4.75	11.13
Sig	.000	.000	.000	.000	.000	.000
Gender	.166[*]	.154[*]	.119[*]	.110[*]	.122[*]	.116[*]
Weight	-.042	-	-.058	-	.002	-
Attitude	.109[*]	.100[*]	.046	-	.046	-
PBC	.147[*]	.167[*]	.144[*]	.187[*]	.089[*]	.094[*]
SN (From)	.094[*]	.094[*]	.034	-	.104[*]	.080[*]
SN (Of)	-.014	-	.027	-	-.046	-
Social Support	.044	-	-.024	-	-.033	-

*Significant at the 0.05 level

Table 15

Healthy Eating Regression Models: Full & Reduced Questions 7-9

	Soda		Milk		Breakfast	
	FULL	REDUCED	FULL	REDUCED	FULL	REDUCED
N	842	880	841	906	838	862
R	.281	.279	.220	.198	.277	.271
R^2	.079	.078	.049	.039	.077	.074
ΔR^2	.071	.074	.041	.037	.069	.069
F	10.20	18.50	6.08	18.43	9.84	17.05
Sig	.000	.000	.000	.000	.000	.000
Gender	-.098*	-.095*	.201*	.188*	.112*	.128*
Weight	.104*	.095*	-.056	-	-.099*	-.113*
Attitude	.126*	.141*	-.022	-	.112*	.146*
PBC	.120*	.137*	-.018	-	.058	-
SN (From)	-.015	-	.101*	.060*	.024	-
SN (Of)	.017	-	-.047	-	.016	-
Social Support	.055	-	.032	-	.125*	.149*

*Significant at the 0.05 level

Physical Activity

Multiple linear regression analysis was conducted to evaluate models for predicting physical activity behaviors of adolescents in Southern Appalachia using average scores for attitude, PBC, subjective norms from referent groups, subjective norms of referent groups, social support, gender and weight status. Basic descriptive statistics are in Table 13. All models for physical activity can be found Table 16.

Analysis of regression model to predict total physical activity behavior of adolescents in Appalachia revealed the seven predictor model was able to account for 27.4% of the variance in physical activity behavior, $F_{(7, 839)} = 45.29$, $p < .001$, $R^2 = .274$. Social support was the strongest predictor of physical activity behavior (Beta = .347, $t_{(839)} = 9.09$, $p < .001$). Attitude was the second best predictor of physical activity behavior (Beta = .186, $t_{(839)} = 5.21$, $p < .001$). Not all of the predictors in the model were statistically significant. The equation for

predicting total physical activity = 4.04 + .478(gender) - .742(obese) + .180(attitude) +

.051(PBC) + .085(SN from) + .030(SN of) + .309(Social Support).

The next model evaluated for physical activity only (YRBS questions 10, 11, 14, and15). The results of the regression model indicated the seven predictor model explained 29.2% of the variance, $F_{(7, 841)} = 49.45$, $p < .001$, $R^2 = .292$.]. There were two significant predictors, social support, and attitude. The strongest predictor for physical activity was social support (Beta = .388, $t_{(841)} = 10.30$, $p < .001$) followed by attitude (Beta = .166, $t_{(841)} = 4.71$, $p < .001$). The analysis also found female students and students classified as obese were less likely to engage in physical activity.

A multiple linear regression model was evaluated for sedentary behavior only. The results of the regression indicated the seven predictor model explained 4.5% of the variance $F_{(7, 840)} = 5.67$, $p < .001$, $R^2 = .045$. The strongest predictor was attitude (Beta = .091, $t_{(839)} = 2.21$, $p<.027$). The second significant predictor was gender (Beta =.-.116, $t_{(839)} = -3.36$, $p<.001$). For sedentary behavior, the higher the attitude score, the more likely study participants would engage in sedentary behaviors. As well, male students were less likely to engage in sedentary behaviors when compared to female students.

Table 16

Physical Activity Regression Models: Full & Reduced

	Physical Activity Total		Physical Activity Only		Sedentary Only	
	FULL	REDUCED	FULL	REDUCED	FULL	REDUCED
N	847	865	849	866	847	895
R	.524	.515	.540	.539	.213	.168
R^2	.274	.265	.292	.291	.045	.028
ΔR^2	.268	.263	.286	.288	.037	.028
F	45.29	155.29	49.45	88.29	5.69	12.94
Sig	.000	.000	.000	.000	.000	.000
Gender	.040	-	.106*	.108*	-.116*	-.082*
Weight	-.057	-	-.094*	-.095*	.055	-
Attitude	.186*	.201*	.166*	.170*	.091*	.153*
PBC	.026	-	-.008	-	.071	-
SN(From)	.045	-	.047	-	.010	-
SN (Of)	.011	-	-.019	-	.065	-
Social Support	.347*	.396*	.388*	.400*	.019	-

*Significant at the 0.05 level

<div align="center">Research Question Three</div>

Research question three aimed to determine if there was a difference between the strength of predictor variables, subjective norms and social support (Table 17). Between the two types of subjective norms measured, subjective norms from referent groups were the strongest predictor. Although social support was a better predictor for breakfast, it was not a significant predictor other healthy eating models.

Table 17

Healthy Eating - Comparison of Subjective Norms and Social Support

	SN (From)		SN (Of)		Social Support	
	B	Sig.	B	Sig.	B	Sig.
Healthy Eating Total	.094	.027*	-.014	.646	.044	.422
Fruit only	.034	.425	.027	.528	-.024	.523
Vegetables Only	.104	.017*	-.046	.292	-.033	.398
Soda	-.015	.717	.017	.693	.055	.147
Milk	.101	.020*	-.047	.273	.032	.412
Breakfast	.024	.581	.016	.712	.125	.001*

*Significant at the 0.05 level

For physical activity, social support was a better predictor (See Table 18). Neither subjective norms of referent groups nor subjective norms from referent groups were significant predictors of physical activity or sedentary behaviors. Separate analysis of each construct also found neither social support nor subjective norms were significant predictors of sedentary behaviors.

Table 18

Physical Activity - Comparison of Subjective Norms and Social Support

	SN (From)		SN (Of)		Social Support	
	B	Sig.	B	Sig.	B	Sig.
Physical Activity Total	.045	.261	.011	.756	.347	.000*
Physical Activity Only	.047	.233	-.019	.599	.388	.000*
Sedentary Behavior Only	.010	.829	.065	.119	.019	.660

*Significant at the 0.05 level

Summary

In summary, analysis revealed generally high rates of physical activity, low rates of sedentary behavior, and healthy dietary behaviors among study participants when compared to state and national norms. However, 42.8% reported drinking at least one soda daily and 42.9% consumed between 1-6 sodas over the course of seven days. More than half of the study population was classified as either overweight (20.7%) or obese (31.4%). For multiple linear regression analysis, models including TPB and social support were able to predict healthy eating and physical activity behavior among adolescents in Appalachia. Findings revealed the TPB constructs of attitude (Beta = .110, t (824) = 2.83, p < .005) and perceived behavioral control (Beta = .147, t (824) = 3.14, p < .001) were the strongest predictors of healthy eating behaviors. For physical activity, the strongest predictors of behavior were attitude (Beta = .186, t (839) = 5.21, p < .001) and social support (Beta = .347, t (839) = 9.09, p < .001). The comparison of

subjective norms and social support found subjective norms from referent groups was a better predictor of healthy eating behaviors, and social support was a better predictor of physical activity.

CHAPTER 5

DISCUSSION

The rapid increase in childhood obesity rates in the United States and around the world has resulted in a need to identify effective interventions to reverse the current trend. Transitioning into adulthood, targeting the health behaviors of adolescents is an effective approach to preventing the adoption of behaviors that could lead to increased risk of obesity and chronic disease. The health behaviors believed to have the most impact on both the cause and solution to the current obesity epidemic are healthy eating and physical activity (CDC, 2015b; HSPH, 2015). Complex behaviors, motivating factors for healthy eating and physical activity are made up of a unique combination of factors defined by the values and beliefs of the target population. For this reason, it is important to identify tools to assist in the identification of those motivating factors and the implementation of targeted interventions. The TPB is a behavior change model that provides a mechanism to achieve both these goals. Contributing to a gap in the literature, this study described the daily habits of healthy eating and physical activity of adolescents in Southern Appalachia. It also examined the ability of the TPB and social support to predict healthy eating and physical activity behaviors of this study population.

Research Question One

The purpose of research question one was to describe the daily health behaviors of adolescents in Southern Appalachia. The analysis for this study revealed a significant number of participants already adopted several healthful behaviors. This population reported a lower percentage of individuals engaging in sedentary behaviors of television watching and playing video or computer games. A higher percentage of study participants reported regular physical activity, exceeding both state and national samples in reaching minimum physical activity

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recommendations as well as participation in team sports. This group also reported a higher percentage attending daily physical education classes when compared to the state of Tennessee sample. Healthy eating habits included regular consumption of fruits and vegetables, with 42% of participants reporting they ate three or more servings daily. In the category of vegetable consumption, the study participants exceeded both Tennessee and national daily averages. More than one-third reported drinking milk daily and eating breakfast every day. Studies that assessed the association between healthy eating and physical activity behaviors found adolescents who reported regular physical activity were more likely to consume fruits and vegetables (Lowry Michael, Demissie, Kann, & Galuska, 2015).   These findings show the study population's healthy behaviors were in line with existing research.

Although there were higher rates of healthy eating and physical activity, and lower prevalence of sedentary behaviors in this sample when compared to state and national norms, these healthy behavior patterns were not reflected in weight status. More than half of the study population was classified as either overweight (20.7%) or obese (31.4%) based on BMI scores. A dietary behavior that emerged from the analysis as a possible contributing factor to weight status was consumption of sugar sweetened beverages.

Approximately 42.8% of participants reported drinking at least one soda daily. Another 42.9% consumed between 1-6 sodas over the course of seven days. Soda consumption is an important finding because of the role it plays in the obesity epidemic. Participants were not asked to specify the size of the soda they consumed. However, the typical 20-ounce soda contains 240 calories and 15 to 18 teaspoons of sugar (HSPH, 2016). For adolescents ages 12-19, sugar sweetened beverages can account for 13-28% of their daily calories (CDC, 2010). Research shows that people who consume just one 12-ounce serving of a sugary drink daily will

gain more weight over time than people who do not. Frequent consumption of sugar sweetened

beverages also increases the risk of developing type 2 diabetes and heart disease (HSPH, 2016).

This dietary behavior is likely an important contributing factor to the higher percentage of

participants that were identified as overweight or obese and should be the focus of future

investigation and intervention.

<div align="center">Research Questions Two and Three</div>

The regression analysis revealed the TPB and social support were able to predict health

behaviors of adolescents in Southern Appalachia, with the individual constructs producing varied

statistical significance based on the identified health behavior. For healthy eating behaviors,

TPB and social support accounted for 10.8% of the variance. Previous studies using the TPB

found variances for healthy eating behavior among adolescents of 9.6% to 49% (Ajzen, 1991;

Armitage & Connor, 2001; Finlay et al., 2002; Godin & Kok, 1996; McEachan et al., 2011). A

meta-analysis by McEachan (et al., 2011) found TPB exaplained 9.6% of variance in dietary

behaviors of adolescents compared to 26.7% in adults. A study focused on healthy eating

intentions of adolescents found variances ranging from 25% pre-intervention to 65% post-

intervention among the TPB constructs (Muzaffar et al., 2014). The results for healthy eating

from this study were lower when compared to previous reports, but similar to a meta-analysis

that specifically assessed adolescents. Despite not accounting for a large portion of the variance,

TPB did produce significant results, confirming its utility with the study population.

For physical activity, the TPB and social support accounted for 27.9% of the variance in

behavior. Previous studies using the TPB to predict behavior and intention for physical activity

found it accounted for 20% to 44% of variance. For studies that focused on physical activity

behaviors of adolescents, the variances ranged from 20% - 62%, with one meta-analysis finding

the TPB explained 22.2% of behavior and 49.6% of intention (Ellis, et al., 2013; McEachan et al., 2011; Plotnikoff. et al., 2011). The regression model for total physical activity produced results consistent with previous studies, and appears to be a good predictor of physical activity behavior for adolescents in Southern Appalachia.

Examination of individual variables revealed attitude was a significant predictor for both physical activity and healthy eating, accounting for variance in models for total healthy eating, soda, breakfast, physical activity, and sedentary behaviors.   This finding is consistent with existing research that identifies attitude as a strong predictor of health behaviors for adolescents (McEachan et al., 2011).   In designing interventions, this finding means the more favorable the view a person has about the behavior, the more likely he or she is to perform the behavior.

PBC produced varied results in the models. It emerged as a strong predictor of healthy eating behavior, but was not a significant predictor of physical activity behavior. When assessed in adolescents, studies that tested both PBC and social support found the predictability of PBC diminished. Similar mixed results have been found in several studies. A study of middle school students found PBC was a significant predictor of both intention and behavior. Another study that assessed the physical activity of 9th graders found TPB accounted 58% of variance. When social support measures were added the models, it accounted for an additional 7% of the variance for physical activity, but the contribution of PBC decreased (Hamilton & White, 2008). In a study assessing physical activity of 8th grade girls, PBC was strong predictor of behavior intention, but not behavior (Saunders et al., 2004). These finding suggest that perceived control is an important predictor of healthy eating behaviors for adolescents. However, its predictability with physical activity in adolescents varies depending on the gender, age of the population, and the other variables considered in the assessment of the behavior. PBC is a significant predictor

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of intentions and behaviors with younger adolescents, but does not consistently predict behavior in older adolescents.

Two forms of subjective norms were assessed in this study. Subjective norms of referent groups, or descriptive norms, assessed the perception one has of how important referent groups actually behave. Subjective norms from referent groups, or injunctive norms, assessed the perceptions of expectation to engage in a specific behavior from referent groups (Courneya et al., 2000; Hamilton & White, 2008). Subjective norms of referent groups did not reach significance in any of the regression models. Observed health behaviors of referent groups were not a significant predictor of health behaviors for this sample. Subjective norms from referent groups was a significant predictor of healthy eating behaviors only; significant in models for total healthy eating, vegetables, and soda. This finding indicates participants were more likely to engage in the health eating behavior if they perceived it was an expectation from an important referent group.

In addition to not being a strong predictor for physical activity, subjective norms also produced the lowest standardized coefficient in two of the three models in which it was significant. A possible reason for this may be the questionnaire used assessed subjective norms. For both types of subjective norms, multiple referent groups were assessed. This included friends, parents, teacher, and classmates. The scores were combined to produce one composite score for analyses. Studies of subjective norms found that including non-salient referent groups in an assessment may result in an underestimate of the influence of subjective norms (Baker et al., 2003; Hamilton & White, 2008). Since the influence of these groups varies by behavior, the best method to determine their true contribution to a behavior is to assess each group separately.

Given the variety of eating behaviors subjective norms predicted, identifying which referent group was the source of the influence on the behavior will help to improve interventions.

Social support was the strongest predictor in model that tested all measures of both physical activity and sedentary behavior and the model that tested physical activity only. One reason for this finding may be related to the type of activities and social support assessed by the study. For this study, the types of social support examined most closely mirrored instrumental and informational supports. Instrumental support is defined as tangible aid or service in the form of action, materials, or goods and services provided by an individual. Informational support is advice, suggestions, feedback, and information provided to improve an individual's life circumstance (Clark et al., 1999; Glanz et al., 2008). By design, participation in team sports fits well with the social support construct as team sports reflect many of the characteristics that define both instrumental and informational supports. Individuals that play sports experience group membership, parental assistance getting to practices and games, and information exchange through instruction and guidance from coaches and teammates on how to execute the activity. This finding is similar to a study that examined differences in motivation for team sports versus moderate to vigorous physical activity of 8th grade girls in South Carolina (Saunders, et al., 2004). Using measures of social support similar to this study, they found social support was a strong predictor of physical activity for the study sample, exceeded both subjective norms and PBC. This study also found family support was a strong predictor of team sport participation. This finding is appropriate as the type of family support assessed by the study included behaviors consistent with characteristics of instrumental support.

Another important contributing factor relates to how social support was measured in the current investigation. Other studies assessed social support based on the source of the support,

incorporating the individual input of multiple important referent groups, such as friends and family, with the type of support they provided (Hamilton & White, 2008; Rhodes et al., 2002; Saunders et al., 2004,). This resulted in lower association between physical activity and social support as the mixing of the referent groups reduced the strength of the measure (Saunders et al., 2004). Also, research on the source of social support shows support from parents is important for younger children, but support from friends is a better predictor of physical activity older adolescents (Mendonça, Cheng, Mélo, & de Farias Júnior, 2014). This study used a measure that focused on the types of support closely related to physical activity and the social influence of one referent group, friends (Courneya et al., 2000; Godin & Kok, 1996; Hamilton & White, 2008). This approach aided in identifying specific forms of support that are important for participation in physical activity, strengthening the ability of the construct to predict the behavior.

Social support as predictor was almost exclusively limited to physical activity. One exception was breakfast. Analysis found social support and TPB accounted for 7.6% of variance and the strongest predictors were attitude and social support, each with comparable contributions to the variance. For other food items, subjective norms were the best predictor. This is consistent with other research for adolescents (Armitage & Conner, 2001). However, a study that specifically assessed TPB and breakfast behavior found subjective norms was not a significant predictor of the behavior (Wong & Mullan, 2009). A key difference between the studies mentioned and the other food items in the study is breakfast was not assessed based on consumption of a specific food items. Instead, it asked about the activity of eating a meal. For this reason, social support as predictor is an acceptable finding. As an activity, breakfast is more closely related to other items assessed for physical activity, such as playing on a team or attending a physical education class. Also, many school districts in Tennessee offer universal

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breakfast as a part of the school nutrition program. This allows schools to provide free breakfast items to all students regardless of income (Tennessee Department of Education, 2015). It is important to note participants were not asked to specify who provides breakfast or where they ate the meal. But, this is likely an activity participants are eating with a group that includes family, friends, or classmates at home or at school. In terms of important characteristics of social support associated with this behavior, forms of instrumental support like group membership and availability of food items help would help to facilitate this behavior for adolescents.

As stated earlier, subjective norms were a better predictor of healthy eating, while social support was a better predictor of physical activity. This division by health behavior may be explained by a possible association between the constructs. A previous report that assessed physical activity behaviors of adolescents had similar findings. Comparing subjective norms and social support, researchers examined the predictability for a variety of physical activity behaviors among adolescents. In models that did not include social support, subjective norm emerged as a strong predictor, accounting for 34% of the variance. However, once social support was added to the model, the contribution of subjective norms decreased by as much as 10% and it was no longer a significant predictor (Okun et al., 2003). What these findings suggest is the association between subjective norms and physical activity is influenced by social support. Since a similar interaction was observed with healthy eating, additional research is needed to better understand the relationship between these constructs.

The control variable of gender was an important predictor of healthy eating, physical activity, and sedentary behaviors. Male participants were more likely to report eating healthy and engage in physical activity. Weight status was also a significant predictor, explaining some of the variance in behaviors related to soda intake, breakfast consumption patterns, and physical

activity. Participants with a weight status classified as obese were more likely to regularly

consume soda and less likely to eat breakfast or engage in regular physical activity. The

differences observed in behaviors between weight status and gender are consistent with the

literature. Studies have found boys are more likely to be physically active while girls are more

likely to have lower rates of physical activity and higher rates of sedentary activity (Leech et al.,

2014). The difference in physical activity behaviors between boys and girls has been observed in

children beginning as young as age six (Chung et al., 2012). As they age, the gap increases, with

fewer girls ages 12-14 meeting recommendations for daily physical activity (Chung et al., 2012).

This difference in physical activity levels is also associated with higher BMI (Leech et al., 2014).

When compared to children classified as underweight and healthy weight, children that were

identified as overweight or obese are less likely to engage in sustained moderate to vigorous

physical activity (Fagan et al., 2008). It is also important to note there is a difference in

behavioral intentions based on weight status, but adolescents classified as obese have been

shown to be more willing to adopt weight loss measures when compared to adolescents classified

as overweight (Fagan et al., 2008; Leech et al., 2014). Given the impact of both gender and

weight status, interventions with adolescents that include both genders and varying weight status

need to account for these preexisting differences within the population. Interventions should

allow for modifications to accommodate differences in ability and comfort level of the

participant with the activity.

<div align="center">Implications</div>

The findings of this study support the efficacy of TPB to predict health behaviors of

adolescents. It also contributes to a growing body of evidence supporting the use of behavioral

models to explain motivating factors for health behaviors. In addition, the findings support the

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use of TPB to develop interventions for adolescents in the Appalachian region. However, there is still a need for additional research to better understand health behaviors of this population. This study identified a larger portion of the sample with BMI classifications of overweight or obese, when compared to state and national norms. Most at risk for adverse health outcomes, interventions to decrease excess weight should be target for this portion of the population. The key behaviors to focus on for interventions include soda consumption and sedentary behaviors. Interventions should seek to enhance the impact of physical activity and healthy eating while reducing unhealthy behaviors such as soda consumption and sedentary activity. Looking specifically at physical activity, this study found social support was the best predictor of this behavior. Interventions for physical activity should include components that support the inclusion of important forms of social support relevant to physical activity. This includes support from friends, family members, and opportunities to seek advice for the identified activity. For dietary behaviors, PBC was the best predictor.   While options for food items available for consumption may be dictated by external factors such as policy, creating an environment that allows participants to feel like they have autonomy or control over the decisions they make regarding food choices is important. In the school setting, this could include a process that allow students to select from a list of approved food items what they would prefer to have available for snacks or side items during the school day. For all health behaviors assessed in this study, attitude was a significant predictor. Thus, it is important to work with the target population to identify desirable activities. This may include enhancing existing programs and activities or incorporating sedentary behaviors into a physical activity. For example, creating a game or a healthy recipe based a book or video game the is important to the population may help to increase participation in the activity.

Finally, policies in place to support physical activity behavior for high school students should be modified to better meet students' needs. The two policies focus on physical education class and the Tennessee 90-minute law. It is recommended high school students receive a minimum of 225 minutes of physical education each week (HSPH, 2016). However, the state of Tennessee requires only one physical education class be completed over the four years of high school (Tennessee Department of Education, 2015). Typically, this required Lifetime Behaviors class is taken during the first year of high school, with most students completing the class by the end of the 9th grade. The state of Tennessee also mandates the integration of physical activity into the daily learning environment through T.C.A 49-6-1021. Known as the Tennessee 90-minute physical activity law, local districts are required to integrate a minimum of 90 minutes of physical activity per week into the school day for all students in grades K-12 (Tennessee Department of Education, 2015). The Annual Report from the 2014-2015 school year showed the overall rate of compliance with this policy by school systems was 64%. While the elementary schools (98%) level of compliance remained unchanged, rates among middle schools (90%) and high schools (69%) decreased (Tennessee Department of Education, 2015).

To adequately address the need for regular physical activity at the high school level, changes to the policies should be considered. Research on physical education at the high school level shows up to one hour of physical education could be added to the school day without adversely impacting academic achievement (Story, Nanney, & Schwartz, 2009). To ensure adolescents have regular opportunities for physical activity during the school day, the requirement for physical education should be increased from .5 credits to an annual course each year of high school. In the state of Tennessee, this mandate is already in place at the middle school level. To improve compliance with the Tennessee 90-minute Law, school administrations

need to enlist the input of students and community partners to develop a plane to incorporate alternate forms of activity. This include partnerships with local colleges, business, and schools to maximize resources and create opportunities that interest adolescents. Modifying these policies for high schools will aid in efforts to minimize decreases in physical activity without compromising academic performance.

<center>Limitations</center>

One limitation of this study related to the different methods used to collect data to determine BMI classifications. For both national and state of Tennessee data, BMI calculations were based on self-reported height and weight measurements by survey participants (Kann et al., 2014). However, for the study sample, data were based on objective measurements. Studies comparing BMI data have found that BMI calculations derived from self-reported data are lower than BMI calculations from measured data (Brener et al., 2003b; Elgar et al., 2005;). A study that included high school students from 20 states and Washington D.C. found female students were more likely to underreport their weight, and white students were more likely to over-report their height. When based on self-reported data, female students were more likely to have lower BMIs (Elgar et al., 2005). Thus, the difference between the percentage of participants identified as overweight or obese may be the result of underreported weight or over-reported height values by participants from both the state of Tennessee and national YRBSS survey samples.

Another limitation of the study was the narrow scope of the information gathered by the YRBSS questionnaires used to collect information on dietary and physical activity behaviors. The YRBSS survey is an epidemiologic surveillance system developed by the CDC to monitor health related behaviors among adolescents that lead to health conditions that cause morbidity and mortality in youths and young adults (CDC, 2012c). This limits the information obtained

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about eating and physical activity behaviors. Focused on a limited set of key behaviors, the questionnaire fails to collect information on other important factors such as sedentary behaviors other than television and video games, meal preparation, consumption of processed and fast food, protein sources, sugar sweetened beverages, and serving size.

Given the unique findings about the predictabilty of the TPB and social support in this study, future research should focus on identifying and investigating additional motivational factors associated with healthy eating and physical activity for adolescents. This would include qualitative studies employing methods such as interviews and observations to determine other motivating factors. To capture additional information regarding dietary behaviors, a more detailed questionnaire, such as the Speck Food Frequency Questionnaire(FFQ), might be used. Used in the Team Up for Healthy Living study along with YRBSS questions, to document eating behaviors, this 83-item questionnaire collects data on all major food groups as well as intake of desserts and sweets, and food preparation. For adolescents, the questionnaire has good reliability, with a Cronbach alpha range of .60 to .89 (Speck, Bradley, Harrell, & Belyea, 2001). Both the FFQ and YRBSS questions gather information on foods consumed over the previous 7 days prior to completing the survey. However, the FFQ provides a more detailed record of eating habits, capture both healthful and less healthful foods consumed.

To enhance the predictability of the TPB, it should be paired with another behavioral model that targets characteristics unique to the target population not adequately identified by the TPB. Behaviors that would benefit from this pairing in this population include healthy eating and physical activity. Regression models for both healthy eating and sedentary behavior found less than 10% of the variance in behavior. Although the total model for physical and sedentary behavior produced comparable results, further analysis reveals most of the variance was

associated with physical activity only as the behaviors associated with physical activity

behaviors measured are similar to important characteristics the social support measure used.

Building on the study findings, the TPB construct of PBC emerged as an important

predictor for healthy eating. Since adolescents are at an age where they are becoming more self-

directed, pairing the TPB with a model such as Self-Determination Theory (SDT) may assist in

better identifying motivational factors for these health behaviors. SDT seeks to understand the

process through which a person acquires motivation to both initiate and maintain a new behavior

(Deci & Ryan,1985; Deci & Ryan, 2002; Ryan, Patrick, Deci, & Williams, 2008). Key

constructs of SDT include autonomy, competence, and relatedness. Autonomy assesses internal

motivation to engage in a behavior. Competence is how effective an individual feel in ongoing

interaction with their social environment.   Relatedness refers to how connected an individual

feel to others. In this study, the predictability of subjective norms and social support was divided

by the behavior being assessed. Since subjective was the best predictor for healthy eating, the

addition of competence and relatedness provides another avenue to assess the influence of social

support (Deci & Ryan,1985; Deci & Ryan, 2002; Ryan et al., 2008). In the SDT model,

competence is achieved when relevant supports are available in the environment to facilitate the

behavior. For example, to address the issue of healthy eating for adolescents, a necessary

support to facilitate healthy eating would include appropriate food items being available and

accessible in the environment.

Another behavior model that could enhance the predictability of TPB with adolescents is

the Behavioral Willingness model (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008;

Gibbons & Gerrard, 1995).   Like the TPB, intention plays an important role in predicting

behavior. However, the Behavior Willingness model proposes that not all behaviors are planned;

and this is especially true with young people. Defined as an individual's openness to engage in a risk behavior, the Behavior Willingness model seeks to explain decisions made by young people that are not planned or lack clear intention to perform. This model may be useful in assessing less healthful behaviors of sedentary behaviors and consumption of food items such as sugar sweetened beverages, processed foods, and fast food.

Conclusion

Diet and physical activity are key factors in both the cause and solution to childhood obesity. Although the comparison analysis revealed participants exceeded their state and national counterparts in some health behaviors, the higher percentages of individuals consuming soda daily may contribute to the higher rates of obesity observed. The findings of this study support the use of the TPB to predict health behaviors of adolescents. Like previous studies, the TPB produced varied results based on the behavior of interest. Important findings included the prominent role of attitude as a predictor of both health behaviors as well as the division of subjective norms and social support by health behaviors. Also important was the lack of predictability of PBC with physical activity. Another important finding was the role of social support in facilitating participation in physical activity. Finally, subjective norms produced varied results, emerging as a significant predictor for healthy eating behaviors only. The findings of this study are important to future research and interventions with this population. Interventions that focus on increasing healthier food options and opportunities for physical activity among individuals identified as overweight or obese are the most needed. An important tool to aid in the development and implantation of future interventions is the TPB. The theory identified key factors that are unique to the population and important to consider when designing

and implementing interventions. Its application along with additional constructs like social

support will help to target childhood obesity through effective interventions.

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Appendix A: Independent Variable Questions

Theory of Planned Behavior (TPB) & Social Support

TPB: Attitude Toward Healthy Eating and Physical Activity

The numbers under Questions 35 and 36 represent a range of attitude between the two words listed. Please circle a number best fit your attitude.

35. For me to *be a healthy eater would be…*

Useless					Useful
1	*2*	*3*	*4*	*5*	*6*

Harmful					Beneficial
1	*2*	*3*	*4*	*5*	*6*

Undesirable					Desirable
1	*2*	*3*	*4*	*5*	*6*

Bad					Good
1	*2*	*3*	*4*	*5*	*6*

Unenjoyable					Enjoyable
1	*2*	*3*	*4*	*5*	*6*

Boring					Interesting
1	*2*	*3*	*4*	*5*	*6*

36. For me, being physically active would be ...

Useless					Useful
1	*2*	*3*	*4*	*5*	*6*

Harmful					Beneficial
1	*2*	*3*	*4*	*5*	*6*

Undesirable					Desirable
1	*2*	*3*	*4*	*5*	*6*

Bad					Good
1	*2*	*3*	*4*	*5*	*6*

Unenjoyable					Enjoyable
1	*2*	*3*	*4*	*5*	*6*

Boring					Interesting
1	*2*	*3*	*4*	*5*	*6*

TPB: Perceived Behavioral Control (PBC) Toward Healthy Eating and Physical Activity

PBC for healthy eating will be measured using an index derived from the responses to several questions on healthy eating:

Responses will be rcoded using a 5-point Likert-type scale ranging from - *definitely yes* to *definitely no.*

Please answer questions 37 to *40, supposing you set a goal* to *now eat healthy.*

37. Can you try hard enough at it?

38. Do you have enough self-discipline for it?

39. Do you have enough time to work at it?

40. Are you fortunate enough to prefer healthy food?

Please answer questions 41 to 44, *supposing you set a goal to now be physically active.*

41. Can you try hard enough at it?

42. Do you have enough self-discipline for it?

43. Do you have enough time to work at it?

44. Are you fortunate enough to prefer physically active?

TPB: Subjective Norms: Perceived Group Norms FROM Referent Group (HE & PA)

Students were asked to rate agreement with the statements such as, -my close friends (or other referent groups) are healthy eaters and - my close friends (or other referent groups) expect me to eat healthy using a 5-point Likert-like scale ranging from - *strongly disagree* to *strongly agree.* The Index of Eating Habits of Significant Others (not including - my dose friends/other referent groups expect me to eat healthy) was shown to be moderately reliable with a Cronbach's α of 0.62.

Questions 39 to 46 are about what expectation people have for you on your eating and physical activity

39. My close friends expect me to eat healthy.

40. My classmates expect me to eat healthy.

40. My teachers expect me to eat healthy.

42. My parents expect me to eat healthy.

43. My close friends expect me to be physically active.

44. My classmates expect me to be physically active.

45. My teachers expect me to be physically active.

46. My parents expect me to be physically active.

TPB: Subjective Norms: Perceived Group Norms OF Referent Group (HE & PA)

Questions 47 to 54 are about what expectation people have for you on your eating and physical activity

47. My close friends eat healthy.

48. My classmates at healthy.

49. My teachers eat healthy.

50. My parents eat healthy.

51. My close friends are physically active.

52. My classmates are physically active.

53. My teachers are physically active.

54. My parents are physically active.

Social Support for Healthy Eating and Physical Activity

3-item Scale of Social Support for Healthy Eating and an 8-item Scale of Social Support for

Physical Activity. Study participants were asked to respond to each of the items using a 5-point Likert-type scale ranging from - *strongly disagree* to *strongly agree.*

Questions 15 to 24 *are about your relationship with other people in eating.*

15. There are people I can count on to help me eat healthy.
16. There is no one I can turn to for advice about healthy eating.

17. I am part of a group of people who have the same attitudes about what we should eat.

18. There is no one to take over chores *for* me so I have time to eat healthy.

19. I am good friends with at least one person who values healthy eating.

20. There is someone I can talk to about how to eat healthy.

21. There is a person I can turn to for advice if I find the way I eat is not healthy.

22. There is no one who rewards me for being a healthy eater.

23. There is no one with whom I feel comfortable talking about healthy eating.

24. There are people who will change their schedule to prepare healthy food for me.

Questions 25 to 34 *are about your relationship with other people in physical activity.*

25. There are people I can count on to be physically active with me.
26. There is no one I can turn to for advice about physical activity.

27. I am part of a group of people who have the same attitudes about physical activity.

28. There is no one to take over chores for me so I have time to be physically active.

29. I am good friends with at least one person who values physical activity.

30. There is someone I can talk to about physical activity.

31. There is a person I can turn to for advice if I have a problem with physical activity.

32. There is no one who rewards me for being physically active.

33. There is no one with whom I feel comfortable talking about physical activity.

34. There are people who will change their schedule to be physically active with me.

Youth Risk Behavior Surveillance System (YRBSS)

YRBSS: Dietary Behavior Items

The next 9 questions ask about food you ate or drank during the past seven (7) days. Think about all the meals and snacks you had from the time you got up until you went to bed. Be sure to include food you ate at home, at school, at restaurants, or anywhere else.

1. During the past 7 days, how many times did you drink **100% fruit juices** such as orange juice, apple juice, or grape juice? (Do **not** count punch, Kool-Aid, sports drinks, or other fruit-flavored drinks.)

    ☐ I did not drink 100% fruit juice during the past 7 days

    ☐ 1 to 3 times during the past 7 days

    ☐ 4 to 6 times during the past 7 days

    ☐ 1 time per day

    ☐ 2 times per day

    ☐ 3 times per day

    ☐ 4 or more times per day

2. During the past 7 days, how many times did you eat **fruit**? (Do **not** count fruit juice.)

    ☐ I did not eat fruit during the past 7 days

    ☐ 1 to 3 times during the past 7 days

    ☐ 4 to 6 times during the past 7 days

    ☐ 1 time per day

    ☐ 2 times per day

    ☐ 3 times per day

    ☐ 4 or more times per day

3. During the past 7 days, how many times did you eat **green salad**?

    ☐ I did not eat green salad during the past 7 days

    ☐ 1 to 3 times during the past 7 days

    ☐ 4 to 6 times during the past 7 days

    ☐ 1 time per day

    ☐ 2 times per day

    ☐ 3 times per day

    ☐ 4 or more times per day

4. During the past 7 days, how many times did you eat **potatoes**? (Do **not** count French fries, fried potatoes, or potato chips.)

☐   I did not eat potatoes during the past 7 days

☐   1 to 3 times during the past 7 days

☐   4 to 6 times during the past 7 days

☐   1 time per day

☐   2 times per day

☐   3 times per day

☐   4 or more times per day

5. During the past 7 days, how many times did you eat **carrots**?

☐   I did not eat carrots during the past 7 days

☐   1 to 3 times during the past 7 days

☐   4 to 6 times during the past 7 days

☐   1 time per day

☐   2 times per day

☐   3 times per day

☐   4 or more times per day

6. During the past 7 days, how many times did you eat **other vegetables**? (Do **not** count green salad, potatoes, or carrots.)

☐   I did not eat other vegetables during the past 7 days

☐   1 to 3 times during the past 7 days

☐   4 to 6 times during the past 7 days

☐   1 time per day

☐   2 times per day

☐   3 times per day

☐   4 or more times per day

7. During the past 7 days, how many times did you drink a **can, bottle, or glass of soda or pop**, such as Coke, Pepsi, or Sprite? (Do **not** count diet soda or diet pop.)

☐ I did not drink soda or pop during the past 7 days

☐ 1 to 3 times during the past 7 days

☐ 4 to 6 times during the past 7 days

☐ 1 time per day

☐ 2 times per day

☐ 3 times per day

☐ 4 or more times per day

8. During the past 7 days, how many **glasses of milk** did you drink? (Count the milk you drank in a glass or cup, from a carton, or with cereal. Count the half pint of milk served at school as equal to one glass.)

☐ I did not drink milk during the past 7 days

☐ 1 to 3 glasses during the past 7 days

☐ 4 to 6 glasses during the past 7 days

☐ 1 glass per day

☐ 2 glasses per day

☐ 3 glasses per day

☐ 4 or more glasses per day

9. During the past 7 days, on how many days did you eat **breakfast**?

☐ 0 days

☐ 1 day

☐ 2 days

☐ 3 days

☐ 4 days

☐ 5 days

☐ 6 days

☐ 7 days

YRBSS: Physical Activity & Sedentary Behavior Items

The next 6 questions ask about physical activity.

10. During the past seven (7) days, on how many days were you physically active for a total of **at least 60 minutes per day**? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.)
- ☐   0 days
- ☐   1 day
- ☐   2 days
- ☐   3 days
- ☐   4 days
- ☐   5 days
- ☐   6 days
- ☐   7 days

11. On how many of the past 7 days did you do exercises to **strengthen or tone your muscles**, such as push-ups, sit-ups, or weight lifting?
- ☐   0 days
- ☐   1 day
- ☐   2 days
- ☐   3 days
- ☐   4 days
- ☐   5 days
- ☐   6 days
- ☐   7 days

12. On an average school day, how many hours do you watch TV?
- ☐   I do not watch TV on an average school day
- ☐   Less than 1 hour per day
- ☐   1 hour per day
- ☐   2 hours per day
- ☐   3 hours per day
- ☐   4 hours per day
- ☐   5 or more hours per day

13. On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work? (Include activities such as Xbox, PlayStation, Nintendo DS, iPod touch, Facebook, and the Internet.)

☐ I do not play video or computer games or use a computer for something that is not school work

☐ Less than 1 hour per day

☐ 1 hour per day

☐ 2 hours per day

☐ 3 hours per day

☐ 4 hours per day

☐ 5 or more hours per day

14. In an average week when you are in school, on how many days do you go to physical education (PE) classes?

☐ 0 days

☐ 1 day

☐ 2 days

☐ 3 days

☐ 4 days

☐ 5 days

15. During the past 12 months, on how many sports teams did you play? (Count any teams run by your school or community groups.)

☐ 0 teams

☐ 1 team

☐ 2 teams

☐ 3 or more teams

VITA

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