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Risks, Protections, and Weight Status Among Springdale High School Students

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Risks, Protections, and Weight Status Among Springdale High School Students

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Abstract

This study examined the role of sociodemographic characteristics and various social factors in determining BMI among adolescent high school students. In a sample of 1,493 students at a public high school in Springdale, Arkansas, disparities in body mass index across race/ethnicity, gender, and social class were assessed. This project also examined risk and protective factors in the individual, peer, and family domains as they contributed to weight status outcomes and disparities. Using a quantitative approach, BMI outcomes were examined in a four-step multiple regression model, considering both main effects and interactions of race/ethnicity, class, and gender, as well as risk and protective factors. Statistical analyses revealed a significant impact of age and gender on BMI, and an intersectional effect of gender and social class. Additionally, self-esteem and frequent family meals were identified as significant protective factors related to lower BMI scores.

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Dedication

This thesis is dedicated to all families and communities fighting to end social inequality and to give their children a brighter future.

Table of Contents

CHAPTER ONE

INTRODUCTION

In some historical contexts, a high body weight was often an indicator of wealth and

fortune—but in contemporary society being overweight, in most cases, is associated with low

socioeconomic status and poor health (Alaimo, Olson, & Frongillo, 2001; Dinour, Bergen &

Yeh, 2007; Franklin et al., 2012). Particularly among children and adolescents, rates of obesity

are high and studies find that children from disadvantaged families are more likely to be

overweight/obese than those from more affluent families (Alaimo, Olson, & Frongillo, 2001;

Casey et al., 2006). In addition, this effect seems to be in part a function of race, ethnicity, and

other social factors (Alaimo, Olson, & Frongillo, 2001; Casey et al., 2006; Gordon-Larsen, Adair

& Popkin, 2003; Ogden et al., 2014; Townsend et al., 2001; Van Hook & Baker, 2010).

In the current study, being overweight or obese is seen as the result of social

circumstances and conditions rather than personal choice, to which weight is often attributed. We

believe that one's social environment produces risks and protections for weight status outcomes

at the personal as well as the environmental level. Furthermore, we anticipate these risk and

protective factors operate differently for youth of different racial, ethnic, and socioeconomic

backgrounds as well as gender.

A. Background

Weight status outcomes vary significantly across racial and ethnic groups. Though there

is a substantial body of research on racial disparities in weight outcomes, the clear majority of

these studies focus largely on disparities between Black and White individuals or neighborhoods

(Boardman et al., 2005; Crespi et al., 2015). Meanwhile, the weight status concerns of other

marginalized racial and ethnic groups remain greatly underrepresented in the literature. Two such groups are the Hispanic and Pacific Islander populations.

Some recent research indicates that Hispanic ethnicity is associated with higher weight status in youth at the individual and at the school level compared with non-Hispanic youth (Hauser et al., 2013; Rundle et al., 2012). In a report published on obesity rates in the United States for 2011-2012, Hispanic children ages 2-19 years had higher rates of overweight and obesity than any other racial/ethnic category, with 38.9 percent of Hispanic youth meeting criteria for overweight or obese status (Ogden et al., 2014). Given these findings, it seems important that further research be done on the weight disparities between Hispanic and non-Hispanic youth. This research must reach beyond descriptive statistics and begin to investigate the specific risks and protections impacting Hispanic youth health outcomes.

Another population that has been affected by the obesity epidemic is the Pacific Islander population. The problem of overweight/obese status among Pacific Islanders is misrepresented in the literature primarily because Pacific Islanders are often undifferentiated from Asian-Americans in research settings although the two populations have very different health needs and risks (Frisbie, Cho, & Hummer, 2001; Srinivasan & Guillermo, 2000). When Pacific Islanders are disaggregated from Asian Americans, studies find they experience high rates of obesity (Grandinetti et al., 1999; Hawaii Department of Health, 2011; McCubbin, 2012; McGarvey, 1991). Furthermore, it is sometimes important to disaggregate Pacific Islanders into subpopulations, as different groups of Pacific Islanders can have unique health concerns and needs as well. For example, whereas immigration can sometimes play a protective role against negative health outcomes like obesity, people immigrating to the U.S. from the Marshall Islands do not experience a protective effect because obesity is an even greater epidemic in their native

2

land than in the United States. Due to their dependency on Western foods, the Marshallese consume high amounts of fat and their rates of overweight and obesity are extremely high. Fifty percent of men and 60 percent of women living in the Marshall Islands are overweight or obese (Gittelsohn et al., 2003). Combined with the health disadvantages plaguing their home country, the economic and cultural challenges facing Marshallese immigrants in the U.S. do not make for a promising health profile (McElfish, 2016).

Clearly, research is needed to explore the complex set of risk factors among Marshallese and other Pacific Islanders. The present study aims to identify specific risk factors by analyzing BMI disparities in a sample of high school students across three racial and ethnic categories, including Marshallese, implementing a risk and protective factors framework. The study utilizes a sample of high school students from a Northwest Arkansas school where the most prevalent minority groups are Hispanic and Marshallese students (Fitzpatrick, 2015).

In addition to race and ethnicity, other social factors which have been known to influence weight status are gender and socioeconomic position. Though results are mixed, many studies have found that weight status varies significantly between males and females (Hernandez & Pressler, 2014; Van Hook & Baker, 2010). Furthermore, it seems that gender sometimes interacts with race and ethnicity. Specifically, studies find that non-White females tend to experience the greatest risk for poor weight status outcomes (Gordon-Larsen, Adair & Popkin, 2003; Rundle et al., 2012; Hernandez & Pressler, 2014). Low socioeconomic status has also been shown to serve as a risk factor for overweight or obese status, but whether this risk operates differently when race, ethnicity, and gender are accounted for is not clear (Demment, Haas, & Olson, 2014; Goodman, Slap, & Huang, 2009). In the present study, we are interested in examining the

intersection of racial/ethnic identity, gender, and social class as they apply to weight status and health outcomes.

The goal of this study is to analyze individual and environmental risk factors as well as protective factors to uncover which of these mechanisms are correlated with Body Mass Index (BMI) scores for Hispanic and Marshallese students compared to the overall student population. This research project stands to make an important contribution to the bodies of literature on Pacific Islander and Hispanic youth health concerns in the United States. Currently, there is some evidence that these populations experience elevated levels of obesity and obesity-related health issues, but more research is needed, particularly dealing with adolescents. More research is also needed to determine how gender and social class interact with Hispanic and Marshallese identity, which will be examined in this study. Most importantly, this study will not only attempt to identify disparities in health, but to pinpoint the specific social characteristics and circumstances which contribute to this inequality. This could have important policy implications in the fight against childhood obesity in the United States.

B. Significance

Over the past several decades, the prevalence of overweight status and obesity in the United States has risen to epidemic levels (Fryar, Carroll, & Ogden, 2014; Wang & Beydoun, 2007). Today, 68.5 percent of adults are overweight or obese and 31.8 percent of children are overweight or obese— more than double the proportions in the 1970's (Fryar, Carroll, & Ogden, 2014; Ogden et al., 2014). This means that these Americans are also at risk for the many comorbid conditions that can accompany being overweight or obese, including diabetes, hypertension, hypercholesterolemia, cardiovascular disease, sleep apnea, asthma, fatty liver disease, cancer, and others. (Bouldin et al., 2006; Pulgaron & Delamater, 2014; Van Itallie,

1985). As recent as the 1990's, a pediatric case of Type 2 Diabetes was unheard of, and today up to 45 percent of diagnosed pediatric cases of diabetes are Type 2 diagnoses (American Diabetes Association, 2000; Kaufman, 2002). Levels of non-communicable disease in children are especially concerning when one considers the evidence that weight status in childhood is highly predictive of health outcomes in later adulthood (Guo et al., 2002; Pulgaron & Delamater, 2014). Studying risks and protections for detrimental health outcomes in young people is particularly important because interventions and preventative measures taken in childhood could potentially impact the likelihood of developing weight-related health problems later in life.

In addition to physical health consequences, overweight and obese status are tied to a social stigma deeply embedded in modern American culture. A strong sense of blame is placed on overweight and obese individuals, attributing their weight to poor choices and lack of self-control (Brownell, 2005; Puhl & Brownell, 2001). We argue the contrary, that weight status is a by-product of one's social environment and status, of factors mostly *outside* the individual's control. In our model, we argue that risks and protections available to a person influence his or her likelihood of being overweight or obese. For adolescents, this includes not only personal characteristics, but also other risks and protections found at the family level and in the youth's social network.

The goal of this study is to identify factors that are correlated with an increase in BMI scores among adolescents. We also want to know what factors, if any, serve as protective mechanisms for adolescents in the fight against unhealthy weight outcomes. This study will analyze BMI outcomes in terms of risks and protections, while acknowledging health outcomes as by-products of many social influences. We will analyze risk factors at the individual level, such as depressive symptomatology, as well as environmental risk factors, such as food

5

insecurity in the family. Protective factors also exist at both the individual and environmental levels, for example self-esteem and having a large social network. Additionally, we anticipate that weight status will differ across racial and ethnic groups, gender, and social class, and that risk and protection will vary as well. Specifically, we expect that adolescents in marginalized racial/ethnic groups will experience a greater net risk compared to those adolescents who are not members of marginalized racial/ethnic groups, and thus will have higher BMI scores. We also expect that females and students who qualify for free and reduced lunch will have higher BMI scores than other students.

It is important to note that although weight is only one facet of a person's well-being, it serves as an important indicator of overall health. Many people in the normal BMI range are also at risk for similar health issues as those experienced by overweight people, and for similar reasons (Davis et al., 2004; Srinivasan & Guillermo, 2000). Though we cannot measure those internal health issues here, our findings about weight status inequality may lead scientists in the medical field to begin asking questions about other manifestations of health inequality. The disparities in BMI and weight status outcomes across racial and ethnic boundaries, gender categories, and social class stand for a larger issue; inequality in health and well-being for marginalized peoples in the United States.

THEORY AND EVIDENCE

Health and Social Status

Though it can be challenging to think of our health as a product of environment and social circumstances beyond our control, health is, and has always been, a direct product of these things. Moreover, health outcomes—wellness, injury, illness—are unequal and differ across social identities. Socioeconomic status, race, ethnicity, and gender play complicated and significant roles in the understanding of our well-being. Although the specific names we associate with illness may change over time, the social forces operating behind human health remain constant.

Barr (2014) notes that while the progression of healthcare may change the nature of health problems, it has done little to narrow the social disparity between the healthy and the unhealthy:

> In 1900 a poor seamstress was more likely to die from tuberculosis than was the son of an affluent family. In 2000 a poor seamstress was more likely to contract high blood pressure and arthritis, to have her infant die before its first birthday, and herself to die earlier than the son of an affluent family. While the circumstances… have changed dramatically over the hundred years… with countless medical advances, their health status relative to each other has changed little. (p. 10).

A century ago, the most feared health conditions were infectious diseases. Today, leading causes of death include cancer, diabetes and obesity-related conditions. Although the obesity epidemic in America is a recent development, the inequality underlying this epidemic has existed for over a century. Weight status is simply a vessel through which social inequality manifests itself. Where this inequality was once visible through the prevalence of infectious diseases such as tuberculosis, it now presents itself in the form of overweight status and the health of overweight

versus normal weight people. In the subsequent review of current literature on weight status outcomes, we can easily see how health differs for individuals depending on their place in the social hierarchy.

When we consider weight status as a manifestation of social inequality, it is not surprising that obesity rates are high and socially stratified in places like Arkansas, where social inequality is especially visible. When it comes to prevalence of adult and child obesity, diabetes, and hypertension, Arkansas ranks among the top 10 states in America (Trust for America's Health and Robert Wood Johnson Foundation, 2016). Unsurprisingly, Arkansas also ranks among the worst-performing states in measures of resident food security, higher education attainment, assets and savings, and overall financial stability (Center for American Progress, 2016). Additionally, Arkansas has some of the largest socioeconomic gaps between Whites and racial/ethnic minorities when compared with other states (Wheeler, 2014). In this study, we focus on Springdale, Arkansas, where we find the largest populations of Hispanic and Pacific Islander peoples in the state. These are two minority groups who suffer disproportionately from overweight and obese status, as well as Type II Diabetes and many other complications that are comorbid with obesity (Aluli, 1991; Davis et al., 2004; Grandinetti et al., 1999; Hauser et al., 2013; McGarvey, 1991; Rundle et al., 2012).

The Intersectionality of Race, Ethnicity, Class, and Gender in Weight Status Outcomes

As stated earlier, socioeconomic disparities in weight status vary greatly by race, ethnicity and gender (Crespi et al., 2015; Gordon-Larsen, Adair & Popkin, 2003; Hernandez & Pressler, 2014; Miech et al., 2006; Miyazaki & Stack, 2015; Rundle et al., 2012; Schmeer, 2010; Singh et al., 2008; Wang & Beydoun, 2007). Whether data is collected from a large national survey or a more local sample, the results show complex interactions of social risks and

resources over a backdrop of demographic differences. Consistently, racial and ethnic minorities experience greater risk for undesirable weight status outcomes, and seem to experience the disadvantage of lower socioeconomic status more strongly than their non-Hispanic White counterparts (Franklin et al., 1991; Singh et al., 2008; Singh, Siahpush, & Kogan, 2010). Additionally, many studies have found that socioeconomic disparities in weight are disproportionately unfavorable toward women and young girls (Dinour, Bergen & Yeh, 2007; Franklin et al., 1991; Townsend et al., 2001). Some findings also indicate that certain resources may help buffer against poor weight status outcomes for females specifically (Goldfield et al., 2011). With this in mind, the current study uses an intersectional lens to examine how risk and protective factors operate differently through race, ethnicity, gender, and social class.

Intersectionality is a theory which metaphorically explains social disadvantages stemming from discrimination and various manifestations of inequality. In other words, this theory is used to discuss ways in which social characteristics such as race, class, and gender *intersect* with one another. The basis for this theory is outlined by Kimberlé Crenshaw (1989) in her critique of an antidiscrimination doctrine:

> Consider an analogy to traffic in an intersection, coming and going in all four directions. Discrimination, like traffic through an intersection, may flow in one direction, and it may flow in another. If an accident happens in an intersection, it can be caused by cars traveling from any number of directions and, sometimes, from all of them. Similarly, if a Black woman is harmed because she is in the intersection, her injury could result from sex discrimination or race discrimination. (p. 149)

According to intersectionality, inequalities intersect like roads on a map. For individuals who belong to more than one marginalized social group, their experience of discrimination and inequality is unique. When reviewing the literature on risk and protective factors in weight status outcomes, it is clear that intersectionality has a presence in weight disparities.

For the purposes of this study, intersectionality will be used to analyze the complex interactions between gender, social class, and the racial/ethnic identities of Hispanic and Marshallese students. Based on existing literature we expect that risks and protections may operate differently for students whose identities vary along these demographics. Students who are Hispanic or Marshallese, are female, and qualify for free and reduced lunch could potentially could potentially experience intersectional oppression from three directions and we expect these students will have the highest net risk when risk and protective factors are controlled for.

Race and Ethnicity

Weight status literature consistently finds that racial and ethnic minorities are disproportionately at risk for being overweight and/or obese. Furthermore, socioeconomic disparities in weight status tend to be more pronounced for certain racial and ethnic minorities. To date, most of the research on these health disparities focuses on the disadvantage for Black individuals and their families. However, other racial/ethnic minorities, such as Hispanic/Latino and Pacific Islanders, are also disproportionately affected by obesity and health disparities, and more work is needed to determine how these minorities experience weight status inequality (Aluli, 1991; Davis et al., 2004; Grandinetti et al., 1999; Hauser et al., 2013; McGarvey, 1991; Rundle et al., 2012).

The proposed study of a sample of high school students from Springdale, Arkansas, will attempt to examine the role of race and ethnicity in weight status outcomes, focusing on Hispanic and Marshallese populations. More specifically, this study examines the interaction of race and ethnicity with a number of other social risks and resources. We anticipate that non-white Hispanic and Marshallese identities will be associated with a greater likelihood of being

overweight and/or obese. While resources such as self-esteem may mediate this relationship, we do not expect that the disadvantage of racial/ethnic status to disappear entirely.

Gender

In addition to racial and ethnic disadvantage, we anticipate that weight status will vary based on gender. More specifically, we expect that the risks posed by racial/ethnic identity and other social characteristics will operate differently for males and females. Based on extant literature, we expect that disparities in weight status will be more pronounced, and outcomes less favorable, for females (Martin & Ferris, 2007).

The literature also suggests that gender may interact with racial/ethnic identity such that females identifying with marginalized racial or ethnic groups will experience the least favorable outcomes (Gordon-Larsen, Adair & Popkin, 2003; Rundle et al., 2012; Hernandez & Pressler, 2014). Though current intersectional studies on weight status focus largely on disparities between African-American and Caucasian persons, we believe similar phenomena will apply to the marginalized racial/ethnic groups in our study; Hispanic and Marshallese students. From a framework of intersectionality, we anticipate that the net risk for overweight and obesity will be highest for Hispanic and Marshallese females.

Social Class

Research has consistently shown that poverty and low socioeconomic position are tied to a myriad of undesirable health outcomes (e.g. Fitzpatrick, 2013; Kosa & Zola, 1975; Schulz & Mullings, 2006). Among these is unhealthy weight status which, for wealthy nations such as the United States, means being overweight and obese (Barriuso et al., 2015). The connection between poverty and obesity is especially concerning for children and adolescents, whose socioeconomic position as youth often can be predictive of their health in adulthood.

Since prevalence of adolescent overweight and obesity began rising around three decades ago, the literature on weight status disparities in this age group has grown substantially. Studies vary greatly in methodology, levels of data, and areas of focus, and results tend to be complicated with interactions of age, race, class, gender, and other variables. In general, household income along with parental education and occupation status tend to be inversely related to overweight and obesity for adolescents and young adults (Goodman, 1999; Singh, Siahpush, & Kogan, 2010). However, almost all studies examining such disparities note that they operate differently across race and gender groups (Crespi et al., 2015; Gordon-Larsen, Adair & Popkin, 2003; Hernandez & Pressler, 2014; Miech et al., 2006; Miyazaki & Stack, 2015; Rundle et al., 2012; Schmeer, 2010; Singh et al., 2008).

Longitudinal research finds that children who move into low-income status during childhood are more likely to be obese compared with children who were never low-income, and children who remain low-income throughout their childhood are more likely to maintain overweight status whereas children who are upwardly mobile do not differ from children who never experience low-income status (Demment, Haas, & Olson, 2014). Another longitudinal study found that the socioeconomic disparities in weight status increase throughout adolescence, such that the impact of poverty on overweight risk is even greater for 17-year-olds compared to 15-year-olds (Miech et al., 2006). It also appears that the socioeconomic gap in weight status has grown wider over time; from 2003 to 2007, obesity rates increased in all income levels, but the increase was more dramatic for low-income groups than for higher income categories (Singh, Siahpush, & Kogan, 2010).

One explanation for the relationship between low socioeconomic position and overweight/obese status deals with the neighborhood and its built environment. Childhood and

adolescent obesity is much higher in neighborhoods that are considered unsafe and have no access to sidewalks, parks, or recreation centers (Beech et al., 2011; Singh, Siahpush, & Kogan, 2010). Children from low-SES families tend to live in these neighborhoods, and their freedom to engage in healthy amounts of physical activity is seriously inhibited, placing them at risk for high weight status.

In her research on child-rearing, Annette Lareau finds that middle class families tend to nurture their children's development through organized activities, where lower-class children tend to spend more time "hanging out" and are given more independence than middle-class children (Lareau, 2011). It may be that the middle-class style of parenting fosters the development of healthy habits which can protect children against obesity and poor health as they grow older. Additionally, low-SES neighborhoods are often located in areas where the accessibility and affordability of healthy food is little to none, otherwise known as food deserts (Gartin, 2015). Environmental obstacles to outdoor recreation and physical activity, in combination with low accessibility to healthy foods, result in large socioeconomic disparities in weight status outcomes among children and adolescents.

In the present study, it is expected that social class may play a significant role in determining weight status outcomes. Viewing risks and protections through an intersectional lens, we expect that social status may intersect with gender and racial/ethnic identity. Thus, the disadvantage of low social status may be more pronounced for minorities and for females. Accordingly, the risks amplifying this disadvantage and the protections buffering it may differ as well.

A Risk and Protective Factors Framework

The proposed study is grounded in a framework of risks and protections. This theoretical approach has historically been used to examine risk factors for and protections against negative health behaviors and outcomes, and it serves as an ideal model with which to frame the issue of adolescent weight status (Fitzpatrick, 2011; Fitzpatrick, Willis & O'Connor, 2014). Through the risk and protective factors framework, our aim is to identify social circumstances which pose specific risks to young people for unwanted weight status outcomes, and protective elements which can counteract these risks. Protective factors can serve one of two functions in this model; they can mediate the negative impact of risk factors on the health-compromising outcome, or they can have a buffering effect, reducing the negative impact for certain youths and amplifying the impact for others who lack these protective resources (Fitzpatrick, 1997). In our analysis, an example of such a protective factor is self-esteem. For some students, higher levels of self-esteem may mediate the risk posed by low socioeconomic status. For other students with low self-esteem, the risk posed by lower SES would be more salient to negative health outcomes.

It is important to note the multilevel nature of risk and protective factors theory. According to Fitzpatrick and LaGory, "the salience of certain risk and protective factors varies across individuals, families, schools and communities" (2011: 94). In a risks and protections model, a negative outcome is attributed not to choice but to some circumstantial factors outside of an individual's control (Fitzpatrick, 2011). These factors can be qualities of the individual or of the broader social environment. For example, depression would be considered an individual risk factor, but the entire family--possibly the community, typically experiences food insecurity and poverty though they may impact individual outcomes. Protective factors at the environmental level would include things such as frequent family meals or having a large social

network. In this framework, health outcomes are the net result of a complex interaction between any number of risk and protective factors operating at the individual and environmental levels. We analyze risks and protections that stem from the student's individual self, their peer network, and their family.

Individual Risk and Protective Factors

A modest body of research exists on the relationship between individual factors such as depression and self-esteem, and weight status outcomes among adolescents. One study by Fitzpatrick and colleagues (2014) examined individual circumstance and resource variables as determinants of overweight/obesity among a sample of 5th-7th grade early adolescents. The study reports that CES-D and perceived social class significantly impacted one's likelihood of being overweight/obese. Higher levels of depression were associated with being overweight/obese status, and students who perceived themselves as being middle or lower class were more likely to be overweight/obese than students who perceived themselves as upper-class (Fitzpatrick, Willis, & O'Connor, 2014). While this may in part be related to the impact of actual socioeconomic status, it is also related to students' perception of social status relative to their classmates.

In this same study, certain individual resources seemed to lower the likelihood of being overweight or obese and mediated the effects of the individual circumstances discussed above. Higher self-esteem, greater number of friends, and a more in-depth relationship with those friends all appeared to be protective effects against overweight/obese status (Fitzpatrick, Willis, & O'Connor, 2014). These findings notably imply that breadth and depth of social networks play important roles in health outcomes. However, the preliminary nature of these findings, as noted by the authors, should be heeded. Further, more elaborate examination of personal circumstances

and resources is needed to establish the salience of these risk and protective factors in weight status outcomes.

Risks and Protections in the Social Environment

If we adopt the belief that a child's health is shaped by his or her social environment, then we must consider the role of the family in the construction of health. From a risk and protective factors framework, "the earliest and most enduring influence in the socialization of youth is the family" (Fitzpatrick, 1997: 133). A study in Canada found that more frequent family meals is associated with lower BMI in adolescent females, but not in males, controlling for age, parental education, and snack-food consumption (Goldfield et al., 2011). This is despite the fact that males reported having more frequent family meals than females. These findings are in agreement with studies that found frequent family meals help adolescent females to experience positive emotions and feel more connected to their families, ultimately leading to positive health outcomes (Fairborn et al., 1997; Franko et al., 2008; Hodges, Cochrane, & Bremerton, 1998; Neumark-Sztainer et al., 2004). Hauser et al. (2013) also found that frequent family dinners and child vitamin consumption were protective factors, halving a child's risk for overweight status. In another study, having siblings appeared to be a protective effect against overweight status (Moens et al., 2009).

More research is needed on the role of family characteristics in predicting adolescent weight status outcomes. Current literature on families and weight status largely focuses on the "rules" that families enforce regarding meal times and snacking, and the ways in which parents try to talk to their children about health (Berge et al., 2015; Hauser, et al. 2013). When it comes to the social environment, more important considerations involve the social support offered by the family, and the structural disadvantages or resources the child experiences by way of his or

her family circumstances. For example, does the structure of the family determine a child's likelihood of being unhealthy? Does living in a two-parent household serve as a protective factor against unwanted health outcomes? These are questions which future studies should continue to address. Another way the family can influence one's risk for obesity is through the family-level social disadvantage. Some literature suggests that a child whose family suffers from food insecurity may experience increased risk for overweight and obese status (Barriuso et al., 2015).

The correlation between food insecurity and being overweight or obese is for many, a puzzling one, because this relationship operates differently across time and space. Throughout history and in many places today, food insecurity has been associated with lower than normal body weight (Tanumihardjo et al., 2007). This makes sense to anyone with a basic understanding of the human body; if the body cannot take in as many calories as it needs, it draws its energy from body fat, and thus when someone is unable to feed themselves regularly, they are likely to lose weight. However, in many wealthy countries today, food insecurity is associated with *overweight* status, a relationship which authors have begun to refer to as the hunger-obesity paradox (Barriuso et al., 2015; Scheier, 2005). Increasingly, studies are finding that, net of confounding demographic and lifestyle variables, food insecurity is strongly related to one's likelihood of being overweight or obese, especially in females (Alaimo, Olson, & Frongillo, 2001; Casey et al., 2006; Dinour, Bergen & Yeh, 2007; Franklin et al., 2012; Larson & Story, 2011; Martin & Ferris, 2007; Townsend et al., 2001; Willis & Fitzpatrick, 2016).

Some studies find that overweight status is not strongly related to total caloric intake, but rather to consumption of sugar-sweetened beverages and foods dense in fat and sugar compared with fruits and vegetables (Ogden et al., 2012). In other words, weight is not necessarily a product of how much we eat, but rather *what* we eat. Food insecurity, by definition, requires a

deficiency in "enough food for an active, healthy life" (Coleman-Jensen et al., 2011:2). Therefore, someone who is food insecure may be eating the types of energy-dense foods that lead to excess weight gain, while not actually consuming *enough* food and nutrients to maintain an active and healthy lifestyle. In fact, some individuals and families who suffer from food insecurity opt to purchase high-fat foods to prevent hunger when they cannot afford larger quantities of healthier foods (Scheier, 2005; Tanumihardjo et al., 2007).

There is evidence suggesting that efforts to alleviate food insecurity may have a desirable impact on the weight status outcomes of children. Several studies have found that children and adults from households who participate in SNAP and similar programs, when compared with eligible non-participants, have a decreased probability of overweight and obese status (Burgstahler, Gundersen, & Garasky 2012; Hoynes, Schanzenback, & Almond, 2012; Jones et al., 2003; Schmeiser, 2012). Researchers theorize that the aid provided by programs such as SNAP allow families the choice to purchase healthy foods that they would be unable to afford without assistance, thus leading to better health outcomes for these families (Gundersen, 2016). In attempts to facilitate this health-positive phenomenon, some policy initiatives at the state and national levels have been proposed to restrict the foods that can be purchased with SNAP benefits to only those considered healthy. However, the issue of food stamp restrictions remains hotly debated, and more research is needed to determine whether these initiatives would be effective (Gunderson, 2016).

Research Questions

As demonstrated in the literature review, a complex intersection of demographics can influence one's risk for being being overweight or obese. These demographic identities serve as a backdrop for the individual and environmental risks and protections which can also impact

18

one's likelihood of being overweight, such as depression and social capital. Considering these risk and protective factors through an intersectional perspective, this study seeks to examine the complex issue of weight status in a sample of high school students in Northwest Arkansas.

The central research questions on which we base our analyses are aimed at filling gaps in the literature on the interaction of social risks and protections and their interrelationships with weight status outcomes, specifically for Hispanic and Marshallese populations. Although racial and ethnic inequality is clearly important to weight status outcomes, little is known about the specific risks and protections contributing to Hispanic and Marshallese weight status outcomes. Thus, our central research questions are as follows:

1) Do BMI scores differ for students who are Hispanic or Marshallese compared with their non-Hispanic, non-Marshallese peers?

2) Do BMI scores differ by gender?

3) Do BMI scores differ by social class?

4) Are the effects of race and ethnicity, gender, and social class on BMI scores intersectional?

5) Are risk factors such as depressive symptoms, negative student behaviors, and food insecurity associated with increased BMI scores?

6) Do protective factors such as high self-esteem, social capital, and family meals mediate/moderate the risk for high BMI scores?

To answer these research questions, we analyzed survey data collected in fall of 2015 (n = 1493) 10th-12th graders from Springdale High School in Springdale, Arkansas (Fitzpatrick, 2015). This data offers unique insights into the health risks posed disproportionately among Hispanic and Marshallese adolescents.

CHAPTER THREE

DATA AND METHODS

The current study is based on data collected in fall of 2015 from a sample of 10th-12th grade students (n=1493) at Springdale High School in Northwest Arkansas (Fitzpatrick, 2015). The goal of this study is to identify various risk and protective factors for being overweight or obese, and to examine how they operate differently across race, ethnicity, gender, and social class. This chapter outlines the procedure used to collect the data, a description of the sample, and the measurement of key variables in the analysis as well as reasons for including these variables.

Design

Surveys were administered to 10th-12th grade students by their teachers, and all students were eligible to complete the survey as long as their classroom participated. Teachers were asked to limit their involvement during the administration of the questionnaire so as to optimize students' comfort in answering questions with honesty. A Spanish version of the survey was provided to all students who requested one. Students were asked questions about their demographic characteristics, family structure, social class, friend networks, health behaviors, risk behaviors, food insecurity, and mental and physical well-being. The goal of this survey was to assess variables related to health in a representative sample of high school students in the Springdale school district.

Sample

The sampling frame for this survey consisted of all 10th-12th grade students enrolled at Springdale High School. Excluding 116 students who were unable to participate at the time of the survey, the eligible number of students was 2,032. Of these eligible students, approximately

20

22 percent refused to participate or were absent during the time of the survey, yielding a response rate of about 78 percent. The final sample was composed of 53 percent Hispanic/Latino and 14 percent Marshallese students. We believe this sample to be representative of the Springdale school district, where Hispanic/Latino and Marshallese are the most prominent minority groups. Based on BMI measurements taken from self-reported height and weight, about 23 percent of the students in the sample were overweight and 15 percent were obese based on The Centers for Disease Control standards. The overall percentage of students exhibiting unhealthy weight status in the sample is higher than the national average among adolescents which stands at 32 percent combined overweight and obese (Ogden et al., 2014).

Measurement

In this study, we examine the influence of demographic and circumstantial variables such as social class and accessibility to food on the BMI outcomes of high school students, and how they operate differently across sociodemographic groups. Our analysis explores risk and protective factors in the individual domain, such as depression and self-esteem, as well as in the social domain, including variables related to the family, school, and peer networks. The following sections discuss the measurement of the variables used in the analysis.

Weight Status

Weight status is the dependent variable in this analysis and is measured using BMI calculations based on students' self-reported height and weight. BMI is calculated by squaring the value of one's weight in kilograms divided by his or her height in meters, and is assessed based on distributions specific to age and gender (Centers for Disease Control, 2010). Among student populations, it is found that self-reported height and weight provide accurate assessments of weight status (Goodman, 1999; Kubik, Lytle, & Story 2005). The Centers for Disease Control

categorizes BMI into four groups of weight status estimated on gender and age (Centers for Disease Control, 2010). However, for our purposes, we use a continuous BMI variable in order to capture relationships along the entire distribution of BMI. Thus, we are able to execute a block regression model while maintaining information that might be lost if we were to recode this data into a dichotomous or categorical variable.

Sociodemographic Variables

Race and Ethnicity

The literature on weight status outcomes among adolescents indicates that demographics such as race and ethnicity can strongly influence one's likelihood of being overweight or obese (Davis et al., 2004; Fryar, Carroll, & Ogden et al., 2014; Gordon-Larsen, Adair & Popkin, 2003). In Springdale, Arkansas, there is a strong presence of Hispanic/Latino as well as Marshallese, two minority groups who have been shown to experience higher rates of overweight and obesity compared with the general population (Ahlgren, Yamada & Wong, 2014; Gittelsohn et al,. 2003; Ogden, et al., 2014). Our study aims to explore the ways in which risks and protections for weight status play out differently for Hispanic and Marshallese students compared with non-Hispanic, non-Marshallese students. We included two variables in our survey measuring ethnicity. Students were asked, "Are you of Hispanic, Latino, or Spanish origin?" and "Are you Marshallese?" Each item was coded yes =1.

Gender

As discussed in the previous chapter, much of the current research on adolescent weight status finds that risks and protections for overweight/obese status are different for males and females (Goldfield et al., 2011). Gender in itself can be a risk factor, with overall rates of overweight and obese status differing between boys and girls (Martin & Ferris, 2007; Rundle et

al. 2012). However, it is also possible that girls are influenced disproportionately by certain risk and protective factors, such as socioeconomic status or frequent family meals, compared with boys (Dinour, Bergen, & Yeh, 2007; Franklin et al., 1991; Goldfield et al., 2011; Hernandez & Pressler, 2014; Schmeer, 2010; Townsend et al., 2001). Therefore, gender was included among the important demographic variables in our analysis. Gender was measured as a dichotomous variable in which students were asked, "What is your sex?" Responses were coded 1 = female.

Social Class

Social class can often be a risk factor related to one's likelihood of being overweight or obese. While our instrument included several different measures related to social class, for the purposes of this study we use free and reduced lunch. Students who receive free and reduced lunch, a form of government assistance, demonstrate identifiable financial disadvantage. Students were asked how they pay for their lunch, and a dummy variable was created with 0=Not Receiving and 1=Receiving free or reduced-price lunches at school. This variable represents a proxy for social class in our analysis.

Age

The Centers for Disease Control assesses child and teen weight status using gender- and age-specific BMI distributions (Centers for Disease Control, 2010). In this sample, the age range is much smaller than that of the CDC's data since this study is concerned with high school students only. In order to account for the effects of age within this range, age has been included in the demographic variables controlled for in the first block of the regression. This variable was measured simply by asking students their age in years, and no coding was necessary.

Risk Factors

Depressive Symptomatology (Individual)

A measure of depressive symptomatology was included as a potential risk factor for unwanted weight status outcomes. This variable was measured with a shortened version of the 20-item Center for Epidemiological Studies for Depression (CES-D) Scale which has been used extensively to measure depressive symptoms in adolescents (Radloff, 1977). For our purposes, eight items from the CES-D scale were used to assess depressive symptomatology in our sample of high school students. The scale was reliable with a Cronbach's alpha = .92 (Mean = 19.59; S.D. = 15.84). Students were asked how often over the past couple weeks they had felt sad, lonely, worrisome, or had trouble sleeping, getting up in the morning, etc. Possible responses ranged from 0 (Less than one day) to 3 (five to seven days) for each item. The shortened CES-D scale used here was weighted by 2.5 (the number of items in the original measure divided by the number of items in our shortened measure) for comparison with studies using the full 20-item questionnaire. From a risk and protective factors framework, psychological distress poses risk to an individual's health (Ensel & Lin, 1991). We anticipate that students with higher CES-D scores will report higher BMI scores.

Student Risk (Peers)

A scale for student risk was constructed and consisted of four items asking students how many times, in the past month, they had: 1) Been to the principal's office; 2) Cut or skipped school without an excuse; 3) Been in a physical fight; and 4) Been threatened by someone. Students could choose from five possible responses ranging from None = 0 to Six or More times = 4. The scale was moderately reliable with a Cronbach's alpha = .61 (Mean =1.43; S.D. = 2.26). In our model, this scale for student risk represents a category of social stressors which may

impact a student's psychological and physical well-being. We theorize that students who are subject to social stressors are more likely to experience undesirable health outcomes such as overweight or obese status.

Food Insecurity (Family)

Five items from the USDA food security module were used to measure food insecurity in this survey. Students were asked, "Thinking about your experience with food over the past year… Did you worry that food at home would run out before your family got money to buy more? Did the food that your family bought run out and you didn't have money to get more? How often were you not able to eat a balanced meal because your family didn't have enough money to buy food? Did your meals include a few kinds of cheap foods because your family was running out of money to buy food?" and, "Have your meals been smaller because your family didn't have enough money to buy food?" For each of these questions students had the option to respond "Never = 0," "Sometimes = 1," or "A lot = 2." From these five items, a composite food insecurity scale was computed ranging from 0 to 10, with 10 representing the highest degree of food insecurity and 0 representing the absence of food insecurity. The scale was reliable with a Cronbach's alpha = .88 (Mean = 1.62; S.D. = 2.23). Students whose families experience food insecurity are at risk for poor health outcomes due to their lack of proper nutrition. We expect higher food insecurity scores will be related to higher BMI scores.

Protective Factors

Self-esteem (Individual)

In this study, self-esteem is included as a potential protective factor against negative weight status outcomes. We used a shortened version of Rosenberg's 10-item self-esteem index to measure how students perceive themselves in general and in contrast with their peers

(Rosenberg, 1965). The five items we use include; 1) I feel that I am a person of worth, at least on an equal plane with others; 2) I feel that I have a number of good qualities; 3) I am able to do things as well as most other people; 4) I take a positive attitude toward myself; and 5) On the whole, I am satisfied with myself. Possible responses ranged from Strongly Agree = 4 to Strongly Disagree = 1. The scale was reliable with a Cronbach's alpha = .87 (Mean = 10.36; S.D. = 2.98). While the relationship between self-esteem and weight status can be bidirectional, we argue here that self-esteem is part of a life-stress paradigm that may have implications for students' psychological and physical health (Ensel & Lin, 1991). Specifically, we believe that high self-esteem is a protective mechanism which may mediate the risk for overweight and obese status.

Close Friends

We include a measure of social capital to test the influence of the peer-level social environment on the student's net risk. The selection of this variable is based on the concept that a wider social network allows a greater wealth of resources and can have protective benefits against unwanted outcomes, such as poor health (Almgren, Magarati, & Mogford, 2007; Coleman, 1988). For high school students, social networks consist of school friends and same-age peers. In this study, social capital is measured simply by asking students how many close friends they have. We expect that students with more friends will have greater social capital which will serve as a protective resource against unhealthy weight outcomes (Almgren, Magarati, & Mogford, 2007; Fitzpatrick, Willis, & O'Connor, 2014). Thus, students with more friends will likely report lower BMI scores and experience a lower risk for obesity than students who report few close friends.

Frequent Meals at Home

In this model we included a measure related to how often students ate meals at home with their families. Following the prompt, "Thinking about the places you usually eat," students were asked eight questions pertaining to where and with whom they eat their meals. This index was then coded into two variables, one for frequency of meals eaten at home, and the other for frequency of meals eaten out. Measuring the frequency with which students eat meals at home (as opposed to a convenience store or family restaurant, for instance) allows us some insight into the eating habits of the student as well as a measure of social capital within the family. Some studies have shown that eating meals with one's family can serve as a protective factor against being overweight or obese for adolescents (Goldfield et al., 2011). Thus, we expect that more frequent meals at home will be associated with lower BMI scores.

Analytic Strategy

The analysis focuses on cross-sectional relationships between risk and protective factors for BMI scores and changes in these relationships across demographic groups. First, independent-sample t-tests examine any differences in BMI scores between groups, not accounting for risk and protective factors. Analysis of variance examines the intersectional nature of race, ethnicity, class, and gender as it applies to BMI scores. Next, bivariate analyses provides us with some basic information concerning the variables examined in the model and correlations between these variables.

Finally, a multiple regression model tests individual hypotheses of risk and protection, and examines significance for blocks of independent variables. The first block includes demographic variables, the second block includes risk variables, and the third block adds protective factors. In a fourth block, we test for the interaction effects of race/ethnicity, gender and social class. This

modeling strategy allows us to examine the influence of specific risk factors, how they may be

moderated by protective factors, and whether BMI varies across sociodemographic groups.

CHAPTER FOUR

RESULTS

Descriptive Statistics

As seen in Table 1, the mean BMI score for this sample of high school students is 24.78, and the standard deviation is 5.56. For our purposes, a BMI score of 25 and up indicates overweight or obese status, so the average student in this sample falls at the high end of the normal weight, or just below the threshold for overweight status. The sample is approximately 54 percent female, and the average student in this sample is about 16 years old. The sample is comprised of 53 percent Hispanic and 14 percent Marshallese students, which is representative of the Springdale, Arkansas population. Over 68 percent of students in the sample receive free or reduced lunch.

Using a weighted CES-D scale, a score of 16 or higher indicates clinical levels of depression. On average, students in this study scored 19.59 on the CES-D scale, which demonstrates a high rate of clinical caseness; the standard deviation was 15.84. Self-reported student risk was relatively low with an average score of 2.44 and a standard deviation of 2.77, on a scale from 0 to 10. Scores on the food insecurity scale were also low, with students scoring 1.62 on average, and the standard deviation at 2.23, on a scale from 0 to 10.

Our self-esteem scale, based on Rosenberg's model, had possible scores ranging from 4 to 20. On average, a student in this sample scored 10.36 on the self-esteem scale, and the average distance from the mean was 2.98. Students reported having about four close friends, and the average deviation from the mean was 3.10. Students were asked how often they ate meals at home as opposed to eating meals at a restaurant or convenience store. On average, students

scored a 7.89 on this 16-point scale, indicating that a typical student eats fewer than half of all

meals at home with family or friends. The standard deviation for meals at home was 2.78.

Table 1. Descriptive Statistics for Model Variables

	%	Mean	S.D.
Dependent Variable			
BMI Score	--	24.78	5.56
Demographics and Controls			
Age	--	16.27	0.961
Gender (1=Female)	53.90%	--	--
Free/Reduced Lunch (1=Receiving)	68.40%	--	--
Hispanic (1=Hispanic)	52.80%	--	--
Marshallese (1=Marshallese)	13.90%	--	--
Risk Factors			
Depression (Weighted CESD)	--	19.59	15.84
Student Risk	--	2.44	2.77
Food Insecurity	--	1.62	2.23
Protective Factors			
Self-esteem	--	10.36	2.98
Number of Close Friends	--	4.24	3.10
Meals at Home	--	7.89	2.78

Differences in BMI Means

We expected that BMI scores would vary by race and ethnicity such that Hispanic and

Marshallese students would exhibit higher BMI scores than non-Hispanic, non-Marshallese

students. In order to test these differences, independent-sample t-tests were examined for the

comparisons between Marshallese and non-Marshallese, Hispanic and non-Hispanic, and

Hispanic/Marshallese versus all other students. Table 2 shows the results of these t-tests.

The first t-test examined BMI differences between Hispanic and non-Hispanic students, and this t-test was not significant. The second comparison tested the BMI differences between Marshallese and non-Marshallese students and this result was significant at p < .05, such that Marshallese students reported higher BMI scores than other students. Finally, a t-test examined the difference in average BMI score for a group of Marshallese *and* Hispanic students compared with a second group composed of all other students, and this difference was not statistically significant. Based on these preliminary findings, it seems that Marshallese students have significantly higher BMI scores on average than all other students. In addition to there being a significant difference in Marshallese vs. non-Marshallese, gender was also significant. In this sample of high school students, males reported higher weight status than females. The poverty variable, free/reduced lunch, was not significant for this sample of students.

Table 2. Differences in BMI (N=1493)

	Mean Difference
Hispanic	24.574
Other	24.998
Marshallese*	25.374
Other	24.680
Hispanic/Marshallese	24.745
Other	24.839
Male*	25.272
Female	24.349
Receiving Free/Reduced Lunch	24.835
Not Receiving	24.651

*1-Tailed Independent Samples t-test; * p < .05; ** p < .01*

Bivariate Relationships

Table 3 shows correlations for all variables in the model, including the dependent variable, sociodemographic controls, risk factors and protective factors. Age, gender, and

Table 3. Correlations

	1	2	3	4	5	6	7	8	9	10	11	12
Dependent Variable												
1. BMI												
Demographics												
2. Age	.096***											
3. Gender	-.083***	-.055*										
4. Free/Reduced Lunch	.019	-.015	-.013									
5. Hispanic	-.041	-.033	.024	.303***								
6. Marshallese	.053*	.076**	-.047*	.163***	-.404***							
Risk Factors												
7. Depression	.029	.031	.275***	-.043	-.062**	-.045						
8. Student Risk	.059*	.101***	-.031	.009	-.066**	.068**	.191***					
9. Food Insecurity	.046*	.018	-.043	.185***	-.099***	.166***	.219***	.202***				
Protective Factors												
10. Self-Esteem	-.061*	.073**	-.153***	-.030	.005	.032	-.414***	-.116***	-.195***			
11. Close Friends	.005	.013	-.198***	.008	-.126***	.109***	-.159***	-.001	-.041	.130***		
12. Meals at Home	-.087***	-.120***	-.026	.068**	-.030	.111***	-.141***	-.006	-.147***	.150***	.111***	

p<.05*   p<.01**   p<.001***

Marshallese racial status are all significantly correlated with BMI, such that older males and Marshallese students tend to have higher BMI scores. The relationship between gender and BMI is mild and works in the opposite direction as we predicted earlier, with males, rather than females reporting higher BMI scores. Age and Marshallese racial status operate as predicted earlier, with older students and Marshallese students having higher BMI scores. The social class measure, free and reduced lunch, was not significantly correlated with BMI, and there was no relationship between Hispanic ethnic status and BMI.

In terms of risk, depression was not significantly correlated with BMI, but student risk and food insecurity were significant risk factors. As predicted, students who scored higher on the student risk scale and showed higher levels of food insecurity reported higher BMI scores than lower-risk, food-secure students. Additionally, self-esteem and eating more meals at home were negatively correlated with BMI, showing significant protective effects from these factors such that students with higher self-esteem scores and who ate more meals at home, reported lower BMI scores. The number of close friends did not have a significant relationship with BMI.

According to these correlations, it seems that student risk behaviors and food insecurity may place adolescents at a higher risk for overweight or obese status, and this risk may be lowered for students with high self-esteem and who eat meals at home frequently. Next, multivariate analyses will determine whether risk and protection varies by race/ethnicity, gender, and social class.

Multivariate Relationships

Table 4 presents the results of the final multiple regression model, using the same variables analyzed in the correlations table above. Model 1 includes only the sociodemographic variables, showing the role of age, gender, social class, and racial/ethnic background in

predicting weight status. In this model, age has a mild, positive relationship with BMI that is significant at p < .001. Gender has a mild, negative relationship with BMI that is significant at p < .01. These associations indicate that older students and males tend to have higher BMI scores than their peers; free and reduced lunch, Marshallese status, and Hispanic status were non-significant.

In Model 2, the risk variables were added and we examined the association of depression, student risk, and food insecurity with BMI scores. None of the risk variables had a

Table 4. BMI Regression

Variables	Model 1 b (β)	Model 2 b (β)	Model 3 b (β)	Model 4 b (β)
Demographics				
Age	.536 (.092)***	.501 (.086)***	.508 (.087)***	.514 (.088)***
Gender (female=1)	-.811 (-.073)**	-.932 (-.083)**	-.991 (-.089)***	-2.038 (-.182)***
Free/Reduced Lunch (1=Receiving)	.292 (.025)	.248 (.021)	.280 (.024)	-.566 (-.048)
Hispanic (1=Hispanic)	-.406 (-.036)	-.315 (-.028)	-.364 (-.033)	-.377 (-.034)
Marshallese (1=Marshallese)	.377 (.023)	.403 (.025)	.441 (.027)	.456 (.028)
Risk Factors				
CES-D		.015 (.042)	.005 (.015)	.005 (.015)
Student Risk		.074 (.037)	.065 (.032)	.065 (.032)
Food Insecurity		.028 (.011)	-.013 (-.005)	-.013 (-.005)
Protective Factors				
Self-Esteem			-.130 (-.069)*	-.130 (-.069)**
Number of Close Friends			-.004 (-.002)	-.004 (-.002)
Meals at Home			-.280 (-.049)**	-.280 (-.049)*
Interactions				
Gender X Free/Reduced Lunch				1.563 (.015)**
Constant	16.462	16.556	18.919	19.429
Degrees of Freedom	5	8	11	12
R-Squared	.018***	.022	.028**	.032**

*p<.05   **p<.01   ***p<.001

34

significant relationship with BMI, but the relationships with age and gender remained. In Model 3 the protective factors were added; self-esteem, number of close friends, and meals at home. Self-esteem had a mild, negative association with BMI such that students with high self-esteem tend to have lower BMI scores, as we predicted earlier ($p < .05$). Frequent meals at home had a protective effect as predicted, showing a mild, negative association with BMI ($p < .01$). Number of close friends was not related to BMI outcomes, and the risk variables remained non-significant in this model. It seems that students with high self-esteem and who eat more meals at home will tend to have lower BMI scores, and thus there may be a protective effect against overweight and obesity for these variables.

Intersectional Relationships

In order to further examine the interrelationships among risk, protection, and sociodemographic characteristics, additional analyses examined a series of interaction effects. These interaction effects between gender, social class, and Marshallese and Hispanic identity help to address the question of intersectionality. In Model 4, interaction variables were added to test the intersectional nature of these sociodemographic variables. Interaction variables were created for Hispanic and gender, Marshallese and gender, Hispanic and free/reduced lunch, Marshallese and free/reduced lunch, and finally gender and free/reduced lunch. Each of these interaction variables was tested individually in the fourth model to determine if any interaction of race/ethnicity, gender, and social class was present. There did not appear to be a significant interaction of race/ethnicity with gender, or of race/ethnicity with free/reduced lunch. However, the interaction between gender and free/reduced lunch had a mild, positive relationship with BMI ($p < .01$), and this can be seen in Table 4. The interaction suggests that females receiving free lunch reported higher BMI scores than their peers. This finding highlights the importance of

examining these interaction effects separately to determine intersectional relationships and their

impact on BMI scores.

CHAPTER FIVE

DISCUSSION

Our findings were clearly different than what we originally expected based on existing literature. We predicted that females would be at a greater risk for high BMI scores, and our analysis found that males consistently reported higher BMI, except in the interaction model. We also predicted that students who qualified for free or reduced lunch would be at risk for higher BMI, but this variable did not appear to have a significant relationship with BMI except in the interaction with gender. We did find that Marshallese racial was related to higher BMI scores, but the Marshallese variable was not significant in the regression models with all sociodemographics accounted for.

Hispanic status was not related to BMI as we expected it would be. Hispanic students had similar BMI levels when compared with the entire sample of students, and the Hispanic variable was not significantly related to BMI in the regression models. We predicted Hispanic ethnicity would be associated with higher BMI based on existing research, but it seems that this is not the case in Springdale, Arkansas. It is possible that living and attending school in a predominantly Hispanic community results in lower risk for Hispanic students compared with living in a mostly non-Hispanic community. Further research should explore the importance of place in racial/ethnic health disparities.

The results enable us to draw some conclusions about weight status outcomes among Marshallese high school students. As can be seen in the preliminary analyses, BMI scores are significantly higher for Marshallese than for Hispanic and other students, as predicted. Bivariate analyses also pointed to an association between being Marshallese and having a high BMI. However, controlling for age, gender, and social class, and taking into account risk and

protective factors, Marshallese racial identity did not seem to have a substantial effect on BMI scores. Additionally, this risk appears to be mediated by self-esteem and frequency of meals at home.

Overall, our findings support the idea that the social environment plays a role in one's physical health. We were able to identify demographic groups that have higher overall risk than others, and certain protective factors that might mediate this risk. However, the specific risk variables used in this study did not have significant relationships with BMI in any of the models. It was expected that depression, student behavioral risk, and food insecurity might increase the likelihood of being overweight or obese, but these factors did not seem to increase risk for students having higher BMI outcomes.

Depression was included as a potential risk factor for overweight and obese status based on the idea that poor mental health could prevent adolescents from engaging in healthy eating and exercise habits (Ensel & Lin, 1991). In this study, depression was not at all correlated with BMI, and did not have a significant role in the complete model of risk and protection. Though students in this sample reported high depression scores on average, it seems depression may affect students differently as there is no pattern between CES-D score and BMI.

Student behavioral risk did show a mild correlation with high weight status in bivariate analyses, but did not appear to be a significant risk for any of the regression models. Likewise, food insecurity was mildly positively correlated with BMI but did not stand out as a significant risk factor in the regression. It is possible that food insecurity does not have a pronounced impact on adolescent health in places where there are sufficient resources to assist food insecure families. Although more than half of our sample qualified for free or reduced lunch, students did not report high insecurity when asked about their families' ability to obtain adequate food. Since

so many students rely on the school to provide them with meals, this may account for lack of variation in students' diets, and thus for variation in BMI scores. Though students who come from disadvantaged backgrounds may experience higher rates of psychological distress and behavioral issues, the school's role in their diet and exercise may prevent these stressors from affecting their weight by allowing them equal access to healthy meals and activities.

Our findings indicated that individual and environmental factors could in fact mediate the risk for high BMI scores. Frequent family meals and high self-esteem seem to be important protective influences against high BMI scores in many adolescents. Based on these results, the implementation of school-based programs aimed at lowering overweight and obesity among adolescents should heed the importance of raising self-esteem and fostering family connectedness. Further research is needed to explore other types of protections that may operate similarly, and based on these findings it may be fruitful to focus on family-oriented protective factors.

Also important among the findings was that males reported higher BMI scores than did females. This contradicts the conclusions drawn from the literature review which indicated that females typically experience higher risk for overweight and obese status, and raises questions about the role of gender in health outcomes. Future studies need to examine how risks and protections vary between males and females more carefully and try to identify the mechanisms that increase risk for males in certain samples of adolescents. Notably, the effects of gender are intersectional with socioeconomic status, such that females receiving free or reduced lunch have higher BMI risk than their peers. This finding highlights the importance of examining weight status outcomes through an intersectional lens, as the interrelationships between gender and

social class can be complex and multidirectional. While males have higher BMI scores in general, females seem to feel the effects of low socioeconomic status more strongly than males.

Limitations and Future Research

One limitation of this study is that the final model with all demographics, risks, and protections, explained little over three percent of the total variation in BMI among this sample of adolescents. This could be a problem of misspecification where that other variables that were not included in this particular study were accounting for much of the variation. Nevertheless, the study does play an important role in showing that social factors at the personal and environmental level can be important when trying to understand complex weight status outcomes among different sociodemographic groups. Future research should attempt to explore relationships with the many other potential influences on weight status in adolescents.

In addition to the low R-square value, another limitation of this study is the lack of established causality, particularly among protective factors and BMI. We believe that self-esteem is part of a paradigm of mental-well being that is tied to improved physical health outcomes. However, it is quite possible that the relationship between self-esteem and BMI could be explained in the opposite direction, especially taking into consideration the social stigma often attributed to overweight status among adolescents. A longitudinal study may be better able to determine causality in this relationship, and future longitudinal research on weight status should examine the role of self-esteem. Regardless, policymakers and practitioners working with students in this age range should bear in mind that self-esteem and family meals can be important considerations in the fight against adolescent obesity.

The inconsistencies between this study and much of the extant literature which inspired it, shows that the interaction of risks and resources can vary across time and space, and operate

differently among certain racial/ethnic groups such as Pacific Islanders and specifically

Marshallese students. While many prior studies found that females and Hispanic students had

higher-than-normal risks for overweight and obesity, these patterns did not seem to apply in the

same way to this large sample of students living in Springdale, Arkansas. Many researchers

contend that social class is a significant predictor of weight status, but that was also not the case

for this sample of students.

Conclusion

The importance of continuing to study weight status outcomes in communities like

Springdale is to show how these relationships can vary from place to place. While there is great

value in collecting data on a national basis and conducting analysis with a large sample

representative of the whole country, there is also an important value in learning which areas and

demographics may yield different results from those of the national caliber. If nothing more, this

study should show that policymakers and advocates for childhood health must customize their

efforts to the places in which they will be implemented. Only when we focus on the particular

needs of a school and the people which comprise it, will we be able to make real change happen

in the way of improving childhood health outcomes.

As emphasized throughout the study, BMI is just one quantifiable measure in the greater

context of health and well-being. The disparities identified in this study relating to gender,

Marshallese racial identity, and Hispanic ethnicity are not only important when addressing the

widespread issue of childhood obesity, but also as indicators of social inequality. The high rates

of obesity amongst Marshallese students compared with their non-Marshallese peers point to a

strong social disadvantage which may translate to other aspects of life and should be explored in

future studies concerning Marshallese children and families. The gender gap in weight status

identified in this study serves as an important indication that norms and expectations for health behaviors differ between boys and girls, depending on racial identity. Furthermore, the unique disadvantage felt by females from low-socioeconomic backgrounds shows that health outcomes are intersectional across race and social class. Studies focusing on BMI and other manifestations of health in adolescence should consider the intersectional nature of health inequality.

In addition to making a significant contribution to the literature on adolescent obesity and weight status, this study is an important addition to current research on social inequality for Pacific Islander populations like the Marshallese. The results also exemplify the importance of intersectionality as it accounts for unique interactions of racial/ethnic background, socioeconomic status, and gender in determining health outcomes and other manifestations of inequality and privilege. Using an intersectional lens and a theoretical framework of risk and protection, this study has demonstrated the sometimes unexpected ways that sociodemographic variables such as class and gender can result in unique profiles of disadvantage, and should stand as an example for future studies on health issues such as obesity.

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UNIVERSITY OF ARKANSAS

July 26, 2016

MEMORANDUM

TO:	Leanna Gavin
	Kevin Fitzpatrick
FROM:	Ro Windwalker
	IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	16-07-012
Protocol Title:	*Risks, Resources, and Weight Status among Springdale High School Students*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 07/26/2016 Expiration Date: 07/25/2017

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (https://vpred.uark.edu/units/rscp/index.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 1,493 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

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50