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Weight perceptions and pre-suicide behaviors among United States high school students, YRBS 2011

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An abstract of
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Abstract

Weight perceptions and pre-suicide behaviors among United States high school students, YRBS 2011

By Merriah A. Croston

Suicide is the 3rd leading cause of death for adolescents and young adults 15-24 years, behind homicides and unintentional injuries (1). Further, when data from the 2009 Youth Risk Behavior Survey (YRBS) were analyzed, 16% of US 9th to 12th grade students in reported suicidal ideation, 13% reported creating a plan, and 8% reported at least one suicide attempt during the previous year.

Research shows that obesity and perceived weight are related to pre-suicide behaviors, such as suicidal ideation, suicide planning, and suicide attempt (2,3). The purpose of this research was to explore the association between perceived weight status and pre-suicide behaviors, and further characterize factors that confound, moderate, or mediate the association between perceived weight status and pre-suicide behaviors among a nationally representative sample of high school students who participated in the YRBS in 2011.

Results of this study show that for all outcomes, high school students who perceived themselves to be overweight were more likely to engage in pre-suicide behaviors. The relationships between perceived weight status and all pre-suicide behaviors were moderated by age, and the relationship between perceived weight status and suicide planning was moderated by sex. The relationship between perceived weight status and suicidal ideation was confounded by age, prolonged sadness, and unhealthy weight control behaviors. The relationship between perceived weight status and suicide planning was confounded by sex, age, prolonged sadness, discord between actual and perceived weight status, and unhealthy weight control behaviors. The relationship between perceived weight status and suicide attempt was confounded by age, race/ethnicity, prolonged sadness, and discord between actual and perceived weight status.

Results of this study suggest that there are particular subpopulations of high school students who perceive themselves to be overweight and are potentially at greater risk of attempting suicide than other subpopulations. In consideration of the Healthy People 2020 goal to reduce the rate of attempted suicide among adolescents by 10%, targeted primary prevention efforts and intervention programs in schools, physicians' offices, and at home could be implemented to address the increased risk of pre-suicide behaviors among youth who perceive themselves to be overweight.

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CHAPTER I: INTRODUCTION

INTRODUCTION AND RATIONALE

In 1999, suicide received heightened national attention when Surgeon General Dr. David Satcher proposed a plan to develop a comprehensive national suicide prevention strategy. This plan was encapsulated in the acronym A.I.M., meaning awareness, intervention, and methodology. This approach recognized suicide as a preventable public health issue and was intended to systematically target suicide and pre-suicide behaviors in ways that have not been met through market or other governmental interventions (4,5). At present, the 2nd objective under the Mental Health and Mental Disorders section of Healthy People 2020 is to reduce the rate of attempted suicide among adolescents by 10%. In 2009, the CDC reported that the attempted suicide rate among adolescents was 1.9 per 100,000. The target rate is 1.7 per 100, 000 by the year 2020 (6).

According to D'Orio and Garlow in their 2004 work that describes suicide prevention as a national imperative that claims approximately 30,000 lives per year, the ethnic, demographic, and geographic impact of suicide is well understood; however, little is understood about the etiology of suicide, from its neurobiology and pathophysiology, to what makes suicide prevention programs effective (4). Further, non-fatal pre-suicide behaviors—including suicidal ideation, suicide planning, and non-fatal suicide attempts—are even less understood.

As practitioners pioneer programs that pair violence prevention and chronic disease prevention (7), it is important to better characterize the associations between suicide and risk factors for chronic disease in youth populations. In fact, Greydanus and colleagues (2010) assert that all youth with chronic illness should be regularly screened for risk factors for suicide. One such risk factor is obesity. It is estimated that 30% of the US population is obese (8). Over the last decade, obesity has dramatically increased among youth. By some estimates, the percentage of US youth

who are overweight or obese (defined as a body mass index (BMI) of 25–29.9 or 30.0 and above, respectively) has more than tripled since 1980, with 15% of youth considered overweight in 2000 (9). Research shows that obesity and perceived weight or body dissatisfaction are related to pre-suicide behaviors (2,3).

The purpose of this research was to explore the association between risk factors related to actual and perceived weight status and non-fatal pre-suicide behaviors among a nationally representative sample of high school students. The preventive implications are examined in the context of A.I.M. and the Center for Disease Control and Prevention's (CDC) Healthy People 2020.

RESEARCH QUESTION AND HYPOTHESES

Is there an association between perception of weight status and pre-suicide behaviors, including ideation, planning, and attempt (individually and cumulatively) in United States' youth and young adults grades 9 through 12 who participated in the Youth Risk Behavior Survey (YRBS) in 2011? Do other variables moderate or mediate these associations, such as demographic variables and other suicide and obesity- or weight perception-related variables (prolonged sadness, unhealthy eating habits, bullying, and discord between actual and perceived weight status)? The null hypothesis was that there would be no association between perception of weight status and pre-suicide behaviors in youth and young adults grades 9 through 12 who participated in the YRBS in 2011, when controlling for demographic variables, and other correlates. The alternative hypothesis was that there would be an association between perception of weight status and pre-suicide behaviors in youth and young adults grades 9 through 12 who were administered the YRBS in 2011, when controlling for demographic variables and correlates.

THEORETICAL FRAMEWORK

The developmental-transaction model (10) was used to guide the understanding of factors associated with pre-suicide behaviors among youth in this thesis. More specifically, it provided a proposed framework for understanding the expression of pre-suicide behaviors.

In their 2012 review, Hawton, Saunders, and O'Conner stated that experts emphasize diathesis-stress explanations in theoretical formulations of youth suicide. These formulations propose that predisposing individual characteristics, such as biological (e.g., serotonin imbalances), personality (e.g., perfectionism, impulsivity), and cognitive vulnerabilities (e.g., impaired social problem-solving) combine with exposure to negative life events, including both distal and proximal adversity, and psychiatric disorders to increase risk of self-destructive behaviors across the lifespan. Proven distinctions between factors associated with the development of suicidal ideation versus those that increase the likelihood that such thoughts will progress to attempted suicide have advanced these theoretical formulations (10).

Hawton and colleagues' (2012) model identifies depression as a primary risk factor for suicidal ideation. In turn, studies have shown that obesity and perceived weight are associated with depression (11–18). Systematic reviews show that the association between obesity and depression is bi-directional (15,17). While some prospective studies provide evidence that depression is a risk factor for obesity and perceived weight (14,15,17), most show that obesity and weight perception increase the risk for depression (11–13,16–18). It is posited that the latter association is largely etiologically attributable to biological and social factors. Gender is a proven moderator of this relationship (13,15,17).

Building upon the literature cited above, this thesis expanded Hawton and colleagues' (2012) theoretical model beyond depression to explore the association between perceived weight and pre-suicide behaviors after puberty (Figure 2, below). Although studies have also shown an

association between obesity and perceived weight and other psychiatric or personality factors presented in Figure 1, only depression was explored in this thesis.

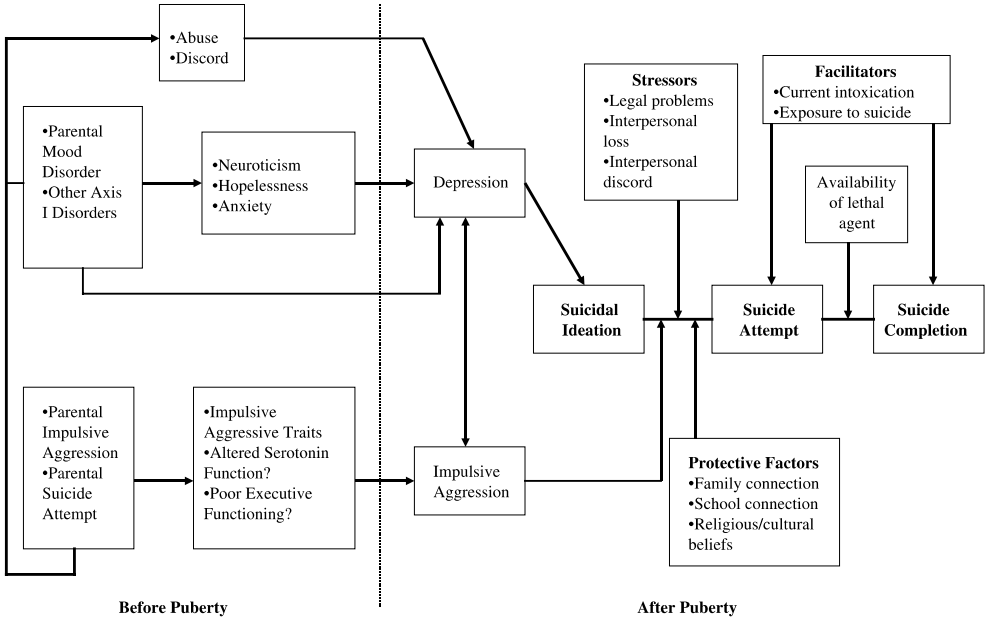

Figure 1. Development-transactional model of youth suicidal behavior (19)

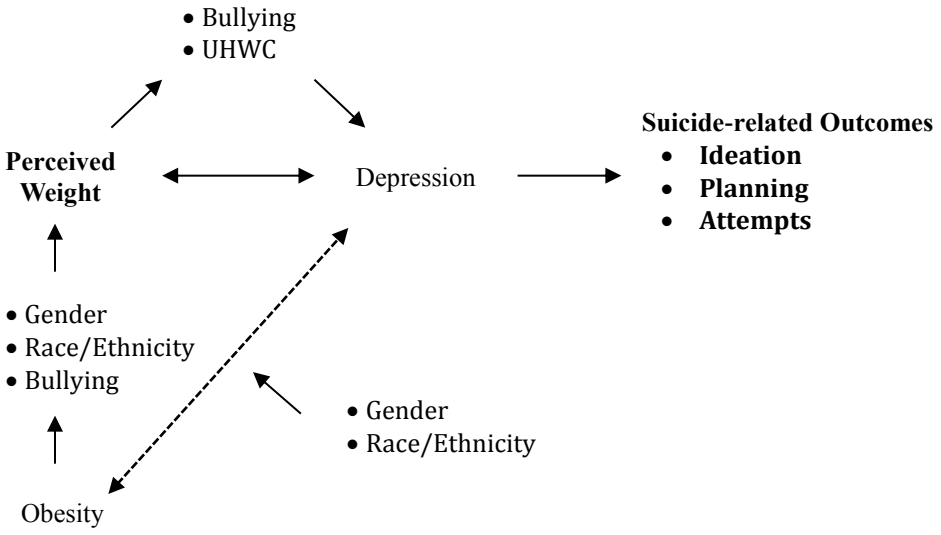

Figure 2: Model of the relationship between perceived weight and pre-suicide behaviors among youth after puberty. Confounding factors are not presented. (UHWC=unhealthy weight control)

CHAPTER II: LITERATURE REVIEW

SUICIDE AS A PUBLIC HEALTH PROBLEM

The epidemiology of suicide is fairly well understood (20). In 2010, 38,364 deaths were attributed to suicide, with an age-adjusted rate of 12.4 per 100,000. There were also 713,000 emergency department visits for self-inflicted injury (with or without suicidal intent; (21). Between 1999 and 2008, suicide was the 11th leading cause of death in the United States (US), with approximately 30,000 deaths per year (22). However, by 2010, suicide replaced motor vehicle accidents as the 10th leading cause of death in the US (21,23).

Historically, the US annual suicide rate slightly increased in the 1980's, followed by a persistent shallow decline through the 1990's. US suicide rates began to gradually increase in 2000. In sum, the rate has not varied appreciably over the past couple of decades, proving suicide to be persistent and consistent (4,20,24,25). Although the US suicide rate has remained fairly constant, the distributional impact on demographically specific groups (e.g., age, race, ethnicity, gender) varies considerably (17,19,20).

This study presents a particular focus on pre-suicide behaviors among youth and the relationship of these outcomes to perceived weight status. This focus was chosen because: (1) Suicide is a leading cause of death among youth ages 10 to 24; (2) As the percentage of overweight and obese youth rises, it has become a more closely studied risk factor for pre-suicide behaviors (27); (3) There is a proposed derivation of pre-suicide behaviors in early adulthood from risk factors that emerge in childhood and adolescents (20); (4) In a resource-depleted environment, pairing chronic disease and violence prevention efforts among youth populations has been considered (7). In addition to the impact that suicide has on youth, within the last decade, suicide has surpassed homicide, becoming the 2nd leading cause of death for adults between the ages of 25 and 34 years,

further highlighting the importance of research and prevention efforts with a youthful focus. Accordingly, if the most recent rise in the mid-adult suicide rate is at least partially attributable to period effects, as suspected, it is imperative to understand the risk and protective factors for the thoughts and behaviors that precede suicide among youth. As research on the associations between weight status and suicide have advanced, studies have found that the relationship between obesity and suicidal behavior is mediated by perceptions of weight or body size, thus the focus on the relationship between weight perception and suicidal outcomes in this thesis (9).

In the following sections, a spectrum of pre-suicide behaviors among youth will be discussed, as well as the varying impact of and risk factors for these thoughts and behaviors among youth. Herein, the term "youth" is preferentially applied to individuals between the ages of 10 years and 25 years. The term "youth" replaces "adolescent" or "adolescence", since "youth" is less specifically-defined and accommodates the variability in the age ranges of study populations in the research referenced in this thesis (10).

Suicide is a significant global public health problem for youth. Currently, it is the 2nd leading cause of death in young people worldwide (2,10). In the US, suicide is presently the 3rd leading cause of death among youth between the ages of 10-14, behind malignant neoplasm and unintentional injury. Suicide is also the 3rd leading cause of death for adolescents and young adults 15-24 years, behind homicides and unintentional injuries (1). In 2010, the most current data published by the CDC, the number of suicides among persons between 10-14 years and 15-24 years were 267 and 4,600, respectively (22). In 2010, adolescents and young adults aged 15-24 years had a suicide rate of 10.5 per 100,000 individuals (22,28). Researchers suggest that suicide among this age group is likely underreported due to the stigma associated with suicide (10).

Despite the persistence of suicide as a primary public health issue among youth, there has been a

steady net decline in recent decades. Returning to the unappreciable increase and decrease in suicide rates between 1980 and 2000 that was discussed in the section "Suicide as a Public Health Problem", these data show an overall decline in suicide rates dating back more than 10 years among the youngest age group. However, in 2004, there was a significant increase in the youth suicide rate, mostly occurring among girls between the ages of 10 and 19 years. This increase was followed by a slight decrease in suicides in 2005 (1,29). Although the underlying factors influencing these rising and falling trends are not well understood, it is assumed that the same factors underlie both (25).

CONTINUUM OF PRE-SUICIDE BEHAVIORS: THOUGHTS, COMMUNICATIONS AND BEHAVIORS

Before discussing youth suicide, it is imperative to present the nomenclature that will be applied to suicide-related behavior throughout this document. In 2011, the Centers for Disease Control and Prevention (CDC) published "Self-Directed Violence Surveillance: Uniform Definitions and Recommended Data Elements" by Crosby, Ortega, and Melanson to address the absence of uniform definitions for self-inflicted injuries. Prior to this publication, there were no nationally recognized, standard definitions for pre-suicide behaviors. Use of consistent terminology is expected to improve communication among researchers and practitioners (30). The definitions proposed by the CDC in this directive document were applied to the research discussed herein and are expressed below (Table 1). Accordingly, rather than applying the term "suicidality" to the full breadth of suicidal thoughts (ideation), communications (planning), and behaviors (attempted suicide/suicide) listed below, these outcomes will be referred to alternately or cumulatively as "pre-suicide behaviors" throughout this document.

Since the CDC's directives do not specifically cover the full breath of outcomes explored in this

document, definitions provided by Silverman and colleagues in 2007 have been used, wholly or adapted, to describe suicidal ideation and planning. Updated definitions proposed by Silverman et al. (2007) appear most frequently in epidemiological literature; thus, they were combined with the CDC's recommendations and applied herein (Table 1).

Table 1: Pre-suicide behaviors—thoughts, communications and behaviors.

Term	Definition
Pre-suicide Thoughts	
Suicidal Ideation	Self-reported thoughts of engaging in suicide-related behavior (31).
Pre-suicide Communications	
Suicide Planning	Acts or preparation towards imminently making a suicide attempt, but before potential for harm has begun (31).
Pre-suicide Behaviors/Suicide	
Suicide Attempt	A non-fatal self-inflicted potentially injurious behavior with any intent to die as a result of the behavior. A suicide attempt may or may not result in injury (30).
Suicide	Death caused by self-inflicted injurious behavior with any intent to die as a result of the behavior (30).

The results presented in this document cover suicidal ideation, planned suicide, and suicide attempt(s). Although there is no measure of suicide used in the analysis discussed herein, further consideration of the etiology and natural history of suicidal thoughts, communications, and

behaviors is inclusive of this outcome.

For methodological reasons, disproportionately more research efforts characterize suicide, neglecting the full spectrum of pre-suicide behaviors, making this thesis a valuable contribution to suicide research and primary prevention. By studying pre-suicide behaviors in combination and individually, the problem's breadth is better characterized. Self-harm (with or without suicidal intent) is a major public health problem and is an important risk factor for suicide, which will be discussed in a later section. The attempted suicide rate is approximately 10 times the suicide rate and over 15% of individuals repeat a suicide attempt within a year of their initial attempt (20,32). By studying suicidal thoughts, plans, and attempts, the population-level risk for suicide can be better characterized.

There are three main sources of self-harm (with or without suicidal intent) data: hospital discharge files, surveys, and mortality files. However, there are no national efforts to monitor the full scope of pre-suicide behaviors. The CDC's National Violent Death Reporting System (NVDRS) tracks suicide. There are also national efforts that survey specific age groups. Specifically, the National Youth Risk Behavior Survey (YRBS) monitors a set of pre-suicide behaviors (ideation, planning, and attempt) among middle and high school students.

Beyond YRBS and NVDRS, local surveillance systems and select population surveys of self-reported behavior constitute additional efforts to collect and maintain data on suicide and pre-suicide behaviors. As previously mentioned, different definitions of pre-suicide behaviors, in addition to differential respondent interpretations of surveys and question formats, make comparisons between studies of self-reported outcomes difficult (20). These variations also cause difficulties when attempting to geographically aggregate data.

PRE-SUICIDE BEHAVIORS AMONG YOUTH

EPIDEMIOLOGY

There is a strong association between suicidal ideation and suicide attempts (1). Accordingly, increases in youth suicide rates in recent years suggest that similar trends may be present for other pre-suicide behaviors, particularly among girls—the population most affected by the 2004 increase in suicides (1). Wolitzky-Taylor et al. (2010) were the first to examine a nationally representative sample of youth to determine whether the above is true. When comparing the 1995 and 2005 National Survey of Adolescents (NSA) data for youth between 10 and 19 years old, the prevalence of suicidal ideation declined, while the prevalence of attempted suicide remained stable. The decline in ideation was only significant among boys ages 10 to 14 years old, which suggests that the decline in suicidal ideation was largely attributable to this group, rather than a widespread downward trend among youth between ages 10 to 19 years. Regardless, the discord between the trends in suicide and attempted suicide suggests that youth are, perhaps, more likely to attempt suicide once they think about it (1).

As previously mentioned, the literature is more established regarding the impact of completed suicide than pre-suicide behaviors, such as ideation, planning, and attempted suicide. The prevalence of suicidal ideation and suicide attempts is higher than the prevalence of suicide among adolescents (2). Although international variation exists, findings from many community-based studies show that around 10% of adolescents report having self-harmed with some degree of reported suicidal intent (10). When self-reported data from the 2009 YRBS were analyzed, 16% of US 9th to 12th grade students in a nationally representative sample reported suicidal ideation, 13% reported creating a plan, and 8% reported at least one suicide attempt during the previous year. This was an increase compared to the numbers reported after the previous YRBS

collection cycle in 2007 (28). As mentioned above, period effects have been proposed as an explanation for recent increases in the mid-adult suicide rate. Whether the increase in suicidal thoughts, communications, and behaviors among youth can be attributed to the same proposed period effects has yet to be explored in the literature.

When studying the US population, only, there are considerable differences among sub-populations. Key demographic differences are discussed in the following subsections.

Race/Ethnicity & Age

In the US, youth of Indian/Alaskan descent have the highest rates of suicide of all ethnic groups; however, non-Hispanic/Latino white youth historically have had higher suicide rates than non-whites. Hispanic/Latino and white youth have the highest rates of ideation and attempt (28). Recently, the suicide rate for young black males has consistently risen and now approximates that of whites (26,28). The age-specific suicide rate among blacks between the age of 15 and 24 years in the US was 49% higher in 1995 than in 1981 and continues to rise. However, the rate of whites in the same age group increased by 5%, comparatively less than their black counterparts (24,28). Kaplan-Meier survival analysis of the relationship between ethnic group and age of suicide victims reveals that the median age of black victims precedes that of white victims. Therefore, blacks commit fewer suicides, but at a younger age, yielding an inflated number of years of potential life lost (YPLL) (20).

Rate differences between racial and ethnic groups are complicated by the fact that racial/ethnic differences in pre-suicide behaviors may result from underlying socioeconomic disparities. This is because black households are overrepresented in lower socioeconomic strata (20). Socioeconomic status will be discussed further below.

The Gender Paradox & Age

It is well established that rates of suicide, suicidal ideation, and attempts increase with age and that a gender paradox exists with regard to these thoughts and acts. Boys have a suicide rate 5 times higher than girls. However, while suicide rates are higher among boys than girls, girls have higher rates of suicidal ideation and attempted suicide (10,20,28). Among high school students in the US in 2009, girls were more likely to report having considered, planned, and attempted suicide compared to boys (considered suicide: 17.4% versus 10.5%, planned suicide: 13.2% versus 8.6%, and attempted suicide: 8.1% versus 4.6%, respectively) (29). Accordingly, rates of hospital-treated self-harm are also higher in female youth than they are in male youth. The sex ratio decreases with age in the later teenage years, as suicidal ideation and attempts become increasingly common in boys and level off in girls (28).

It is proposed that the gender paradox in youth is due to a discord in pubertal onset in males versus females. A survey that used a measure of pubertal stage in individuals aged 12–15 years in schools in Australia and the US showed that the onset of self-harm was related to pubertal phase, rather than chronological age (10). It has also been proposed that there are different disease pathways not only for males and females, but also for other subpopulations, based upon their unique exposure to risk and protective factors (4).

CORRELATES

When considering factors associated with pre-suicide behaviors and the natural history of suicide, assuming a chronological progression—from suicidal ideation, to planning, attempts, and ultimately, suicide—it may be a moment or decade of contemplation that results in suicide.

Current research has yet to elucidate the etiology of suicide and the average time frame that passes between the introduction of specific risk factors (chronic and acute stressors) and the suicide-related event. Given the previous, combined with statistics pointing to the median age of black and white suicide victims in early and middle adulthood, respectively, it is imperative to assess associations between the pre-suicide behaviors and risk and protective factors during youthful years (10-24 years) (26).

Pre-suicide behaviors are the end products of a complex interplay between biological, psychiatric, psychological, social, and cultural risk factors (10). Over the last two decades, several studies have offered valuable insight into the factors that are positively and negatively associated with suicide and a range of suicidal-related outcomes, including ideation and attempted suicide (1,29). Suicide planning is rarely studied and has been excluded from the following table and portions of the following subsections (Table 2, below). Correlates of suicide, suicidal ideation, and attempted suicide have not deviated significantly since the 1990's according to Wolitzky-Taylor and colleagues, as determined by their 2010 study. In this study, NSA data from 1995 and 2005 were compared and results revealed that the risk factors in 1995 were consistent with those in 2005 (1). Suicidal ideation, attempted suicide, and suicide share risk factors; however, there is not complete overlap. Some risk factors are unique to each outcome. (10)

The following sub-sections describing topic-specific correlates are not intended to be an exhaustive review of the literature, nor a deep dive into the characteristics of all correlated factors. However, they are intended to provide a brief introduction to pertinent risk factors and a base for applying a theoretical framework (Figure 2) that explains the relationship between perceived weight and pre-suicide behaviors among youth. This section was developed based upon the most recent literature, particularly systematic reviews, and was written to provide justification for the variables included in this study's logistic regression models—independent, confounding,

modifying, and moderating variables.

Correlates of pre-suicide behaviors are classified into 6 broad categories: (1) sociodemographic, (2) social, (3) family adversity and individual negative life events, (4) psychiatric and psychological, (5) physical health, and (6) method. While researchers have explored a wide range of factors that fall within these 6 categories, the following sub-sections will detail factors that have a significant association with suicidal ideation, attempts, and suicide, as proven by multiple studies (Table 2) (10,19,28). As stated previously, Table 2 does not contain information for suicide planning because the topic is scantily covered in the literature. Where information is available, however, planning is included in the following review.

Table 2: Select factors that are associated with pre-suicide behaviors or suicide.

Endorsement indicates there is a significant association. Lack of endorsement indicates there is no known significant association, whether studied or unexplored (1,10,19,28,34)**.**

	Thoughts/Behaviors		
	Suicidal Ideation	**Attempted Suicide**	**Suicide**
Sociodemographic			
Gender	X	X	X
Age	X	X	X
Low/high SES		X	X
Lesbian, gay, bisexual, or transgender sexual orientation		X	
Race/Ethnicity	X	X	X
Restricted educational achievement		X	X
Social Factors			
Violence exposure	X	X	
Victimization	X	X	
Perpetration of violence	X	X	
Suicide Contagion	X	X	X
Popular Media	X	X	
Bullying	X	X	

Table 2 (continued): Select factors that are associated with pre-suicide behaviors or suicide. Endorsement indicates there is a significant association. Lack of endorsement indicates there is no known significant association, whether studied or unexplored (1,10,19,28,34)**.**

Family adversity/Individual negative life events			
Parental separation or divorce		X	X
Parental death		X	X
Adverse childhood experiences	X	X	X
History of physical or sexual abuse	X	X	X
Parental mental disorder	X	X	X
Family history of suicidal behavior		X	X
Marital or family discord		X	
Previous suicide attempt*		X	X
Psychiatric and psychological factors			
Mental disorders (affective, anxiety and conduct)	X	X	X
Drug and/or alcohol misuse	X	X	X
Impulsivity		X	X
Low self-esteem		X	X
Poor social problem-solving		X	X
Perfectionism		X	X
Hopelessness		X	X

Table 2 (continued): Select factors that are positively associated with pre-suicide behaviors. Endorsement indicates there is a significant association. Lack of endorsement indicates there is no known significant association, whether studied or unexplored (1,10,19,28,34)**.**

Physical Health			
Poorly rated health	X	X	X
Risky sexual behavior	X	X	
Method			
Availability of lethal means			X

Sociodemographic factors

Gender. Gender effects in youth are discussed above. The gender paradox and the proposed cause of this discord are covered in the subsection "Epidemiology". This trend does not seem to have changed for at least the last decade (1).

Race and ethnicity. Race, ethnicity, and the age-related changes in rates among particular racial and ethnic groups are also covered in the subsection "Epidemiology".

Socioeconomic Status. There is little clarification of the association between socioeconomic status and pre-suicide behaviors among race- and age-defined groups. When dissecting components of socioeconomic status, the associations between socioeconomic status and pre-suicide behaviors become even less clear. Some studies show that among black youth, suicidal ideation, attempts, and suicide are positively associated with lower education and higher income (35). Some studies show that suicide attempt rates are higher among youth from lower socioeconomic groups (1,10), while others reveal that higher socioeconomic status imparts

greater risk of pre-suicide behaviors (35).

Sexual orientation. Sexual orientation is also associated with pre-suicide behaviors. Studies show that up to 40% of gay youth attempt suicide. However, the associations between homosexuality and pre-suicide behaviors are relatively unstudied. Gaps in research and prevention efforts are attributed to the stigma attached to being openly gay and to the discomfort and embarrassment that may accompany discussions of sexuality. (Here, "gay" is broadly defined as lesbian, gay, bisexual, or transgender.) In 2005, Kitts' literature review revealed that the increased likelihood of pre-suicide behaviors among gay youth is likely moderated by psychosocial factors that are commonly experienced by homosexual youth. Thus, being gay is not sufficient for an increase in pre-suicide behaviors; rather, the increase is related to a heightened presence of psychological and social factors, such as those listed in Table 2. Therefore, the issues that gay youth encounter are not necessarily unique to their sexual orientation; instead, they seem to face the same issues as their homosexual counterparts with a higher frequency (36). Family reaction and rejection in response to sexual orientation moderates the likelihood of attempted suicide (28,36).

Individual negative life events and family factors

There are several family factors and individual life events that are associated with pre-suicide behaviors. Most notably, attempted suicide is one of the strongest predictors of repeated attempts and ultimate suicide.

History of sexual and physical abuse leads to a significant increase in the occurrence of suicidal ideation and attempt between the ages of 16 and 25 years. Sexual abuse seems to have a greater impact than physical abuse on mental health outcomes and, therefore, has a greater impact on risk

for suicidal ideation and behaviors (28).

Family history of suicide is positively associated with suicidal behavior in youth, independent of psychiatric disorders (28). This relationship has been attributed to genetics, as well as to behavioral contagion and its impact on perceived acceptability. The impact of family history seems to be moderated by other familial factors. In general, families of suicidal youth exhibit issues with communication, problem-solving, social support, and discipline (34).

Stressful life events and other specific familial strain will not be discussed in further detail, due to the broad scope and scattered nature of such factors. A few of the commonly associated risk factors that fall within this combined category are listed in Table 2. Some of these items have been proven to moderate or modify the associations between other factors and pre-suicide behaviors, in addition to their independent correlations to suicidal thoughts and behaviors.

Psychiatric and Psychological Factors

Aside from attempted suicide, psychiatric disorders (particularly affective, anxiety, and conduct) are the strongest predictors of suicidal ideation, attempt, and suicide. Psychiatric disorders are present in up to 90% of youth suicide victims and attempters from various study settings, and their presence is associated with a 9-fold increase in suicide (19,34,37,38). Suicidal thoughts during adolescence are considered the gateway to attempted suicide and suicide during adulthood, since they significantly increase the adult risk of psychiatric problems. Further, there is a dose-response relationship between the number of depressive episodes between the ages of 16 and 21 years and suicidal ideation and attempt (28).

There are a number of studies that show a significant association between drug use (alcohol, cigarettes, and illicit drugs) and pre-suicide behaviors. When attempting to characterize the association between these factors and specific outcomes, there have been mixed findings, which can likely be attributed to methodological and study population differences and limitations (28,29,37,39,40). Using 2005 YRBS high school data, Epstein and Spirito (2009) examined a number of risk factors, inclusive of substance or alcohol abuse, to determine if there were specific drug- or alcohol-related behaviors that were significantly related to suicidal-related outcomes, including suicidal ideation, planned suicide, and attempted suicide. The conclusions of this study were similar to past research; however, a nationally representative sample was used, rather than the smaller populations that are standard in community or clinical studies. Drug use was positively associated with all three outcomes (ideation, planning, and attempt). Specifically, the results showed that recent smoking, drinking before age 13, and being offered or sold drugs within the past 12 months were positively associated with all three outcomes (39).

Epstein and Spirito (2009) posit three methods by which substance use is associated with suicidal ideation, planning, and attempt. They propose: (1) an increase in stress levels that often co-occurs with psychopathology, especially conduct problems, which in turn increase risk for pre-suicide behaviors; (2) substance use also exacerbates psychological symptoms (e.g., depression and disruptive behaviors); just as alcohol increases social disinhibition and unhealthy lifestyles, it could lead to suicidal behavior. Thus, alcohol and other substance use seems to be indirectly related to all three outcomes and moderated by other factors. Further, research and postulations make it clear that substance abuse and psychiatric disorders act synergistically to yield higher risk for suicidal behavior among youth when co-occurring (28,39).

The remaining factors within this category are proposed to moderate other risk factors, according to the theoretical framework used to explain upstream moderators of youth suicide (Figure 1). Depression and its association with weight perception will be discussed in the following section

"Associations between obesity, weight perception, and pre-suicide behaviors among youth".

Method of Attempt

The method used during attempted suicide also plays a role in lethality. A firearm is the most lethal weapon. Drug overdose or poison ingestion is the least lethal weapon. Historically, firearms were the leading suicide method among US youth; however, in 2004, the suicide rates by hanging or suffocation among females aged 10 to 19 years old increased significantly (19). According to Beck's Suicide Intent Scale, choosing a more lethal method may reflect greater intent to die. However, after stratifying by method, the case fatality rate remains greater in men than in women and still rises with age, indicating that method does not solely determine the act's lethality (20).

Social Factors

Cultural/Sociocontextual factors. In 2012, when Amitai and Apter reviewed the literature for social and cultural risk factors for pre-suicide behaviors, the data were fairly scant, compared to studies of other risk factors such as psychological risk factors. Researchers propose that social contextual factors could serve as predictors of suicidal thoughts, communications and behaviors, just as they impact general well-being (29).

Interpersonal violence. Historically, exposure to interpersonal violence among youth has been inconsistently linked to suicidal thought and behavior. However, in their 2009 study, Epstein and Spirito found that aggression and victimization were associated with suicidal ideation, suicide planning, and attempted suicide. Among the specific items they analyzed, the following items were positively associated with all three outcomes: threatened at school in the past 12 months, property stolen at school in the past 12 months, fought in the past 12 months, and ever hit by a

girlfriend or boyfriend. Studies have shown that victimization, both acute and chronic, may result in significant emotional distress and feelings of worthlessness. Victimization is also related to peer rejection, which can lead to the previously mentioned feelings (1,39). Adverse feelings may lead to pre-suicide behaviors and, if unfettered by healthy coping mechanisms, may lead to suicide. In fact, Hawton et al. (2012) proposed that hopelessness, deficient problem-solving skills, and perfectionism seem to moderate the relationship between most, if not all, of the risk factors presented in Table 2 and attempted suicide. They did not mention the role these sentiments and personal characteristics play in the risk of suicidal ideation, nor the transition from suicidal thought to attempt.

Bullying. Recently, the relationship between bullying and suicidal behaviors among youth has been further characterized. Most importantly, boys and girls who are both bullies and victims have a higher likelihood of suicidal behaviors. According to trajectory curves, girl are more affected by bullying than boys, both perpetration and victimization (28).

As with psychiatric and psychological factors, characteristics that seem to moderate the relationship between pre-suicide behaviors and social-contextual factors are hopelessness, problem-solving skills, optimism, and perfectionism. Bullying will be further discussed in the following section "Associations between obesity, weight perception, and pre-suicide behaviors among youth".

Physical Health

Poor health. Epstein and Spirito (2009) also examined the association between high school students' self-reported poor health and suicidal ideation, planning, and attempt. They found a general assessment of one's health to be negatively associated with suicidal ideation,

planning, and attempt. This finding suggests that youth in poor health are more likely than their healthier peers to have suicidal thoughts and exhibit suicidal behavior.

Sexual health. While sexual health does not wholly fall under physical health, it is included in this section because of the association. In their 2009 study, Epstein and Spirito studied risky sexual behaviors. They found that sexual activities, specifically participants' endorsements of forced sex, alcohol use prior to sex, and failure to use a condom, were positively associated with suicidal ideation, suicide planning, and attempted suicide. (39)

ASSOCIATIONS BETWEEN OBESITY, WEIGHT PERCEPTION, AND PRE-SUICIDE BEHAVIORS AMONG YOUTH

It is estimated that 30% of the US population is obese (8). Over the last decade, obesity has dramatically increased among youth. By some estimates, the percentage of US youth who are overweight or obese (defined as a body mass index (BMI) of 25–29.9 and 30.0 and above, respectively) has more than tripled since 1980, with 15% of youth considered overweight in 2000 (9). This increase is even more pronounced in black and Hispanic/Latino youth. With this increase in overweight status among youth, there is concern about the impact it has on short- and long-term physical and psychosocial health outcomes, including pre-suicide behaviors (27).

Research shows that obesity and perceived weight are related to pre-suicide behaviors (2,3). Studying a nationally representative sample of youth, Eaton et al. (2005) found that high school students who perceived themselves to be slightly or grossly under- or overweight had a higher probability of suicidal ideation than other students. And, whites and Hispanics/Latinos who perceived themselves grossly under- or overweight had greater odds of attempting suicide than whites, but this was not found for youth of other race/ethnicities (9). Thus, the impact of weight

perceptions yields different outcomes, depending on race/ethnicity. Further, this relationship is dependent on the extremity of weight perceptions—the more extreme, the greater the odds of pre-suicide behaviors. Eaton et al. (2005) also found that the relationship between obesity and suicidal behavior is mediated by perceptions of weight or body size. Therefore, body mass index (BMI) is significantly associated with suicidal ideation (among all students) and attempts (only among white and Hispanic/Latino students); however, after controlling for perceived weight, this association disappears (9).

Weight and Depression

Obesity and weight perception have been shown to have positive associations with depression and depressive symptoms (11–13), but results have been mixed regarding the directionality of this relationship (15,17). In a review of studies examining the relationship between obesity and depression, Faith et al. (2011) found that 80% of studies reported obesity as a risk factor for depression, while 53% of studies showed that depression was prospectively associated with obesity, which indicates that more researchers have studied the prospective relationship between obesity and the onset of depression. Although studies have consistently shown that gender moderates this relationship, regardless of the directionality, Luppino and colleagues (2010) found that this reciprocal relationship is present among both men and women. The methods applied in these studies and the populations examined were heterogeneous (15,17).

Searches of PubMed produced no published systematic reviews of literature exploring the relationship between obesity and depression among youth populations. However, independent studies show mixed evidence for the directionality of the relationship between obesity and depression among youth (17,41,42). Some studies demonstrate that obesity leads to depression (16,43) and others demonstrate that depression leads to obesity (14). Studies that examine weight

perceptions, rather than obesity, show a prospective relationship between perceptions and psychological well-being, including depressive symptoms, among youth (11–13).

Weight and Pre-suicide behaviors

Lee and Seo (2013) studied a nationally representative longitudinal sample of participants transitioning from adolescents to young adulthood and found that participants who perceived themselves as overweight were more likely to think about committing suicide, even after controlling for well-established covariates such as age, sex, race/ethnicity, and depressive symptoms. This result is consistent with the cross-sectional studies that showed a relationship between weight perception and suicidal ideation and attempts (2,3,44). This result further showed that this effect existed independent of BMI and depressive symptoms. The previous finding suggests that depression may be a partial, rather than full, mediator of the relationship between overweight perception and suicidal thoughts and behaviors (45). In this thesis, the pathway that is inclusive of depressive symptoms will be explored (Figure 2).

Lee and Seo's (2013) study suggests that factors other than depression might mediate and moderate the relationship between overweight perception and suicidal-related outcomes. Other studies show that overweight and obese youths may be more vulnerable to other health-risk behaviors. When adjusted for factors that confound the relationship between health-risk behaviors and obesity, Farhat, Iannotti, and Simons-Morton (2010) found that obese girls between the ages of 15 and 17 were more likely to engage in the following behaviors than their counterparts in other weight categories: frequently smoke cigarettes, frequently drink alcohol, and being a victim or perpetrator of bullying. Among obese girls between the ages of 11 and 15, they found an overlapping, but not identical, set of associated factors, revealing a potential interaction of weight-status with age. Further, younger girls exhibited health-risk behaviors among *both* the

overweight and obese group, unlike girls 15 years and older. Neither overweight nor obese boys in either age group exhibited these same health-risk behaviors, further supporting a gender difference. Older obese boys exhibited greater odds of carrying a weapon as their only difference in health-risk behavior (46).

The previous findings support the literature that reports a gender difference in the impact of weight status on health-risk behaviors, suggesting that age may interact with weight status (46). Although the relationship between overweight perception and suicidal ideation was stronger in girls, such a relationship became weaker in girls more steeply than in boys over time. Regarding body weight perception, past research reports that girls are more sensitive to sociocultural influences than boys, and indicates that society puts tremendous pressure on adolescent girls to look thinner. The results of studies generally indicate that overweight girls seemed to experience a higher degree of stigmatization than overweight boys (47). Accordingly, overweight girls are more frequently teased about their weight and relationally, verbally, and physically bullied. Overweight girls are also more socially marginalized in friendships and romantic relationships (46,47). The association between weight and suicidal outcomes can be explained by the greater extent to which girls' relationships are guided by emotion, making girls more susceptible to sociocultural norms and perceptions. The desire to be socioculturally appropriate may lead certain youth, particularly girls, to participate in other high-risk behaviors, such as those studied by Farhat and colleagues (2010). In contrast, boys appear to externalize, rather than internalize, as suggested by the increased odds of carrying a weapon. However, as youth age, they are exposed to competing needs that require their attention, which explains the relatively steeper decline in suicidal ideation among girls, when compared to boys (45).

A review of the association between body image and age revealed that although body dissatisfaction is stable across the life span for females, they put less emphasis on the importance

of their body shape as they grow older. This review suggested that girls, as they advance into young adulthood, tend to protect their self-esteem from socially undesirable body image because age-related body shape changes are largely uncontrollable (45). Adult women might not perceive their body weight or shape to be as important as it was during their adolescence. Therefore, age appears to act as a protective factor against suicidal ideation in women with body dissatisfaction (45,46).

Most recently, a study using pooled 2007 and 2009 YRBS high school data, examined the differential impact of absolute weight perceptions on pre-suicide behaviors versus incorrect weight perception on such outcomes. In accordance with other studies, Zeller et al. (2013) found that being obese or extremely obese imparted a significantly greater risk of suicidal ideation relative to healthy weight high school students, while controlling for sex, race/ethnicity, age, and prolonged sadness (48). There was no effect of obesity on attempted suicide. Interestingly, youth in all excess weight categories, who were accurate in their weight perception, were at greater risk for suicidal ideation when controlling for demographic characteristics; however, students who were inaccurate were at no greater risk of suicidal ideation. Findings regarding suicide attempts varied, based upon actual weight/weight perception and race/ethnicity. The factors considered in this study were limited. These findings suggest that weight status and weight perceptions interact to better predict risk for pre-suicide behaviors when controlling for demographic characteristics (11).

The research presented in this thesis was designed to further characterize factors that confound, moderate and mediate the association between perceived weight status and suicidal outcomes, such as gender, race/ethnic, obesity, and other health-risk factors (e.g., bullying and unhealthy eating habits).

CHAPTER III: METHODOLOGY

RESEARCH DESIGN

This is a cross-sectional, correlational study of publicly available data files from the nationally administered YRBS. In particular, this research focuses on questions and data from the 2011 survey that are related to perceived overweight status (main independent variable), pre-suicide behaviors (dependent variables), and covariates that potentially moderate, mediate, or confound this relationship (49,50).

The first national, school-based YRBS was administered in the spring of 1990 as a core component of the Youth Risk Behavioral Surveillance System (YRBSS), an epidemiological surveillance system established by the CDC. Among a cadre of surveys comprising the YRBSS, the YRBS uniquely captures demographic characteristics, sentiments, behaviors, and experiences from a nationally representative sample of 9th through 12th graders in all public, Catholic, and other private schools. Since 1991, the YRBS has been conducted biennially (49,50).

The YRBS was launched to systematically describe six major causes of mortality and morbidity among young people in the US school system: (1) unintentional and intentional injuries, (2) tobacco use, (3) alcohol and other drug use, (4) sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases, (5) dietary behaviors, and (6) physical activity. Such information is important in surveying the afore-mentioned health priorities over time; directing prevention strategies, evaluating the impact of broad policies and program changes aimed at these health-risk behaviors; monitoring progress in achieving national health objectives; and, directing school health programs and policies on behaviors that disproportionately contribute to the leading causes of morbidity and mortality among youth (49,50).

TARGET POPULATION AND SAMPLE

The YRBS was administered to a representative sample of the target population of US 9th through 12th grade students. This sample was produced by a three-stage cluster design in order to obtain a nationally representative cross section of US students attending public, Catholic, and other private schools in all 50 States and the District of Columbia. All territories were excluded from the selection frame, except Marshall Islands, Northern Mariana Islands, and Palau (i.e., Puerto Rico, the trust territories, and the Virgin Islands) (49,50).

The current study population included students who provided responses for all questions used to measure the outcomes, independent constructs, confounding factors, and mediating and moderating factors. All variables used to measure outcomes, and independent and confounding factors, are further described in the section "Data Selecting and Variable Coding" of this chapter. Based upon the aforementioned sample restrictions, there were 10,929 students included in this study's population. The unweighted population was 48.5% male and 51.5% female. The racial and ethnic composition of the unweighted study sample was as follows: 49.5% white, 15.6% black, 3.0% Asian, 1.9% American Indian or Alaska Native, 13.1% Hispanic/Latino, 15.3% multi-racial Hispanic/Latino, and 4.5% multi-racial non-Hispanic/Latino. The most highly sampled ages were 15 to 17 years, representing 23.0%, 26.5%, and 25.6% of the sample population. Each grade was approximately equally represented (Appendix 2; Table 5).

INSTRUMENT AND MEASURES

Questionnaires were self-administered and students recorded their responses on computer-scannable booklets or answer sheets. Skip patterns were not included in the questionnaire, which partially elevated variability in questionnaire completion (50). The 2011 YRBS included 97 questions, also referred to as items. Answers to survey items were limited to 8 mutually exclusive responses (51).

In the present set of analyses, most variables maintained the original coding and formatting provided by the CDC. Data modifications are explained in "Data Selection and Variable Coding". Further explanation of CDC's original coding, and variable calculations can be found in the "2011 YRBS Users Manual" (51) .

DATA COLLECTION PROCEDURES AND MANAGEMENT

While the survey was conducted under the auspices of the CDC, the national survey has been conducted under contract with ICF Macro, Inc., an ICF International Company since 1990. The contractor was responsible for sample design, selection, and obtaining the appropriate state-, district-, and school-level clearances to conduct the survey in selected schools. The contractor was also responsible for training personnel (49,50).

In the first-stage sampling frame of the 2011 YRBS, primary sampling units (PSUs) were selected from 16 strata, formed according to degree of urbanization and the relative percentages of black and Hispanic/Latino students in each PSU. PSUs consist of large counties or groups of smaller, adjacent counties. The probability of selection was proportional to total school enrollment for each PSU (49,50).

Preceding the second frame, data from the Quality Education Database (QED) and the Common Core of Data from the National Center for Education Statistics were merged to respective PSUs to form a comprehensive list of public and private schools, along with each institution's enrollment figures. Schools that did not include 9th through 12th grade, were collapsed to form whole schools. Next, schools were categorized based upon enrollment—one group having an estimated enrollment of equal to or greater than 25 students per graduating class (large schools) and the other less than 25 students per graduating class (small schools) (49,50).

In this second frame, schools were selected using a random start, with probability of enrollment proportional to school population size in grades 9 through 12. Approximately one-fourth of PSUs were selected for small school sampling, in which one small school was sampled from each of these units. In the remaining PSUs, three large schools were selected from amongst all schools with equal or greater than 25 students per class. All schools were selected with probability proportional to size. Although schools were sampled with probability proportional to size, schools with high minority populations were oversampled, using an inflated measure of size, to enable separate analysis of data for black and Hispanic students (49,50).

One or two classes from each grade level were sampled from each school during the final stage of sampling. Course selection was restricted to required subjects or all classes meeting during a particular period of the day, depending on the school. Further, classes were selected using systematically-equal probability with a random start. All students in selected courses were eligible to participate. If students refused participation, or did not receive parental consent, they were not replaced, in order to avoid immeasurable bias and maintain the integrity of the study design (49,50).

Among the 194 schools sampled during the second stage of the three-stage cluster sample design, 158 (81%) schools participated. Nationwide, 17,672 students were sampled, cross-cutting various standing courses, required study periods, or home rooms; 15,503 (87%) students submitted questionnaires and 15,425 surveys were usable after data editing. The overall response rate was 71% (51). After excluding students that did not have complete data for the variables of interest, the study population included 10,929 high school students.

In 2011, Washington, Oregon and Minnesota did not participate. California, Missouri, Nevada, and Pennsylvania were not weighted. In total, data from 43 states are present in the national file (49,50).

The logistics of data collection and parental consent were navigated by ICF Macro, Inc. The questionnaire required approximately 45 minutes to complete. Administrators extended opportunities to complete the questionnaire to students who were absent on the day of administration. Students were allowed to complete the survey at a later date, regardless of attendance status during administration day. ICF Macro, Inc. scanned all completed questionnaires from the national survey and sent a Statistical Analysis System (SAS™) dataset to the CDC, where they were processed to eliminate aberrant values affecting data validity and reliability (49,50).

While preparing the 2011 data for analysis, 179 logic statements were performed on each questionnaire. The majority of logic statements compared two questions at a time for consistency. Responses with logical conflicts were set to missing and not imputed, in order to avoid immeasurable bias. Questionnaires with less than 20 valid responses remaining after editing were removed from the dataset. Data cleaning and editing were performed with Microsoft Visual Basic and SAS programs (49,50). Logic statements can be found in the "2011 YRBS Data Users

Manual" (51).

Edited data were sent to ICF Macro, Inc. Statisticians weighted the data, and ICF Macro, Inc. sent weights to the CDC, where the weights were merged with edited data to yield a complete dataset. The 2011 national dataset contains data from states with greater than a 60% response rate, allowing for weighting (50). Each observation was weighted based on the student's sex, race/ethnicity, and grade, in order to adjust for school and student nonresponse and oversampling of Black and Hispanic/Latino students (49). All YRBS datasets are available in Microsoft Access, SAS, ASCII, SPSS, and files and formats. Further details of the study design, data quality, and reliability and validity of analytic results were previously described (49,50).

In the current study, the complete 2011 YRBS dataset was downloaded from the CDC's website in SAS format. Data were housed in SAS datasets and modified using SAS software. SAS procedures that account for survey design were used to analyze the data (e.g., SURVEYLOGISTIC, SURVEYFREQ; Appendix 3).

LIMITATIONS

1. The study sample only included a representative sample of youth enrolled in public and private schools in 43 states of the United States, which excluded Washington, Oregon, Minnesota, California, Missouri, Nevada, and Pennsylvania. Results cannot be generalized to all youth between the ages of 12 and 18.

2. This study followed a cross-sectional design. Therefore, descriptive and inferential

quantitative procedures are not predictive and yield no information on the directionality of confirmed associations between the dependent and independent variables.

3. Data were self-reported. Therefore, responses were likely influenced by cognitive and situational factors. Although BMI can be measured and validated, the outcome measure of suicide (ideation, planning, or attempt within the last 12 months) and the hypothesized mediator (depression within the last 12 months) cannot be validated by a biochemical or physical measure, particularly if the episode or mood is not current or recent.

DELIMITATION

1. Students who did not have complete data for all variables of interest were excluded from this study's population.

DATA SELECTION AND VARIABLE CODING

Pre-suicide behaviors. Suicide-related ideation, planning, and attempt were measured as 3 separate items in the 2011 YRBS. Variables QN25, QN26, and QN27, respectively, were used to capture this information. Presence of these constructs was measured by the following 3 questions: During the past 12 months, did you ever seriously consider attempting suicide?; During the past 12 months, did you make a plan about how you would attempt suicide?; During the past 12 months, how many times did you actually attempt suicide? The first 2 questions were used to measure suicidal ideation and suicide planning, respectively. The third question was used to measure suicide attempt. The responses to each of these questions were originally coded

dichotomously; yes was coded as "1" and no was coded as "2". The responses to all 3 items were combined into a single dichotomous measure of suicidality, which indicated if participants endorsed 1 or more pre-suicide behaviors versus none (Appendix 2; Table 3). This created variable was also coded dichotomously; yes was coded as "1" and no was coded as "2". In the analysis contained herein, all 3 variables (ideation, planning, and attempt) were treated separately and in combination, as described above. The reference group for all outcome variables was coded as "2", indicating that the respondent did not endorse the respective pre-suicide behavior.

Perceived weight status. The independent variable "perceived weight status" was measured using item QN67 in the 2011 YRBS dataset. Perceived weight status was measured using the question: How do you describe your weight? Answers to this question were coded categorically and included 5 responses, ranging from "very underweight" to "very overweight". The responses to this question were used to create a dichotomous variable in the 2011 YRBS dataset, which indicated if the participants considered themselves slightly or very overweight versus neither. The dichotomous coding for this variable in the 2011 YRBS dataset was maintained; the reference group was coded as "2", indicating that the respondents did not perceive themselves to be slightly or very overweight.

Potential Confounding Variables. The following demographic variables were retrieved from the 2011 YRBS dataset and included in this study as confounding factors: age (Q1), sex (Q2), grade (Q3), and race/ethnicity (RACEETH). All variables were coded categorically. Students provided their age, sex, and grade. Age was coded categorically. Students ages 14 or younger (the reference group) were collapsed into one category and coded as "1"; 15 year olds were coded "2"; 16 year olds were coded "3"; 17 year olds were coded "4"; and students who were aged 18 years or older were coded "5". Sex was a dichotomous variable. Females were coded as "1" and males as "2". Males were the reference group. There were 5 grade categories—

9th, 10th, 11th, 12th, and ungraded/other. These categories were coded "1", "2", "3", "4", and "5", respectively. Ninth graders were the reference group. Race/ethnicity was determined using a composite of race and ethnicity. American Indians and Alaska Natives were coded "1"; Asian were coded "2"; blacks or African Americans were coded "3"; Native Hawaiians or other Pacific Islanders were coded "4"; Hispanics or Latinos were coded "5"; multi-racial Hispanics were coded "6"; multi-racial non-Hispanic were coded "7"; whites were the reference group and were coded "8". Sex and race/ethnicity were also considered to be potential mediating variables (Appendix 2; Table 3).

Potential Mediating/Moderating Variables. The following variables were also retrieved from the 2011 YRBS dataset and included in analysis, due to their potential to moderate or mediate the relationship between perceived weight and pre-suicide behaviors: obesity (QNOBESE) status, bully (QN22), ebully (QN23), and sad (QN24). The reference group for all of these variables, which were retrieved from the 2011 YRBS dataset, was coded as "2", indicating that the respondent was: not obese, not physically or electronically bullied, or not sad for a prolonged period of time, respectively.

Overweight and obesity were measured using 2 mutually exclusive dichotomous variables QNOWT and QNOBESE, retrieved from the 2011 YRBS dataset. In this study, both variables maintained their original coding. Age, sex, and body mass index (BMI) were used to determine whether students were overweight or obese. When BMI was at or above the 85th percentile and below the 95th percentile by age and sex, students were considered overweight. When BMI was at or above the 95th percentile by age and sex, students were considered obese (Appendix 2; Table 3). Overweight and obesity were coded dichotomously (yes vs. no) and maintained the same coding found in the 2011 YRBS dataset.

Two types of bullying were measured using 2 separate questions: During the past 12 months, have you ever been bullied on school property? During the past 12 months, have you ever been electronically bullied? Prolonged sadness was approximated using the following question: During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing some usual activities? All responses to the above questions were dichotomous (yes vs. no) and maintained the same coding found in the 2011 YRBS dataset.

The following variables were created using pre-existing variables in the 2011 YRBS dataset: discord between perceived and actual weight (weight discord), and unhealthy weight control behavior (unhealthy control; Appendix 2, Table 3). Weight perceptions reported by participants were compared to the variables that dichotomously indicated whether students were overweight (QNOWT) or obese (QNOBESE) to yield a new variable that indicated whether there was agreement or discord between a student's perceptions versus reality of weight status (weight discord). Discord was indicated when: 1) participants were overweight or obese and did not consider themselves to be overweight or obese or 2) participants were not overweight or obese and did consider themselves to be overweight or obese. Discord was coded as a dichotomous variable (yes vs. no). The reference group was coded as "2", indicating that there was not discord between actual and perceived weight.

The presence of unhealthy weight control behavior was measured using the responses to 3 questions in the 2011 YRBS dataset: During the past 30 days, did you go without eating 24 hours or more to lose weight or to keep from gaining weight?; During the past 30 days, did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight?; During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight? The responses to each of these questions were compiled to yield a composite variable that indicated whether or not students engaged in unhealthy weight control behavior in the last 30 days (unhealthy_control). If students answered affirmatively to any of the 3 above-

listed questions, they were considered to have engaged in unhealthy weight control behaviors. This variable was coded dichotomously (yes vs. no) and the reference group was coded as "2", indicating that there were no unhealthy weight control behaviors endorsed by the participant.

All variables used for analysis and the names by which each variables is referred in the "Results" section can be found in Table 3 of Appendix 2.

DATA ANALYSIS PROCEDURES

CDC designed sample sizes to produce overall and subgroup estimates that are accurate within plus or minus 5% at 95% confidence. Subgroups are defined by sex, grade, race/ethnicity, grade by sex, and race/ethnicity by sex. Estimates for grade by race/ethnicity subgroups are accurate within plus or minus 5% at 90% confidence (49,50).

Descriptive and inferential procedures were performed using standard SAS software and STATA™ software (52,53). All variables were dichotomous or categorical. Unweighted and weighted frequencies and percentages for all variables were calculated. By outcome, weighted frequencies and percentages were calculated for all levels of independent variables; additionally, unadjusted odds ratios and 95% odds ratio confidence intervals were calculated for all levels of independent variables. In order to identify covariates that potentially modified the effect of perceived weight status on pre-suicide behaviors, homogeneity of odds ratios from stratified analysis was assessed using the Breslow-Day test (Appendix 2).

Before performing multivariate regression, collinearity among all independent variables was tested. Variables with variance inflation factors greater than 5 were considered to be potentially collinear with another variable. Subsequently, if 2 or more variables were identified as

problematic in collinearity analysis, one was removed and collinearity analysis was performed again, until there were no indications of problematic multicollinearity according to inflation factors. Decisions about variable removal were based upon a combination of *a priori* knowledge and bivariate analysis.

Multivariate logistic regression was performed to measure the associations between pre-suicide behaviors and the main independent variable "perceived weight status", while controlling for covariates (moderating, mediating, and confounding factors). Initially, covariates listed in Table 3 (Appendix 2) and all terms that captured interactions between the main independent variable and singular covariates were included in models for each outcome. Chunk tests were performed to assess whether all interaction terms, combined, significantly increased the fit of each model. Goodness of fit tests, using the log-likelihood statistic indicated the overall fit of each model. Change of fit between models was assessed using likelihood ratio tests. If each model's fit increased significantly after adding all interaction terms, backward elimination was performed to determine which interaction terms, when removed, did not significantly detract from the model's fit. Models derived from assessment of interaction were considered gold standard models and are referred to as full models in the Results section of this thesis. Following assessment of interaction, covariates were eliminated based upon the following criteria: 1) The variable was not indicated as a potential confounding factor based upon stratified analysis (Tables 8-11, Appendix 2) When removing the covariate from the model, the main independent variable's odds ratio did not change more than 10% of that in the gold standard model; 3) And, ideally, the main independent variable's measured effect did not lose more than 10% precision according to the odds ratio's confidence interval. The models derived from assessment of confounding are referred to as final models in the Results section of this thesis.

For select outcomes, mediation was assessed using the following criteria, as described by Baron

and Kenney (1986): 1) perceived weight status was significantly associated with the pre-suicide behavior; 2) the potential mediator was significantly associated with the pre-suicide behavior; 3) perceived weight status and the potential mediator were significantly correlated; 4) addition of the potential mediator to the logistic regression model caused perceived weight status to be insignificantly associated with the pre-suicide behaviors (54).

As recommended in the guide "YRBS Analysis Software", programmatic procedures that accommodate the study design and complex survey methods were used to analyze YRBS data, including the use of analytic procedures that accommodate the weights associated with each observation in the YRBS dataset (55). All SAS and STATA programs can be found in Appendix 3 (52,53).

IRB CLEARANCE

Analysis performed in completion of this thesis involved secondary analysis of a public-access, de-identified, national dataset. Approval from the Institutional Review Board (IRB) of Emory University was not required.

CHAPTER IV: RESULTS

OUTCOMES, PERCEIVED WEIGHT STATUS, DEMOGRAPHIC CHARACTERISTICS, AND CONFOUNDING FACTORS

A total of 10,929 high school students who were surveyed in 2011 for the YRBS were included in this study. Fully 19.0% (n=2201) of the weighted study population endorsed at least 1 of 3 pre-suicide behaviors. Among the 3 non-mutually exclusive components of suicidality (ideation, planning, and attempt), the greatest proportion of the weighted study population endorsed suicide-related ideation (n=1814; 15.7%), followed by planning (n=1424; 12.3%), and attempt (n=809; 7.0%) (Table 5, Appendix 2).

Among the weighted population of high school students who were included in this study, 5.2% (n=598), 2.7% (n=310), 0.4% (n=46) singularly endorsed suicide-related ideation, planning and attempt, respectively. Four-hundred eighty-five (4.2%) of students seriously considered committing suicide and made plans to attempt suicide in the past 12 months, but did not actually attempt suicide. Another 1.4% (n=132) of students seriously considered committing suicide and attempted suicide in the past 12 months, but did not make a plan to attempt suicide. An additional 0.3% (n=31) of students made plans to attempt suicide and attempted suicide in the past 12 months, but did not indicate that they seriously considered it. Among this study's weighted sample of students, 5.2% (n=599) endorsed all three outcomes: suicide-related ideation, planning, and attempt. Weighted and unweighted frequencies can be found in Table 4 (Appendix 2).

At the point of survey administration, 29.4% (n=3406) of the weighted study population considered themselves to be slightly or very overweight.

The ages most represented were 15 years old (n=2849; 24.6%), 16 years old (n=3033; 26.2%),

and 17 years old (n=2812; 24.3%). The weighted sample was 50.4% (n=5839) male and 49.6% (n=5745) female. Although there was a fairly even distribution of participants across grade levels, students in 9th grade (n=3096; 26.7%) comprised the largest proportion. The greatest frequencies of participants were white (n=7143; 61.7%), black (n=1363; 11.8%) and multiple-race Hispanic (n=1157; 10.0%). Unweighted and weighted frequencies of study variables for the entire sample are available in Table 5 (Appendix 2).

Upon calculation, 12.6% (n=1458) of the weighted population was obese (Table 5, Appendix 2). Although the variable overweight was not included in this study, it was determined that 15.1% (n=1749) of the weighted population was overweight (Calculated weight designations of overweight and obese were mutually exclusive.) Therefore, 27.7% (n=3207) of students were overweight or obese (Table 5, Appendix 2).

Within the last 12 months, 20.4% (n=2359) were bullied in school and 16.6% (n=1919) were electronically bullied. Regarding mood, 27.8% (n=3218) reported being sad for 2 consecutive weeks. At the time of survey administration, there was discord between the perceived weight and actual weight status for 18.4% (n=2132) of the weighted study population. Within the past 30 days, 15.4% (n=1783) of the weighted population engaged in unhealthy weight control behaviors (Table 5, Appendix 2).

WEIGHT STATUS AND COVARIATES BY OUTCOME

For all 4 outcomes of interest (suicidality, ideation, planning, and attempt), frequencies for weight status and its covariates were examined. The percentage of students who were positive for all outcomes was higher among participants who perceived themselves as slightly or very overweight than among participants who did not perceive themselves to be slightly or very

overweight. Twenty-two percent (n=748), 17.5% (n=596), and 10.1% (n=343) of participants who perceived themselves to be overweight endorsed suicide-related ideation, planning, or attempt, respectively. Among study participants who considered themselves overweight, 25.9% (n=881) endorsed suicidality, meaning that they seriously considered attempting suicide, made a plan to attempt suicide, and/or attempted suicide within the past 12 months (Table 6, Appendix 2).

Among the 5 age groups studied, 15-year-old students endorsed all pre-suicide behaviors with the highest frequency and 18-year-old students endorsed all pre-suicide behaviors with the lowest frequency. The percentages of 15-year-old students who considered suicide, planned to attempt suicide, or attempted suicide were 17.0% (n=485), 13.7% (n=390), and 8.6% (n=245), respectively. Among 15 year old students, 20.6% (n=586) endorsed suicidality (i.e., any of these 3 pre-suicide behaviors). The proportions of 18-year-old students who considered suicide, planned to attempt suicide, or attempted suicide were 13% (n=200), 9.8% (n=150), and 5.5% (n=84), respectively (Table 6, Appendix 2).

Female students endorsed pre-suicide behaviors more often than male students. Among females, 22.2% (n=1276) endorsed suicidality (i.e., at least one pre-suicide behavior) compared to 15.8% (n=925) among males. Among females, 18.8% (n=1078) seriously considered committing suicide; 14.3% (n=821) made a plan to attempt suicide; 9.2% (n=530) attempted suicide at least once.

Among 4 out of 5 grade categories studied (excluding ungraded/other), the reference group 9th graders endorsed all pre-suicide behaviors with the highest frequency. The percentages of students who considered committing suicide, planned to attempt suicide, or attempted suicide were 17.1% (n=529), 13% (n=401), and 8.6% (n=265), respectively. Among 9th grade students, 20.6% (n=638) endorsed suicidality (any of these 3 pre-suicide behaviors; Table 6, Appendix 2).

Twelfth graders endorsed all pre-suicide behaviors with the lowest frequencies, 13.6% (n=369) considered committing suicide, 10.5% (n=284) planned to commit suicide, and 5.7% (n=154) attempted to commit suicide at least once. Among 12th graders, 16.1% (n=436) endorsed suicidality through one or more of the above listed pre-suicide behaviors (Table 6, Appendix 2). American Indians/Alaska Natives, Asians, and Native Hawaiian/other Pacific Islanders endorsed all pre-suicide behaviors with the highest frequency. Among American Indians/Alaska Natives, 25.3% (n=24) endorsed suicidality. Twenty-four percent (n=87) of Asian students and 23.3% (n=20) of Native Hawaiian/other Pacific Islander students endorsed suicidality (Table 6, Appendix 2).

A higher percentage of obese students than non-obese students endorsed all outcomes of interest. Among obese students, 22.6% (n=329) endorsed suicidality compared to 18.5% (n=1872) among non-obese students. Among obese students, 19.7% (n=287) seriously considered suicide; 15.0% (n=219) made a plan to commit suicide; and, 7.8% (n=114) attempted suicide at least once (Table 6, Appendix 2).

A higher percentage of students who were bullied at school within the past 12 months endorsed all pre-suicide behaviors than students who were not bullied at school. Students who were electronically bullied endorsed all outcomes at a higher frequency than either students who were bullied at school or students who were not electronically bullied. More than 1/3 (35.6%; n=839) of students who were bullied at school endorsed suicidality, which was more than twice the percentage of students who were not bullied at school (14.8%; n=1362) who endorsed suicidality. Approximately 40% (n=762) of students who were electronically bullied within the last 12 months endorsed one or more of the pre-suicide behaviors, which was more than 2 times the proportion of students who were not electronically bullied (14.9%; n=1439) who endorsed suicidality (Table 6, Appendix 2).

Almost half (47.1%; n=1517) of the students who were sad for 2 weeks within the last 12 months endorsed suicidality (i.e., seriously considered suicide, made a plan, and/or attempted suicide), which was more than 5 times the percentage of students who did not experience prolonged sadness (8.2%; N=685) who endorsed suicidality (Table 6, Appendix 2).

Students endorsing discord between perceived weight status and actual weight also endorsed suicidality at a higher percentage (22.5%; n=479) than those who did not endorse discord between perceived weight status and actual weight (18.2%; n=1722) (Table 6, Appendix 2). Likewise, students who engaged in one or more unhealthy weight control behaviors within the past 30 days endorsed suicidality at a percentage that was three times greater (43.7%; n=779) than the percentage among students who did not engage in unhealthy weight control behaviors (14.5%; 1422; Table 6, Appendix 2).

Bivariate Relationships of Remaining Independent Variables with Suicide Outcomes

With one exception, unadjusted odds ratios were significant for all dichotomous variables; students who perceived themselves to be overweight had increased odds of seriously considering suicide (OR=1.88; CI=1.63-2.17), making a planning to commit suicide (OR=1.88; CI=1.66-2.13), and attempting to commit suicide one or more times (OR=1.85; CI=1.44-2.38). Students who were female, obese, bullied at school, electronically bullied, sad for prolonged periods of time, discordant for perceived versus actual weight status, and engaging in unhealthy weight control behaviors had increased odds of suicidal ideation, suicide planning, and/or suicide attempt (Appendix 2; Table 7). The exception was among obese students; the unadjusted odds ratio for suicide attempt was not significant.

Results were not as consistently significant for categorical variables; not all non-referent groups for age, grade, and race/ethnicity had significant unadjusted odds ratios. Among all age groups, students that were aged 18 years or older had lower odds of seriously considering suicide (OR=0.98; CI=0.82-0.99) than students who were aged 14 years or younger. They also had lower odds of suicidality (OR=0.77; CI=0.64-0.93) than students who were 14 years or younger. Students who were 15 years old had higher odds of attempting suicide one or more times (OR=1.36; CI=1.06-1.75) than students who were 14 years or younger (Appendix 2; Table 7).

Students who were in the 12th grade had lower odds of seriously considering suicide (OR=0.76; CI=0.66-0.88), planning to commit suicide (OR=0.79; CI=0.67-0.92), and attempting suicide one or more times (OR=0.64; CI=0.52-0.79) than 9th grade students. Twelfth grade students also had lower odds of endorsing one or more of the above pre-suicide behaviors (OR=0.74; CI=0.64-0.84) than 9th grade students (Appendix 2; Table 7).

Students who were multi-racial (Hispanic and non-Hispanic) were at increased odds of endorsing all pre-suicide behaviors than white students. American Indian/Alaska Native students were at increased odds of attempting suicide one or more times (OR=2.06; CI=1.09-3.89) than white students. They were also at increased odds of endorsing suicidality (OR=1.61; CI=1.01-2.55). Asian students were at increased odds for suicidal ideation (OR=1.36; CI=1.04-1.77) and suicide attempt (OR=1.53; CI=1.05-2.23) than white students, as well as endorsing suicidality (OR=1.45; CI=1.13-1.87; Appendix 2; Table 7).

STRATIFIED ANALYSIS

Tests for Homogeneity of Odds Ratios

Breslow-Day statistics demonstrated that the following variables potentially confounded the relationship between perceived weight status and suicidality: age, sex, grade, bullied at school, prolonged sadness, and discord between perceived weight status and actual weight status (Appendix 2; Table 8).

Breslow-Day statistics demonstrated that the following variables potentially confounded the relationship between perceived weight status and suicidal ideation: age, grade, and prolonged sadness (Appendix 2; Table 9).

Breslow-Day statistics demonstrated that the following variables potentially confounded the relationship between perceived weight status and suicide planning: age, sex, and discord between perceived weight status and actual weight status (Appendix 2; Table 10).

Breslow-Day statistics demonstrated that the following variables potentially confounded the relationship between perceived weight status and suicide attempt: age, grade, race/ethnicity, and discord between perceived weight status and actual weight status (Appendix 2; Table 11).

MULTIPLE LOGISTIC REGRESSION ANALYSIS

Multiple logistic regression was conducted to examine the association between perceived weight status and each pre-suicide behavior. Separate models were developed for each outcome of interest—suicidality, suicidal ideation, suicide planning, and suicide attempt.

The final models for all outcomes were derived using hierarchical backward elimination. Initially, all covariates that were not problematically collinear, and their interaction terms with perceived weight status, were regressed (Appendix 2).

Associations between perceived weight status and suicidality

Multicollinearity tests indicated that 2 variables were collinear—age (VIF=4.5; data not shown) and grade (VIF=4.5; data not shown). Grade was excluded from regressions.

The initial model controlled for all covariates and all interaction terms. According to the chunk test, one or more interaction terms significantly increased the fit of the model for suicidality (LRT statistic=27.08; p-value=1.00). Subsequently, hierarchical backward elimination was performed and the following variables remained in the model: perceived weight status, age, sex, bully, sad, discord between perceived weight status and actual weight status, unhealthy weight control behavior, and the interaction term for perceived weight status and age. Removal of covariates during assessment of confounding resulted in less than a 10% change in the odds ratio and precision of perceived weight status' effect on suicidality (Appendix 2; Tables 12a and 12b). Further, there appeared to be no terms in the reduced model that mediated the association between perceived weight status and suicidality.

Full model:

$$OR_{\textbf{suicidality}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{race/ethnicity}} + \beta_{\textbf{obese}} + \beta_{\textbf{bully}} + \beta_{\textbf{ebully}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}}$$

Final (reduced) model:

$OR_{\textbf{suicidality}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{bully}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}}$

When controlling for all other variables in the reduced model, students who were age 14 and perceived themselves to be slightly or very overweight had increased odds of suicidality (OR= 1.19; 95% CI= 1.17-1.20). Students who were 17 years old and perceived themselves to be overweight were slightly less likely to seriously consider committing suicide than students who were 14 years old or younger and perceived themselves to be overweight. Bullying at school (OR= 1.42; 95% CI= 1.38-1.46), prolonged sadness (OR=2.80; 95% CI= 2.59-3.03), and unhealthy weight control behavior (OR=1.59; 95% CI= 1.54-1.65) also resulted in increased odds of suicidality that were significant (Appendix 2; Table 12b).

Associations between perceived weight status and suicide-related ideation

Multicollinearity tests indicated that 2 variables were collinear—age (VIF=4.5; data not shown) and grade (VIF=4.5; data not shown). Grade was excluded from regressions.

The initial model controlled for all covariates and all interaction terms. According to the chunk test, one or more interaction terms significantly increased the fit of the model for suicidal ideation (LRT statistic=21.24; p-value=0.99). Subsequently, hierarchical backward elimination was performed and the following variables remained in the model: perceived weight status, age, sad, unhealthy weight control behaviors, and the interaction term for perceived weight status and age. Removal of covariates during assessment of confounding resulted in less than a 10% change in the odds ratio and precision of perceived weight status' effect on suicidal ideation (Appendix 2;

Tables 13a and 13b). Further, there appeared to be no terms in the reduced model that mediated the association between perceived weight status and suicidal ideation.

Full model:

$$OR_{\textbf{suicidal ideation}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{race/ethnicity}} + \beta_{\textbf{obese}} + \beta_{\textbf{bully}} + \beta_{\textbf{ebully}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}}$$

Final (reduced) model:

$$OR_{\textbf{suicidal ideation}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sad}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}}$$

When controlling for all other variables in the reduced model, students who were 14 years old or younger and perceived themselves to be slightly or very overweight had increased odds of seriously considering suicide (OR= 1.19; 95% CI= 1.17-1.20) than students who were 14 years old or younger and did not perceive themselves to be overweight. Prolonged sadness (OR= 3.13; 95% CI= 2.87-3.41) and unhealthy weight control behavior (OR=1.60; 95% CI=1.54-1.66) also resulted in increased odds of suicidal ideation. The effects of the interaction terms for perceived weight status and age on suicidal ideation were not significant. (Appendix 2; Table 9).

Associations between perceived weight status and suicide-related planning

Multicollinearity tests indicated that 2 variables were collinear—age (VIF=4.5; data not shown) and grade (VIF=4.5; data not shown). Grade was excluded from regressions.

The initial model controlled for all covariates and all interaction terms. According to the chunk test, one or more interaction terms significantly increased the fit of the model for suicide planning (LRT statistic=32.17; p-value=1.00). Subsequently, hierarchical backward elimination was performed and the following variables remained in the model: perceived weight status, age, sex, prolonged sadness, discord between perceived weight status and actual weight status, unhealthy weight control behavior, the interaction term for perceived weight status and age, and the interaction term for perceived weight status and sex. Removal of covariates during assessment of confounding resulted in less than a 10% change in the odds ratio and precision of perceived weight status' effect on suicide planning; in fact, the final model was more precise according to the 95% confidence interval (Appendix 2; Table 14a and 14b).

During assessment of confounding, prolonged sadness was identified as a potential mediator. When assessing mediation, the first 3 criteria listed in the Methods section were met; however, when stepping the variable for prolonged sadness into the model with perceived weight status, only, the association between perceived weight status and suicide planning did not lose significance. Perhaps, prolonged sadness is a partial mediator, since the odds ratio for perceived weight status decreased when stepping prolonged sadness (before: OR=1.88, CI=1.67-2.12; after: OR=1.61, CI=1.38-1.86; data not shown) into the univariate model with perceived weight status, only.

Full model:

$$OR_{\textbf{suicide planning}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{race/ethnicity}} + \beta_{\textbf{obese}} + \beta_{\textbf{bully}} + \beta_{\textbf{ebully}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}} + \beta_{\textbf{perceived weight status*sex}}$$

Final (reduced) model:

$OR_{\textbf{suicide planning}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}} + \beta_{\textbf{perceived weight status*sex}}$

When controlling for all other variables in the reduced model, male students who were 14 years old or younger and perceived themselves to be slightly or very overweight had increased odds of planning to commit suicide (OR= 1.22; 95% CI= 1.20-1.24) than male students who were 14 years old or younger and did not perceive themselves to be overweight. Students who were 17 years old and perceived themselves to be overweight were slightly less likely to plan to commit suicide than students who were 14 years old or younger and perceived themselves to be overweight (OR=0.98; 95% CI=0.98-0.98). The effect of the interaction term for perceived weight status and sex on suicide-related planning was not significant (chi-square p-value=0.07), according to a significance level of 0.05. However, females who perceived themselves to be overweight were more likely to plan to commit suicide than males who perceived themselves to be overweight (OR=1.32; 95% CI= 1.29-1.36). Prolonged sadness (OR=2.72; 95% CI= 2.47-2.99) and unhealthy weight control behaviors (OR= 1.62; 95% CI= 1.55-1.68) also resulted in increased odds of suicide planning (Appendix 2; Table 14b).

Associations between perceived weight status and suicide-related attempt

Multicollinearity tests indicated that 2 variables were collinear—age (VIF=4.5; data not shown) and grade (VIF=4.5; data not shown). Grade was excluded from regressions.

The initial model controlled for all covariates and all interaction terms. According to the chunk test, one or more interaction terms significantly increased the fit of the model for suicide attempt

(LRT statistic=25.44; p-value=1.00). Subsequently, hierarchical backward elimination was performed and the following variables remained in the model: perceived weight status, age, race/ethnicity, prolonged sadness, discord between perceived weight status and actual weight status, and the interaction term for perceived weight status and age. In the full model, perceived weight status had no significant effect on suicide attempt (Appendix 2; Table 14a). Exclusion of covariates during assessment of confounding resulted in a slight increase in perceived weight status' odds ratio. In fact, the perceived weight status' odds ratio was significant in the final model, likely due to removal of partial mediators and/or an increase in power to detect the effect (Appendix 2; Table 15a and 15b).

During assessment of confounding, prolonged sadness and unhealthy weight control behavior were identified as potential mediators. When assessing mediation, the first 3 criteria listed in the Methods section were met by prolonged sadness and unhealthy weight control behavior; however, when separately stepping unhealthy weight control behavior and prolonged sadness into the model with perceived weight status, only, the associations between perceived weight status and suicide attempt did not lose significance. Perhaps, prolonged sadness and unhealthy weight control behavior are partial mediators of the association between perceived weight status and suicide attempt, since the odds ratios for perceived weight status decreased by more than 10% when stepping prolonged sadness (before: OR=1.85, CI=1.45-2.36; after: OR=1.49, CI=1.14-1.95; data not shown) or unhealthy weight control behavior (before: OR=1.85, CI=1.45-2.36; after: OR=1.33, CI=1.05-1.71; data not shown) into a model containing perceived weight status, only.

Full model:

$OR_{\textbf{suicide attempt}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{sex}} + \beta_{\textbf{race/ethnicity}} + \beta_{\textbf{obese}} + \beta_{\textbf{bully}} +$

$\beta_{\textbf{ebully}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{unhealthy weight control behaviors}} + \beta_{\textbf{perceived weight status*age}}$

Final (reduced) model:

$OR_{\textbf{suicide attempt}} = \beta_{\textbf{perceived weight status}} + \beta_{\textbf{age}} + \beta_{\textbf{race/ethnicity}} + \beta_{\textbf{sad}} + \beta_{\textbf{weight discord}} + \beta_{\textbf{perceived weight status*age}}$

When controlling for all other variables in the reduced model, students who were 14 years old or younger and perceived themselves to be slightly or very overweight had increased odds of attempting suicide one or more times (OR= 1.19; 95% CI= 1.16-1.21) than students who were 14 years old or younger and did not perceive themselves to be overweight. Students who were 16 years old and perceived themselves to be overweight were more likely to attempt suicide than students who were 14 years old or younger and perceived themselves to be overweight (OR=1.45; 95% CI=1.37-1.53). (Appendix 2; Table 15b). Prolonged sadness (OR=3.82; 95% CI= 3.16-4.62) also resulted in increased odds of suicide attempt.

CHAPTER V: DISCUSSION

The purpose of this research was to explore the association between weight-related risk factors and non-fatal pre-suicide behaviors among a nationally representative sample of high school students. The preventive implications are examined in the context of A.I.M. and the Centers for Disease Control and Prevention's (CDC) Healthy People 2020 (6). Former US Surgeon General Dr. David Satcher's proposed plan A.I.M.—meaning awareness, intervention, and methodology—which recognizes that suicide is a preventable public health issue that requires systematic targeting in ways that have not been met through current interventions (4,5). Although more than a decade has passed since A.I.M. was initially proposed, Healthy People 2020 indicates that suicide is still a relevant public health issue. At present, the 2nd objective under the Mental Health and Mental Disorders section of Healthy People 2020 is to reduce the rate of attempted suicide among adolescents by 10%. In 2009, the CDC reported that the attempted suicide rate among adolescents was 1.9 per 100,000. The target rate is 1.7 per 100, 000 by the year 2020 (6).

This study found that, in the 2011 YRBS weighted study population, approximately 16% of the students endorsed suicidal ideation, 12% endorsed suicide planning, and 7% endorsed suicide attempt. These percentages did not change appreciably from those reported by Cash and Bridge (28) when they analyzed self-reported data from the 2009 YRBS.

Approximately 29% of this study's weighted population perceived themselves to be slightly or very overweight.. Based upon their BMI, 27.7% of this study's weighted population was actually overweight or obese. In 2000, 15% of youth were considered overweight (9).

In this research, the following questions were addressed: Is there an association between perception of weight status and pre-suicide behaviors, including ideation, planning, and attempt

(individually and cumulatively) among United States' youth and young adults grades 9 through 12 who participated in the Youth Risk Behavior Survey (YRBS) in 2011? Do other variables moderate or mediate these associations, such as demographic variables and other suicide and obesity- or weight perception-related variables, including prolonged sadness, bullying, discord between actual and perceived weight status, and unhealthy weight control behaviors?

Association between perception of weight status and pre-suicide behaviors

According to bivariate analysis, students who perceived they were overweight were more likely to seriously consider committing suicide, plan to commit suicide, and attempt suicide. Studying a nationally representative sample of youth in 2005, Eaton et al. (9) also found that high school students who perceived themselves slightly or grossly overweight had a higher probability of suicidal ideation. In the 2013 Zeller et al. study, overweight youth in all excess weight categories who were accurate in their weight perception were at greater risk for suicidal ideation; however, students who were inaccurate were of no greater risk of suicidal ideation (48). Eaton and colleagues also discovered that the relationship between weight perception and ideation is dependent on the extremity of weight perceptions—the more extreme, the greater the odds of pre-suicide behaviors (9).

The interaction term for perceived weight status and age was included in all full models after assessing the impact of interaction terms on each model's fit. Students who were 14 years old or younger and perceived themselves to be overweight had increased odds for suicidality, suicidal ideation, suicide planning, and suicide attempt than students who were 14 years old or younger and did not perceive themselves to be overweight. The 15-year-old students who perceived themselves to be overweight did not differ from students who were 14 years old or younger and perceived themselves to be overweight for any outcome. The 16-year-old students who perceived

themselves to be overweight, did not differ from students who were 14 years old or younger and perceived themselves to be overweight for suicidality, ideation, or planning; however, the 16-year-old students who perceived themselves to be overweight were at significantly increased odds of suicide attempt than students who were 14 years old or younger and perceived themselves to be overweight. The 17-year-old students who perceived themselves to be overweight, did not differ from students who were 14 years old or younger and perceived themselves to be overweight for suicidal ideation or suicide attempt; however, 17-year-old students who perceived themselves to be overweight were at slightly lower odds of suicidality and suicide planning than students who were 14 years old or younger and perceived themselves to be overweight. A review of the association between body image and age revealed that although body dissatisfaction is stable across the life span for females, they put less emphasis on the importance of their body shape as they grow older. Lee and Seo (45) suggested that girls, as they advance into young adulthood, tend to protect their self-esteem from socially undesirable body image because age-related body shape changes are largely uncontrollable. Adult women might not perceive their body weight or shape to be as important as it was during their adolescence (45). Therefore, age appears to act as a protective factor against suicidal ideation in women with body dissatisfaction (45,46). Further, as youth (males and females) age, they are exposed to competing needs that require their attention, resulting in a decline of certain pre-suicide behaviors (45). Among the study population in this thesis, it appears that age was protective, regarding suicide planning, only.

According to the stratified analyses, discord between actual weight status and perceived weight status was a potential confounder of the relationship between perceived weight status and three of the outcomes—suicidality, suicide planning, and attempt. Accordingly, this variable was not considered for exclusion from multivariate models for these three outcomes. When controlling for all other variables in each model, discord between actual weight status and perceived weight

status did not have a significant effect. Frisco and colleagues' (11) suggested that focusing on the intersection of weight and weight perceptions better shows which youth are at risk of depressive symptoms than an approach that treats weight perception and obesity independently. They suggested that weight pessimists are at greatest risk of depressive symptoms. This finding could be considered in future research.

Moderation or mediation of the association between perception of weight status and pre-suicide behaviors

According to bivariate analyses and unadjusted odds ratios, most non-demographic variables that were being examined in this study for their potential to confound, mediate, or moderate the relationship between perceived weight status and pre-suicide behaviors also significantly increased the odds of all pre-suicide behaviors. This included prolonged sadness, school-based bullying, electronic bullying, discord between perceived weight status and actual weight status, and unhealthy weight control behaviors. Among the demographic variables, students who were 18 years or older had significantly decreased odds of suicidal ideation compared to students who were 14 years old or younger. The upper limit of the odd ratio's confidence interval was nearly 1, indicating that the effect was not strong, when controlling for all other variables in the final model. Females had increased odds of all pre-suicide behaviors. Also, in each bivariate model, two or more racial/ethnic groups had increased odds of endorsing each pre-suicide behavior. The racial/ethnic groups with increased odds were not the same for all pre-suicide behaviors; however, across all outcomes, multi-racial Hispanic and multi-racial non-Hispanic students had increased odds. Since all above-mentioned variables were considered to be potential confounders, and perhaps mediators and moderators, the effects of these variables on the relationship between perceived weight status and all pre-suicide behaviors was explored through stratified analyses.

Stratified analyses for each outcome identified variables that potentially modified the effect of perceived weight on each pre-suicide behavior. Although all non-demographic variables (except obesity) were significantly associated with all outcomes, as demonstrated in bivariate analysis, there was a unique set of potential effect modifiers for each pre-suicide behavior.

Aside from prolonged sadness and the interaction term for perceived weight status and age, no other terms remained in all four final models.

In the multivariate analyses, obesity was removed from each model, since it also did not appreciably confound the relationship between perceived weight status and each pre-suicide behavior. Furthermore, obesity was not significantly associated with any pre-suicide behaviors when controlling for perceived weight status and other covariates. This result was expected, since Eaton et al. (45) discovered that the relationship between obesity and suicide-related outcomes is mediated by perceptions of weight or body size. The results of this thesis study align with Eaton and colleagues' finding in 2005, as well as others that demonstrate the same relationship between obesity, weight perception, and pre-suicide behaviors (45,56).

In multivariate analyses, prolonged sadness was a significant covariate and remained in all models as a confounding factor. Although prolonged sadness was examined as a potential mediator for a subset of pre-suicide behaviors, results showed that it did not fully mediate the relationship between perceived weight status and suicide planning and attempts. Although prolonged sadness could be contested as a proxy for depression, these findings corroborate Lee and Seo's study in which they demonstrated that the association between weight perception and suicidal ideation exists, independent of BMI and depressive symptoms, suggesting that depression is a partial, rather than full, mediator of the relationship between weight perception and suicidal thoughts and behaviors (45).

According to stratified analyses, unhealthy weight control behavior(s) was also a potential confounder of the relationship between perceived weight status and three outcomes—suicidality, suicidal ideation and suicide planning. Accordingly, unhealthy weight control behaviors were not considered for exclusion from multivariate models for these three outcomes. When controlling for all other variables in each model, unhealthy weight control behaviors significantly increased the odds of all three outcomes. Crow and colleagues (2) also demonstrated that weight control behaviors of varying extremes and body dissatisfaction were associated with higher rates of suicidal ideation and suicide attempts among adolescent boys and girls. In their study, this also remained true after controlling for depressive symptoms and demographic variables.

Results of stratified analyses demonstrated that sex potentially confounded the relationship between perceived weight status and two outcomes—suicidality and suicide planning. Also, when assessing interaction, the interaction term for weight perception and sex significantly increased the full model's fit. When controlling for all other variables, sex did not have a significant effect on suicidality; however, sex had a significant effect on suicide planning. Females were significantly more likely to make a serious plan to attempt suicide. Further, the interaction term in the suicide planning model was not significant, according to a critical p-value of 0.05. However, results showed that female students who perceived themselves to be overweight were more likely to plan to commit suicide than male students who perceived themselves to be overweight.

According to stratified analysis, sex appeared to confound the relationship between perceived weight status and suicide planning, only—not suicidal ideation or suicide attempt. Regardless of the results of the stratified analyses, the interaction term for perceived weight status and sex was added to all models during assessment of interaction, but only contributed significantly to the fit of the multivariate model for suicide planning. Perhaps, sex has no confounding or modifying effect on the relationship between perceived weight status and suicidal ideation and suicide

attempt because sex acts upstream to inform perception.

"Bullying at school" remained a confounding factor in the multivariate model for suicidality, only. "Bullying at school", however, did not seem to confound the relationship between specific pre-suicide behaviors. When controlling for all other covariates, bullying at school increased the odds of suicidality. Electronic bullying also did not confound the relationship between perceived weight status and any outcome. Recently, the relationship between bullying and pre-suicide behaviors among youth has been further characterized. Most importantly, boys and girls who are both bullies and victims have a higher likelihood of exhibiting pre-suicide behaviors (28). The results of this thesis research indicate that non-specific bullying (rather than weight-related bullying) does not confound the relationship between weight perception and suicidal ideation, suicide planning, or suicide attempt; rather, non-specific bullying confounds the relationship between perceived weight status and endorsement of at least one specific pre-suicide behavior.

Race/ethnicity remained a confounding factor only in the multivariate model for suicide attempt. When controlling for all other covariates, students who were American Indian/Alaska Native or multi-racial Hispanic had significantly increased odds of attempting to commit suicide, compared to whites. There were no other models in which race/ethnicity was a significant confounder. In their study, Eaton and colleagues (9) also found that the impact of weight perceptions yields different outcomes, depending on race/ethnicity. In their study, whites and Hispanics/Latinos who perceived themselves grossly under- or overweight had greater odds of attempting suicide, but this was not found for youth of other race/ethnicities (9).

It was hypothesized that prolonged sadness, unhealthy weight control behaviors, and bullying would mediate the relationships between perceived weight status and all pre-suicide behaviors (Figure 2). Results indicated that none of these factors were full mediators.

STUDY STRENGTHS AND LIMITATIONS

The main strength of this study was the large nationally representative sample size, which imparted power. Additionally, the 2011 YRBS survey data offered variables for multiple suicide-related outcomes, allowing for development of unique models for each outcome. While the literature covering youth suicide has grown, few studies have examined the full breadth of pre-suicide behaviors using a nationally representative sample. In this study, models were developed for the cumulative measure "suicidality", as well as suicidal ideation and suicide planning and attempt, separately. This is the first time YRBS data were used to conduct such a study.

The results of this study were also subject to limitations. This was a cross-sectional study, which prevented assessment of directionality when analyzing relationships between covariates and pre-suicide behaviors. Also, it is important to note that the logistic regression models estimated weighted sample prevalence odds ratios. Prevalence odd ratios are an estimate for population prevalence ratios and will exaggerate the actual ratios when the event of interest is not rare. Pre-suicide behaviors were not rare in this population; thus, interpretations about "likelihood" and "risk" should be made with caution.

The use of self-reported data introduced a few limitations to the research presented herein. Participants may have underreported deviant or unfavorable behavior, such as the outcomes and covariates included in this study.

Also, some variables used in this analysis were broad and loosely approximated constructs presented in Figure 2. In particular, "sadness" was likely a poor proxy for depression or depressive symptoms. Also, the bully variables used in this analysis were broad and reflected the

presence or absence of victimization at school and electronically. It would have been ideal to include variables that captured more specific information about the type of victimization and whether it was related to weight.

IMPLICATIONS FOR SUICIDE PREVENTION AND PUBLIC HEALTH

This study has potential to contribute to public health practice by demonstrating that negative weight perceptions do impart increased odds of engaging in pre-suicide behaviors. Further, results of this study show that age interacts with weight perception, meaning there are certain ages at which perceived overweight status increases the odds for particular pre-suicide behavior. Better understanding the impact of weight perceptions and factors that confound and moderate its relationship with pre-suicide behaviors helps better identify youth who are at greater risk for suicide. Consequently, preventive resources can be allocated in a more targeted manner. For instance, in addition to the interaction between perceived weight status and age, race/ethnicity and prolonged sadness confounded the relationship between perceived weight status and suicide attempt. This suggests that there are particular subpopulations of high school students who perceive themselves to be overweight and are potentially at greater risk of attempting suicide than other subpopulations. In consideration of the Healthy People 2020 goal to reduce the rate of attempted suicide among adolescents by 10% (6), targeted primary prevention efforts and intervention programs in schools, physicians' offices, and at home could be implemented to address the increased risk of pre-suicide behaviors among youth who perceive themselves to be overweight.

DIRECTIONS FOR FUTURE RESEARCH

Future research examining mutually-exclusive, suicide-related outcomes may extend the

conclusions of this study. For instance, it is important to understand if students who perceive themselves to be overweight have increased odds of seriously considering suicide; or of seriously considering suicide and creating a plan to commit suicide; or of seriously considering suicide, creating a plan, and attempting suicide. In this case, models could be developed for students who exclusively endorsed suicide-related ideation; students who only endorsed suicide-related ideation and planning; and, students who endorsed all three suicide-related outcomes.

Moreover, this study was the first to explore the association that weight perception has with other correlates of pre-suicide behaviors (e.g., bullying, unhealthy weight control behaviors, and prolonged sadness) using YRBS data. Further research could incorporate variables that measure impulsive aggression or anxiety, which are both predictive of pre-suicide behaviors (Figure 1). Such research would complement this thesis, which only examined the associations between weight perceptions, prolonged sadness, and pre-suicide behaviors.

As previously mentioned, some variables used in this analysis were broad and loosely approximated constructs presented in Figure 2. Identifying measures that more closely approximate these constructs would add value to future studies.

CONCLUSION

The effect of perceived weight on pre-suicide behaviors has recently been studied with higher frequency. Researchers note that, perhaps, perceived weight is more strongly associated with pre-suicide behaviors than is actual weight status, which is one reason for examining perceived weight status in this study, rather than actual weight. The results of the analysis performed in fulfillment of this thesis largely corroborate previous studies of the association between weight perception and pre-suicide behaviors, but add to the literature by examining a larger set of

outcomes and the interactions between a fuller set of covariates.

This research was also designed to further characterize factors that confound, moderate, and mediate the association between perceived weight status and pre-suicide behaviors. These include age, gender, race/ethnicity, obesity, and other health-risk factors (e.g., bullying and unhealthy weight control behaviors). While there is literature that confirms the relationships between the above listed covariates and pre-suicide behaviors, they have not been studied in tandem with perceived weight status.

Results of this study show that for all outcomes, high school students who perceive themselves to be overweight are more likely to engage in pre-suicide behaviors. The relationship between perceived weight status and suicidal ideation is confounded by age, prolonged sadness, and unhealthy weight control behaviors. The relationship between perceived weight status and suicide planning is confounded by sex, age, prolonged sadness, discord between actual and perceived weight status, and unhealthy weight control behaviors. The relationship between perceived weight status and suicide attempt is confounded by age, race/ethnicity, prolonged sadness, and discord between actual and perceived weight status. It was expected that prolonged sadness, bullying, and unhealthy weight control behaviors would mediate the relationship between weight perception and all suicide-related outcomes. However, none of the covariates studied seem to fully mediate the relationship between weight perception and pre-suicide behaviors.

These results identify some important directions for future research. They can also inform targeted primary prevention efforts and intervention programs to address the increased risk of pre-suicide behaviors among youth who perceive themselves to be overweight.

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APPENDIX II: TABLES

Table 3. Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

YRBS Variables (Not Calculated)			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Outcomes			
QN25 (Ideation)	During the past 12 months, did you ever seriously consider attempting suicide?	A. Yes B. No	Seriously considered committing suicide in past 12 months? 1=Yes 2=No (reference)
QN26 (Plan)	During the past 12 months, did you make a plan about how you would attempt suicide?	A. Yes B. No	Made suicide plan in past 12 months? 1=Yes 2=No (reference)
QN27 (Attempt)	During the past 12 months, how many times did you actually attempt suicide?	A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. 6 or more times	Attempted suicide 1 or more times 12 months? “Yes" if "B", "C", "D", or "E" are endorsed, otherwise "no". 1=Yes 2=No (reference)
Independent Variable			
QN67 (Perceived weight status)	How do you describe your weight?	A. Very underweight B. Slightly underweight C. About the right weight D. Slightly overweight E. Very overweight	Perceived weight status (slightly/very overweight); "yes" if "D" or "E" are selected, otherwise "no". 1= Yes 2= No (reference)

Table 3 (continued). Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

YRBS Variables (Not Calculated)			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Covariates			
Q1 (Age)	How old are you?	A. 12 years or younger B. 13 years old C. 14 years old D. 15 years old E. 16 years old F. 17 years old G. 18 years or older	1=12 years or younger – 14 years old (reference) 2= 15 years old 3= 16 years old 4= 17 years old 5= 18 years or older
Q2 (Sex)	What is your sex?	A. Female B. Male	1=Female 2=Male (reference)
Q3 (Grade)	In what grade are you?	A. 9th grade B. 10th grade C. 11th grade D. 12th grade E. Ungraded or other grade	1= 9th grade (reference) 2= 10th grade 3= 11th grade 4= 12th grade 5= Ungraded or other grade
QN22 (Bully)	During the past 12 months, have you ever been bullied on school property?	A. Yes B. No	Bullied at school in past 12 months? 1=yes 2=no (reference)

Table 3 (continued). Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

YRBS Variables (Not Calculated)			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Covariates			
QN23 (Ebully)	During the past 12 months, have you ever been electronically bullied? (Include being bullied through e-mail, chat rooms, instant messaging, Web sites, or texting.)	A. Yes B. No	Electronically bullied in past 12 months? 1=Yes 2=No (reference)
QN24 (Sad)	During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?	A. Yes B. No	Sad for 2 consecutive weeks in past 12 months? 1=Yes 2=No (reference)
YRBS Variables (Calculated or Transformed)			
Covariates			
RACEETH (Race/Ethnicity)	Composite of the following questions: Are you Hispanic or Latino?; What is your race? (Select one or more responses.)	Hispanic: A. Yes B. No Race: A. American Indian or Alaska Native B. Asian C. Black or African American D. Native Hawaiian or Other Pacific Islander E. White	Race/ethnicity 1= Am Indian/Alaska Native 2= Asian 3= Black or African American 4= Native Hawaiian/Other PI 5= Hispanic/Latino 6= Multiple- Hispanic 7= Multiple - Non-Hispanic 8= White (reference)

Table 3 (continued). Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

YRBS Variables (Calculated or Transformed)			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Covariates			
QNOBESE (Obese)	BMI calculated using responses to the following questions: How tall are you without your shoes on?; How much do you weigh without your shoes on?	N.A. (Both questions have continuous response options)	Obese, based upon BMI 1= Yes 2= No (reference)
Survey Design			
STRATUM	NA	NA	NA
PSU	NA	NA	NA
WEIGHT	NA	NA	NA

Table 3 (continued). Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

Created Variables			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Outcome			
Suicidality	Composite of the following questions: During the past 12 months, did you ever seriously consider attempting suicide?; During the past 12 months, did you make a plan about how you would attempt suicide?; During the past 12 months, how many times did you actually attempt suicide?	A. Yes B. No	Suicidality; "yes" if any 1 of the 3 compositie questions is endorsed, otherwise "no" or missing. 1=Yes 2=No (reference)
Covariates			
Weight_Discord	Calculate using the following YRBS items: QNOBESE, QNOWT, QN67	N.A. (All 3 items are created from other original YRBS variables)	Discord between perceived and actual weight status; "yes" if perceptions and actual weight status are discordant, otherwise "no" or missing. 1=Yes 2=No (reference)

Table 3 (continued). Description of selected items and response options derived from 2011 Youth Risk Behavior Survey and operational definitions, variables names, and categories.

Created Variables			
YRBS Item (Variable Name)	**YRBS Question**	**YRBS Response Options**	**Operational Definitions & Categories**
Covariates			
Unhealthy_Control	Composite of the following questions: During the past 30 days, did you go without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight?; During the past 30 days, did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight? (Do not include meal replacement products such as Slim Fast.); During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?	A. Yes B. No	Unhealthy weight control behaviors 30 days; "yes" if any 1 of the 3 composite questions is endorsed, otherwise "no" or missing. 1=Yes 2=No (reference)

Table 4. Summary Statistics: Unweighted and Weighted Frequencies and Percentage of High School Student that Endorsed Single and Multiple Pre-suicide behaviors, YRBS 2011				
	Unweighted		Weighted	
	N	Percent	N	Percent
Pre-suicide behaviors				
Single Outcomes				
Ideation, only	531	4.9%	598	5.1%
Planning, only	302	2.8%	310	2.7%
Attempt, only	75	0.7%	46	0.4%
Multiple Outcomes				
Ideation + Plan, only	455	4.2%	485	4.2%
Ideation + Attempt, only	134	1.2%	132	1.1%
Plan + Attempt, only	36	0.3%	31	0.3%
Ideation + Plan + Attempt	602	5.5%	599	5.2%

Table 5. Summary Statistics: Weighted and Unweighted Frequencies and Percentage of Categorical Variables, YRBS 2011				
	Unweighted		**Weighted**	
	N	**Percent**	**N**	**Percent**
Dependent Variables				
Suicidality				
Yes	2135	19.5%	2201	19.0%
No	8794	80.5%	9382	81%
Suicide-related ideation				
Yes	1722	15.8%	1814	15.7%
No	9207	84.2%	9770	84.3%
Suicide-related plan				
Yes	1395	12.8%	1424	12.3%
No	9534	87.2%	10159	87.7%
Suicide-related attempt				
Yes	847	7.8%	809	7.0%
No	10082	92.3%	8177	93.0%
Independent Variable				
Perceived weight status				
Yes (Perceived slightly or very overweight)	3314	30.3%	3406	29.4%
No (Not perceived slightly or very overweight)	7615	69.7%	8177	70.6%
Covariates				
Age				
≤12 – 14 yo	1140	10.4%	1359	11.7%
15 yo	2516	23.0%	2849	24.6%
16 yo	2901	26.5%	3033	26.2%
17 yo	2800	25.6%	2812	24.3%
≥18 yo	1572	14.4%	1531	13.2%
Sex				
Female	5633	51.5%	5745	49.6%
Male	5296	48.5%	5839	50.4%
Grade				
9th	2655	24.3%	3096	26.7%
10th	2645	24.2%	2976	25.7%
11th	2931	26.8%	2794	24.1%
12th	2694	24.7%	2713	23.4%
Ungraded/Other	4	0.0%	5	0.0%

Table 5 (continued). Summary Statistics: Weighted and Unweighted Frequencies and Percentage of Categorical Variables, YRBS 2011				
	Unweighted		Weighted	
	N	Percent	N	Percent
Covariates				
Race/Ethnicity				
Am Indian/Alaska Native	208	1.9%	95	0.8%
Asian	329	3.0%	360	3.1%
Black or African American	1701	15.6%	1363	11.8%
Native Hawaiian/Other PI	75	0.7%	86	0.7%
Hispanic/Latino	1436	13.1%	917	7.9%
Multiple- Hispanic	1674	15.3%	1157	10.0%
Multiple - Non-Hispanic	489	4.5%	462	4.0%
White	5017	45.9%	7143	61.7%
Obese				
Yes	1460	13.4%	1458	12.6%
No	9469	86.6%	10126	87.4%
Bullied at school within past 12 months				
Yes	2020	18.5%	2359	20.4%
No	8909	81.5%	9224	79.6%
Electronically bullied within past 12 months				
Yes	1680	15.4 %	1919	16.6%
No	9249	84.6%	9665	83.4%
Sad for 2 weeks within last 12 months				
Yes	3213	29.4%	3218	27.8%
No	7716	70.6%	8366	72.2%
Discord between perceived weight status and actual weight				
Yes	2005	18.4%	2132	18.4%
No	8924	81.7%	9452	81.6%
Unhealthy weight control behaviors within past 12 months				
Yes	1738	15.9%	1783	15.4%
No	9191	84.1%	9801	84.6%

Table 6 Summary Statistics: Weighted Frequencies, Percent, and Standard Error of Categorical Variables by Outcomes of Interest, YRBS 2011

	Suicidality (event=1)		Suicide-related Ideation (event=1)		Suicide-related Plan (event=1)		Suicide-related Attempt (event=1)	
	N	Row Percent	N	Row Percent	N	Row Percent	N	Row Percent
Independent Variable								
Perceived weight status								
Yes (Perceived slightly or very overweight)	881	25.9%	748	22.0%	596	17.5%	343	10.1%
No (Not perceived slightly or very overweight; reference)	1320	16.1%	1066	13.0%	828	10.1%	466	5.7%
Covariates								
Age								
≤12 - 14 yo (reference)	267	19.7%	214	15.8%	166	12.2%	88	6.5%
15 yo	586	20.6%	485	17.0%	390	13.7%	245	8.6%
16 yo	592	19.5%	478	15.8%	396	13.1%	220	7.3%
17 yo	513	18.2%	437	15.5%	322	11.5%	171	6.1%
≥18 yo	243	15.9%	200	13.1%	150	9.8%	84	5.5%
Sex								
Female	1276	22.2%	1078	18.8%	821	14.3%	530	9.2%
Male (reference)	925	15.8%	736	12.6%	603	10.3%	279	4.8%

Table 6 (continued). Summary Statistics: Weighted Frequencies, Percent, and Standard Error of Categorical Variables by Outcomes of Interest, YRBS 2011

	Suicidality (event=1)		Suicide-related Ideation (event=1)		Suicide-related Plan (event=1)		Suicide-related Attempt (event=1)	
	N	Row Percent	N	Row Percent	N	Row Percent	N	Row Percent
Covariates								
Grade								
9th (reference)	638	20.6%	529	17.1%	401	13.0%	265	8.6%
10th	582	19.6%	473	15.9%	404	13.6%	220	7.4%
11th	541	19.4%	443	15.9%	331	11.9%	166	5.9%
12th	436	16.1%	369	13.6%	284	10.5%	154	5.7%
Ungraded/Other	4	80.0%	0	0.0%	4	80.0%	4	80.0%
Race/Ethnicity								
Am Indian/Alaska Native	24	25.3%	20	21.1%	16	16.8%	11	11.6%
Asian	87	24.2%	70	19.4%	51	14.2%	32	8.9%
Black or African American	238	17.5%	181	13.3%	151	11.1%	91	6.7%
Native Hawaiian/Other PI	20	23.3%	18	20.9%	13	15.1%	9	10.5%
Hispanic/Latino	187	20.4%	150	16.4%	123	13.4%	74	8.1%
Multiple- Hispanic	254	22.0%	204	17.6%	173	15.0%	121	10.5%
Multiple - Non-Hispanic	108	23.4%	89	19.3%	69	14.9%	42	9.1%
White (reference)	1284	18.0%	1080	15.1%	828	11.6%	427	6.0%
Obese								
Yes	329	22.6%	287	19.7%	219	15.0%	114	7.8%
No (reference)	1872	18.5%	1526	15.1%	1205	11.9%	694	6.9%
Bullied at school within past 12 months								
Yes	839	35.6%	715	30.3%	566	24.0%	343	14.5%
No (reference)	1362	14.8%	1099	11.9%	858	9.3%	466	5.1%

Table 6 (continued). Summary Statistics: Weighted Frequencies, Percent, and Standard Error of Categorical Variables by Outcomes of Interest, YRBS 2011

	Suicidality (event=1)		Suicide-related Ideation (event=1)		Suicide-related Plan (event=1)		Suicide-related Attempt (event=1)	
	N	Row Percent	N	Row Percent	N	Row Percent	N	Row Percent
Covariates								
Electronically bullied within past 12 months								
Yes	762	39.7%	659	34.3%	514	26.8%	342	17.8%
No (reference)	1439	14.9%	1155	12.0%	910	9.4%	467	4.8%
Sad for 2 weeks within last 12 months								
Yes	1517	47.1%	1338	41.6%	1011	31.4%	665	20.7%
No (reference)	685	8.2%	476	5.7%	413	4.9%	143	1.7%
Discord between perceived weight status and actual weight								
Yes	479	22.5%	403	18.9%	319	15.0%	187	8.8%
No (reference)	1722	18.2%	1410	14.9%	1105	11.7%	621	6.6%
Unhealthy weight control behaviors within past 30 days								
Yes	779	43.7%	679	38.1%	545	30.6%	390	21.9%
No (reference)	1422	14.5%	1135	11.6%	879	9.0%	419	4.3%

Table 7 Bivariate Associations: Unadjusted Odds Ratios of Categorical Variables by Outcomes of Interest, YRBS 2011								
	Suicidality		Suicide-related Ideation		Suicide-related Plan		Suicide-related Attempt	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Independent Variable								
Perceived weight status to be slight/very overweight	1.81*	1.62, 2.03	1.88*	1.63, 2.17	1.88*	1.66, 2.13	1.85*	1.44, 2.38
Covariates								
Age								
15 yo	1.06	0.90, 1.24	1.1	0.92, 1.31	1.14	0.94, 1.38	1.36*	1.06, 1.75
16 yo	0.99	0.84, 1.17	1	0.84, 1.19	1.08	0.89, 1.31	1.13	0.87, 1.46
17 yo	0.91	0.77, 1.08	0.98	0.82, 1.18	0.93	0.76, 1.14	0.94	0.72, 1.22
≥18 yo	0.77*	0.64, 0.93	0.98*	0.82, 0.99	0.78	0.62, 0.99	0.84	0.62, 1.14
Female	1.52*	1.34, 1.70	1.6*	1.42, 1.81	1.45*	1.23, 1.70	2.02*	1.72, 2.38
Grade								
10th	0.94	0.83, 1.06	0.92	0.80, 1.05	1.06	0.91, 1.22	0.85	0.71, 1.03
11th	0.93	0.81, 1.05	0.91	0.80, 1.05	0.9	0.77, 1.05	0.67	0.55, 0.83
12th	0.74*	0.64, 0.84	0.76*	0.66, 0.88	0.79*	0.67, 0.92	0.64*	0.52, 0.79
Ungraded/Other	15.4*	1.72, 138.12	0.44	0.02, 7.98	26.87*	3.0, 241.04	42.73*	4.76, 383.72
Race/Ethnicity								
Am Indian/Alaska Native	1.61*	1.01, 2.55	1.5	0.91, 2.46	1.54	0.90, 2.66	2.06*	1.09, 3.89
Asian	1.45*	1.13, 1.87	1.36*	1.04, 1.77	1.26	0.93, 1.71	1.53*	1.05, 2.23
Black or African American	0.97	0.83, 1.12	0.86	0.73, 1.02	0.95	0.79, 1.14	1.13	0.89, 1.42
Native Hawaiian/Other PI	1.38	0.84, 2.29	0.67	0.41, 1.10	1.36	0.75, 2.46	1.84	0.92, 3.69
Hispanic/Latino	1.17	0.98, 1.39	1.1	0.91, 1.32	1.18	0.97, 1.45	1.38*	1.07, 1.79
Multiple- Hispanic	1.28*	1.10, 1.49	1.2*	1.02, 1.42	1.33*	1.12, 1.59	1.84*	1.49, 2.27
Multiple - Non-Hispanic	1.38*	1.10, 1.72	1.34*	1.05, 1.70	1.36*	1.04, 1.77	1.57*	1.13, 2.19

Table 7 (continued). Bivariate Associations: Unadjusted Odds Ratios of Categorical Variables by Outcomes of Interest, YRBS 2011								
	Suicidality		Suicide-related Ideation		Suicide-related Plan		Suicide-related Attempt	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Covariates								
Obese	1.28*	1.09, 1.51	1.38*	1.14, 1.68	1.31*	1.08, 1.59	1.16	0.83, 1.60
Sad for 2 weeks within last 12 months	10*	8.54, 11.72	11.81*	10.06, 13.86	8.82*	7.28, 10.68	14.98*	11.20, 20.03
Bullied at school within past 12 months	3.19*	2.83, 3.59	3.21*	2.81, 3.68	3.08*	2.60, 3.65	3.19*	2.61, 3.91
Electronically bullied within past 12 months	3.76*	3.31, 4.29	3.86*	3.30, 4.51	3.52*	2.94, 4.21	4.27*	3.50, 5.22
Discord between perceived weight status and actual weight	1.3*	1.15, 1.47	1.33*	1.15, 1.54	1.33*	1.14, 1.57	1.37*	1.07, 1.75
Unhealthy weight control behaviors within past 30 days	4.57*	3.97, 5.26	4.7*	3.97, 5.56	4.47*	3.79, 5.27	6.27*	5.30, 7.41

***significant odds ratio**

Table 8 Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicidality, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	P-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Age**	≤12-14 yo	1.76	1.33	2.33	24.56	<0.0001**
		15 yo	2.41	2	2.9		
		16 yo	2.03	1.68	2.45		
		17 yo	1.23	1	1.51		
		≥18 yo	1.66	1.25	2.2		
	Sex	Female	1.87	1.65	2.12	3.37	0.07*
		Male	1.55	1.33	1.81		
	Grade	9th	1.95	1.63	2.35	15.95	<0.01**
		10th	2.32	1.92	2.8		
		11th	1.69	1.39	2.05		
		12th	1.33	1.07	1.65		
		Ungrade/Other	0.62	0	82.12		
	Race/Ethnicity	Am Indian/Alaska Native	1.76	0.69	4.45	3.24	0.86
		Asian	2.57	1.54	4.27		
		Black or African American	1.84	1.37	2.47		
		Native Hawaiin/Other PI	1.8	0.65	4.99		
		Hispanic/Latino	1.52	1.09	2.11		
		Multiple-Hispanic	1.68	1.26	2.25		
		Multiple-Non-Hispanic	1.92	1.23	3		
		White	1.81	1.6	2.06		
	Obese	Yes	1.92	1.3	2.85	0	0.96
		No	1.9	1.7	2.12		

Table 8 (continued). Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicidality, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	P-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Bullied at school within past 12 months**	Yes	1.98	1.66	2.36	3.06	0.08*
		No	1.64	1.45	1.85		
	Electronically bullied within past 12 months	Yes	1.79	1.48	2.17	0.0391	0.84
		No	1.75	1.56	1.97		
	Sad for 2 weeks within last 12 months	Yes	1.75	1.51	2.02	4.56	0.03**
		No	1.37	1.16	1.63		
	Discord between perceived weight status and actual weight	Yes	2.22	1.78	2.75	5.14	0.02**
		No	1.67	1.49	1.87		
	Unhealthy weight control behaviors within past 30 days	Yes	1.53	1.27	1.85	0.36	0.55
		No	1.43	1.27	1.62		

*= significant at 0.1 level

**= significant at 0.05 level

Table 9 Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicidal Ideation, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Age**	≤12-14 yo	1.76	1.30	2.39	21.5	<0.001**
		15 yo	2.39	1.96	2.92		
		16 yo	2.21	1.80	2.70		
		17 yo	1.26	1.01	1.56		
		≥18 yo	1.82	1.34	2.46		
	Sex	Female	1.89	1.65	2.17	1.86	0.17
		Male	1.63	1.38	1.93		
	Grade	9th	2.01	1.65	2.44	13.54	<0.01**
		10th	2.44	1.99	2.98		
		11th	1.72	1.39	2.12		
		12th	1.41	1.12	1.77		
		Ungrade/Other	NA	NA	NA		
	Race/Ethnicity	Am Indian/Alaska Native	1.68	0.63	4.50	4.97	0.66
		Asian	2.48	1.44	4.28		
		Black or African American	2.20	1.59	3.04		
		Native Hawaiin/Other PI	1.41	0.49	4.04		
		Hispanic/Latino	1.59	1.11	2.27		
		Multiple-Hispanic	1.51	1.11	2.07		
		Multiple-Non-Hispanic	1.93	1.20	3.09		
		White	1.90	1.66	2.18		

Table 9 (continued). Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicidal Ideation, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Obese**	Yes	1.68	1.12	2.51	0.49	0.48
		No	1.95	1.73	2.20		
	Bullied at school within past 12 months	Yes	1.90	1.59	2.28	0.52	0.47
		No	1.75	1.54	2.00		
	Electronically bullied within past 12 months	Yes	1.84	1.51	2.24	0.01	0.91
		No	1.82	1.60	2.06		
	Sad for 2 weeks within last 12 months	Yes	1.76	1.52	2.04	3.87	0.05**
		No	1.38	1.13	1.68		
	Discord between perceived weight status and actual weight	Yes	2.08	1.65	2.62	1.41	0.24
		No	1.78	1.57	2.01		
	Unhealthy weight control behaviors within past 30 days	Yes	1.53	1.26	1.85	0.05	0.82
		No	1.48	1.30	1.70		

*= significant at 0.1 level
**= significant at 0.05 level
NA=insufficient data

Table 10 Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicide Plan, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Age**	≤12-14 yo	2.3098	1.6597	3.2148	17.1846	<0.01**
		15 yo	2.1904	1.7612	2.7242		
		16 yo	2.0628	1.6599	2.5635		
		17 yo	1.1996	0.9362	1.5371		
		≥18 yo	2.0839	1.4804	2.9335		
	Sex	Female	2.0912	1.8013	2.4277	8.8219	<0.01**
		Male	1.4592	1.2127	1.7558		
	Grade	9th	2.0631	1.6636	2.5586	5.7798	0.22
		10th	2.1489	1.7321	2.666		
		11th	1.8165	1.4349	2.2995		
		12th	1.4859	1.1527	1.9153		
		Ungrade/Other	0.6239	0.0047	82.1225		
	Race/Ethnicity	Am Indian/Alaska Native	1.7903	0.6104	5.2506	7.625	0.37
		Asian	3.7784	2.0495	6.9654		
		Black or African American	1.7382	1.2221	2.4723		
		Native Hawaiin/Other PI	1.0914	0.322	3.6991		
		Hispanic/Latino	1.5539	1.0571	2.2842		
		Multiple-Hispanic	1.9391	1.3925	2.7001		
		Multiple-Non-Hispanic	2.2554	1.3446	3.7833		
		White	1.8372	1.582	2.1337		

Table 10 (continued). Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicide Plan, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Obese**	Yes	1.7386	1.0971	2.7553	0.3149	0.57
		No	1.9929	1.7488	2.2712		
	Bullied at school within past 12 months	Yes	1.8315	1.5095	2.2223	0.052	0.82
		No	1.7807	1.5403	2.0587		
	Electronically bullied within past 12 months	Yes	1.8314	1.4878	2.2543	0.0086	0.93
		No	1.8098	1.5725	2.0828		
	Sad for 2 weeks within last 12 months	Yes	1.7193	1.4761	2.0027	2.2093	0.14
		No	1.4121	1.1444	1.7425		
	Discord between perceived weight status and actual weight	Yes	2.4512	1.8865	3.1848	5.9069	0.02**
		No	1.7034	1.4875	1.9505		
	Unhealthy weight control behaviors within past 30 days	Yes	1.7303	1.4115	2.121	3.0155	0.08*
		No	1.3835	1.1913	1.6066		

*= significant at 0.1 level

**= significant at 0.05 level

Table 11 Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicide Attempt, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Age**	≤12-14 yo	1.6687	1.0714	2.5992	18.3382	<0.01**
		15 yo	2.0795	1.5949	2.7114		
		16 yo	2.7256	2.0659	3.596		
		17 yo	1.1352	0.8146	1.5818		
		≥18 yo	1.4129	0.8944	2.2319		
	Sex	Female	1.665	1.3905	1.9938	0.2337	0.63
		Male	1.7977	1.3952	2.3163		
	Grade	9th	1.7853	1.3783	2.3125	15.64	<0.01**
		10th	2.5953	1.9663	3.4254		
		11th	2.0925	1.5247	2.8717		
		12th	1.091	0.7708	1.5443		
		Ungrade/Other	0.6239	0.0047	82.1225		
	Race/Ethnicity	Am Indian/Alaska Native	1.0627	0.3007	3.7559	14.308	0.05**
		Asian	4.0813	1.941	8.5818		
		Black or African American	1.0901	0.6824	1.7411		
		Native Hawaiin/Other PI	1.3509	0.3413	5.3461		
		Hispanic/Latino	1.448	0.895	2.3429		
		Multiple-Hispanic	1.5133	1.0268	2.2304		
		Multiple-Non-Hispanic	1.8811	0.9914	3.5693		
		White	2.1194	1.7382	2.5842		
	Obese	Yes	1.7701	0.9405	3.3315	0.1819	0.67
		No	2.0391	1.7303	2.4031		

Table 11 (continued). Test for Homogeneity of Odds Ratios: Effect of Perceived Weight Status on Suicide Attempt, Stratified by Singular Covariate Response Levels, YRBS 2011

Variable		Level	OR	Lower 95% Confidence Limit for Adjusted OR	Upper 95% Confidence Limit for Adjusted OR	Breslow-Day Test for Homogeneity of ORs	p-value
Crude Perceived Weight Status		Yes					
Adjusted for	**Bullied at school within past 12 months**	Yes	1.7216	1.3649	2.1714	0.0328	0.86
		No	1.7701	1.4621	2.1428		
	Electronically bullied within past 12 months	Yes	1.7754	1.3996	2.2522	0.0125	0.91
		No	1.7448	1.4421	2.1111		
	Sad for 2 weeks within last 12 months	Yes	1.4317	1.2034	1.7032	0.973	0.32
		No	1.7349	1.2344	2.4383		
	Discord between perceived weight status and actual weight	Yes	2.4158	1.7283	3.3768	3.9085	0.05**
		No	1.6544	1.3898	1.9693		
	Unhealthy weight control behaviors within past 30 days	Yes	1.3129	1.0482	1.6445	0.0448	0.83
		No	1.3573	1.0996	1.6754		

*= significant at 0.1 level

**= significant at 0.05 level

Table 12a Full Model: Adjusted Odds Ratios of Indicators for Suicidality When Controlling for Age, Sex and Race/Ethnicity, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.19*	22.33	<0.0001	1.21	1.19	1.23
Obese	-0.04	0.55	0.46	0.96	0.96	0.96
Bullied at school within past 12 months	0.27*	47.68	<0.0001	1.31	1.28	1.34
Electronically bullied within past 12 months	0.24*	31.18	<0.0001	1.27	1.25	1.30
Sad for 2 weeks within last 12 months	1.00*	605.60	<0.0001	2.72	2.51	2.94
Discord between actual weight status and perceived weight status	-0.06	1.71	0.1912	0.94	0.94	0.95
Unhealthy weight control behaviors within past 30 days	0.45*	117.74	<0.0001	1.57	1.51	1.63
Interaction Term						
Perceived overweight * 15 yo	0.12	2.56	0.11	1.36	1.30	1.43
Perceived overweight * 16 yo	0.02	0.07	0.78	1.23	1.20	1.27
Perceived overweight * 17 yo	-0.19*	6.03	0.01	1.00	1.00	1.00
Perceived overweight * ≥18 yo	0.02	0.06	0.81	1.23	1.20	1.27

*significant at 0.05 level
-2LL= 8661.35

Table 12b Final Model: Adjusted Odds Ratios of Indicators for Suicidality When Controlling for Age and Sex, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.17*	29.96	<0.0001	1.19	1.17	1.20
Bullied at school within past 12 months	0.35*	82.56	<0.0001	1.42	1.38	1.46
Sad for 2 weeks within last 12 months	1.03*	687.29	<0.0001	2.80	2.59	3.03
Discord between actual weight status and perceived weight status	-0.05	1.15	0.28	0.95	0.95	0.96
Unhealthy weight control behaviors within past 30 days	0.47*	128.49	<0.0001	1.59	1.65	1.54
Interaction Term						
Perceived overweight * 15 yo	0.12	2.4725	0.1159	1.34	1.28	1.40
Perceived overweight * 16 yo	0.02	0.1314	0.7170	1.21	1.18	1.24
Perceived overweight * 17 yo	-0.18*	5.4347	0.0197	0.99	0.99	0.99
Perceived overweight * ≥18 yo	0.02	0.0477	0.8271	1.21	1.17	1.25

*significant at 0.05 level
-2LL= 8724.84

Table 13a Full Model: Adjusted Odds Ratios of Indicators for Suicidal Ideation When Controlling for Age, Sex and Race/Ethnicity, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.18*	12.19	<0.001	1.20	1.18	1.22
Obese	0.02	0.18	0.68	1.02	1.02	1.02
Bullied at school within past 12 months	0.26*	39.95	<0.0001	1.30	1.27	1.32
Electronically bullied within past 12 months	0.23*	17.32	<0.0001	1.26	1.23	1.29
Sad for 2 weeks within last 12 months	1.08*	645.53	<0.0001	2.94	2.69	3.22
Discord between actual weight status and perceived weight status	-0.05	0.75	0.39	0.95	0.95	0.96
Unhealthy weight control behaviors within past 30 days	0.44*	108.37	<0.0001	1.55	1.50	1.61
Interaction Term						
Perceived overweight * 15 yo	0.09	0.92	0.34	1.31	1.25	1.38
Perceived overweight * 16 yo	0.04	0.53	0.47	1.25	1.22	1.28
Perceived overweight * 17 yo	-0.19*	4.46	0.04	0.99	0.99	0.99
Perceived overweight * ≥18 yo	0.05	0.45	0.50	1.26	1.22	1.30

*significant at 0.05 level
-2LL= 7581.10

Table 13b Final Model: Adjusted Odds Ratios of Indicators for Suicidal Ideation When Controlling for Age, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.17*	14.82	<0.0001	1.19	1.17	1.20
Sad for 2 weeks within last 12 months	1.14*	857.76	<.0001	3.13	2.87	3.41
Unhealthy weight control behaviors within past 30 days	0.47*	119.00	<.0001	1.60	1.54	1.66
Interaction Term						
Perceived overweight * 15 yo	0.08	0.88	0.35	1.28	1.23	1.34
Perceived overweight * 16 yo	0.05	0.81	0.37	1.25	1.22	1.27
Perceived overweight * 17 yo	-0.17*	3.69	0.05	1.00	1.00	1.00
Perceived overweight * ≥18 yo	0.04	0.22	0.64	1.23	1.19	1.28

*significant at 0.05 level
-2LL= 7735.915

Table 14a Full Model: Adjusted Odds Ratios of Indicators for Suicide Planning When Controlling for Age, Sex and Race/Ethnicity YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.21*	15.99	<0.0001	1.23	1.21	1.26
Obese	-0.04	0.35	0.55	0.96	0.96	0.97
Bullied at school within past 12 months	0.25*	17.83	<0.0001	1.28	1.25	1.32
Electronically bullied within past 12 months	0.20*	20.36	<0.0001	1.22	1.20	1.24
Sad for 2 weeks within last 12 months	0.93*	401.87	<0.0001	2.53	2.33	2.76
Discord between actual weight status and perceived weight status	-0.07	1.55	0.21	0.93	0.93	0.94
Unhealthy weight control behaviors within past 30 days	0.43*	96.16	<0.0001	1.54	1.48	1.60
Interaction Terms						
Perceived overweight * 15 yo	0.00	0.00	0.96	1.23	1.20	1.27
Perceived overweight * 16 yo	-0.01	0.05	0.82	1.22	1.19	1.26
Perceived overweight * 17 yo	-0.24*	9.34	<0.01	0.97	0.97	0.97
Perceived overweight * ≥18 yo	0.12	1.50	0.22	1.39	1.31	1.48
Perceived overweight * Female	0.08	3.02	0.08	1.34	1.33	1.34

*significant at 0.05 level
-2LL= 6910.69

Table 14b Final Model: Adjusted Odds Ratios of Indicators for Suicide Planning When Controlling for Age and Sex, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.20*	30.94	<0.0001	1.22	1.20	1.24
Sad for 2 weeks within last 12 months	1.00*	438.40	<0.0001	2.72	2.47	2.99
Discord between actual weight status and perceived weight status	-0.06	1.47	0.23	0.94	0.94	0.95
Unhealthy weight control behaviors within past 30 days	0.48*	129.03	<0.0001	1.62	1.55	1.68
Interaction Terms						
Perceived overweight * 15 yo	0.00	0.00	0.98	1.22	1.19	1.26
Perceived overweight * 16 yo	0.00	0.00	0.95	1.22	1.19	1.26
Perceived overweight * 17 yo	-0.22*	8.22	<0.01	0.98	0.98	0.98
Perceived overweight * ≥18 yo	0.10	1.01	0.31	1.35	1.27	1.43
Perceived overweight * Female	0.08	3.28	0.07	1.32	1.29	1.36

*significant at 0.05 level
-2LL= 7026.229

Table 15a Full Model: Adjusted Odds Ratios of Indicators for Suicide Attempt When Controlling for Age, Sex, Race/Ethnicity, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.12	1.87	0.17	1.13	1.11	1.15
Obese	-0.12	1.41	0.23	0.89	0.87	0.91
Bullied at school within past 12 months	0.18*	7.90	<0.01	1.20	1.17	1.22
Electronically bullied within past 12 months	0.25*	17.12	<0.0001	1.28	1.25	1.32
Sad for 2 weeks within last 12 months	1.13*	245.83	<0.0001	3.10	2.64	3.63
Discord between actual weight status and perceived weight status	-0.08	0.95	0.33	0.92	0.91	0.93
Unhealthy weight control behaviors within past 30 days	0.55*	169.72	<0.0001	1.73	1.66	1.81
Interaction Term						
Perceived overweight * 15 yo	0.02	0.09	0.77	1.15	1.12	1.18
Perceived overweight * 16 yo	0.20*	6.98	<0.01	1.38	1.31	1.44
Perceived overweight * 17 yo	-0.22	4.79	0.03	0.90	0.89	0.92
Perceived overweight * ≥18 yo	-0.04	0.08	0.78	1.08	1.10	1.06

*significant at 0.05 level
-2LL= 4380.78

Table 15b Final Model: Adjusted Odds Ratios of Indicators for Suicide Attempt When Controlling for Age and Race/Ethnicity, YRBS 2011						
Indicator	**Estimate**	**Wald Chi-Square**	**Pr > Chi-Square**	**Odds Ratio**	**Wald Lower 95% Confidence Limit for Adjusted Odds Ratio**	**Wald Upper 95% Confidence Limit for Adjusted Odds Ratio**
Perceived weight status to be slight/very overweight	0.17*	6.47	0.0110	1.19	1.16	1.21
Sad for 2 weeks within last 12 months	1.34*	337.60	<0.0001	3.82	3.16	4.62
Discord between actual weight status and perceived weight status	-0.02	0.08	0.7825	0.98	0.98	0.98
Interaction Term						
Perceived overweight * 15 yo	0.04	0.22	0.6427	1.23	1.19	1.28
Perceived overweight * 16 yo	0.20*	6.21	0.0127	1.45	1.37	1.53
Perceived overweight * 17 yo	-0.15	2.68	0.1019	1.02	1.02	1.02
Perceived overweight * ≥18 yo	-0.07	0.30	0.5827	1.11	1.13	1.08

*significant at 0.05 level
-2LL=4644.766

APPENDIX III: ANALYTIC SAS PROGRAM

```
/*************************************************************************************************************************************
*
Filename: YRBS_2011_Modification_Analytic_Program 022414.sas
Input: 2011 YRBS SAS datafile publicly accessible @ http://www.cdc.gov/HealthyYouth/yrbs/data/
Created by: Merriah Croston
Creation Date: November 2013
Purpose: Preparation and analysis (survey design accommodated) of YRBS 2011 data for purposes of masters thesis
Updates: Jan/Feb/March 2014
*************************************************************************************************************************************
/

LIBNAME yrbs '\\cdc.gov\private\M317\kko0\YRBS11';
LIBNAME yrbs 'T:\';

%let &tdate=032614;



/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                                                   Start Modification
                                                                                                                  */
/*-------------------------------------------------------------------------------------------------------------------*/

PROC FREQ DATA=yrbs.yrbs2011;
TABLES Q1 Q3 RACEETH Q27 Q28 Q67 Q68;
RUN;

PROC DATASETS LIB=yrbs MEMTYPE=data;
  MODIFY yrbs2011;
    attrib _all_ format=;
run;

DATA yrbs.finalyrbs2011; SET yrbs.yrbs2011
(rename=
(QN22=bully
QN23=ebully
QN24=sad
QN25=ideation_suic
```

```
QN26=plan_suic
QN27=attempt_suic
QN67=slightly_very_owt)
);

age=input(Q1,1.);
sex=input(Q2,1.);
grade=input(Q3,1.);

IF raceeth=1 THEN race_eth=1;
ELSE IF raceeth=2 THEN race_eth=2;
ELSE IF raceeth=3 THEN race_eth=3;
ELSE IF raceeth=4 THEN race_eth=4;
ELSE IF raceeth=5 THEN race_eth=8;
ELSE IF raceeth=6 THEN race_eth=5;
ELSE IF raceeth=7 THEN race_eth=6;
ELSE IF raceeth=8 THEN race_eth=7;
ELSE raceeth=.;

IF age in (1,2,3) THEN age=1;
ELSE IF age=4 THEN age=2;
ELSE IF age=5 THEN age=3;
ELSE IF age=6 THEN age=4;
ELSE IF age=7 THEN age=5;


IF (qnowt=1 or qnobese=1) and (slightly_very_owt=2) THEN weight_discord=1;
ELSE IF (qnowt=1 or qnobese=1) and (slightly_very_owt=1) THEN weight_discord=2;
ELSE IF (qnowt=2 or qnobese=2) and (slightly_very_owt=2) THEN weight_discord=2;
ELSE IF (qnowt=2 or qnobese=2) and (slightly_very_owt=1) THEN weight_discord=1;
ELSE weight_discord=.;

IF QN69=1 or QN70=1 or QN71=1 THEN unhealthy_control=1;
ELSE IF QN69=2 and QN70=2 and QN71=2 THEN unhealthy_control=2;
ELSE unhealthy_control=.;

IF ideation_suic=1 or plan_suic=1 or attempt_suic=1 THEN suicidality=1;
ELSE IF ideation_suic=2 and plan_suic=2 and attempt_suic=2 THEN suicidality=2;
ELSE suicidality=.;
```

```
IF (QNOWT=. or QNOBESE=. or slightly_very_owt=. or age=. or sex=. or grade=. or race_eth=. or bully=. or ebully=. or sad=.
or ideation_suic=. or plan_suic=. or attempt_suic=. or suicidality=. or all_suic_outcomes=. or weight_discord=. or unhealthy_control=.) or weight=0
THEN DELETE;

LABEL
weight_discord="Discord btw participant's BMI & weight perception (overweight/obese only)"
unhealthy_control="Particpant endorsed 1+ unhealthy weight control behaviors"
suicidality="Participant endorsed 1+ pre-suicide behaviors";

KEEP
qnowt qnobese slightly_very_owt age sex grade race_eth bully ebully sad ideation_suic plan_suic attempt_suic suicidality
weight_discord unhealthy_control stratum psu weight;

RUN;

*creating outcome variables that reflect when 1 or more outcomes were exclusively endorsed;

DATA yrbs.finalyrbs2011; SET yrbs.finalyrbs2011;

IF ideation_suic=1 and plan_suic ne 1 and attempt_suic ne 1 THEN suic_ideation_only=1;
ELSE suic_ideation_only=2;

IF ideation_suic ne 1 and plan_suic=1 and attempt_suic ne 1 THEN suic_plan_only=1;
ELSE suic_plan_only=2;

IF ideation_suic ne 1 and plan_suic ne 1 and attempt_suic=1 THEN suic_attempt_only=1;
ELSE suic_attempt_only=2;

IF ideation_suic=1 and plan_suic=1 and attempt_suic ne 1 THEN suic_ideation_plan_only=1;
ELSE suic_ideation_plan_only=2;

IF ideation_suic=1 and plan_suic ne 1 and attempt_suic=1 THEN suic_ideation_attempt_only=1;
ELSE suic_ideation_attempt_only=2;

IF ideation_suic ne 1 and plan_suic=1 and attempt_suic=1 THEN suic_plan_attempt_only=1;
ELSE suic_plan_attempt_only=2;

IF ideation_suic=1 and plan_suic=1 and attempt_suic=1 THEN all_suic_outcomes=1;
ELSE all_suic_outcomes=2;
```

```
LABEL all_suic_outcomes="All suicide-related outcomes were endorsed"
suic_ideation_only="Ideation endorsed, only"
suic_plan_only="Plan endorsed, only"
suic_attempt_only="Attempt endorsed, only"
suic_ideation_plan_only="Ideation + Plan endorsed, only"
suic_ideation_attempt_only="Ideation + Attempt endorsed, only"
suic_plan_attempt_only="Plan + Attempt endorsed, only";

RUN;

/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                                  End Modification
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/




/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                  Start Outcome Frequencies Unadjusted/Adjusted
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/

PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLE suic_ideation_only suic_plan_only suic_attempt_only suic_ideation_plan_only suic_ideation_attempt_only
suic_plan_attempt_only all_suic_outcomes;
Title "(Un)Adj Frequencies for Suicide-related Outcomes";
RUN;

/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                          End Outcome Frequencies Unadjusted & Adjusted
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                    Start Frequencies Unadjusted & Adjusted/ChiSq
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/
*all freqs, unweighted & weighted;

PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES slightly_very_owt qnowt qnobese age sex grade race_eth bully ebully sad weight_discord unhealthy_control ideation_suic plan_suic
attempt_suic suicidality;
TITLE "(Un)Adjusted Frequencies for All Variables";
ODS OUTPUT oneway=adj_freqs_allvars;
RUN;

*merge results;
*sort for proc surveyfreq;
PROC SORT DATA=yrbs.finalyrbs2011;
BY stratum psu;
RUN;

*all suicidality;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES
slightly_very_owt*suicidality
qnowt*suicidality
qnobese*suicidality
age*suicidality
sex*suicidality
grade*suicidality
race_eth*suicidality
bully*suicidality
ebully*suicidality
```

```
sad*suicidality
weight_discord*suicidality
unhealthy_control*suicidality
/ chisq cl or;
TITLE 'Descriptive Stats: All IV, confounding, and moderating variables of consideration * suicidality (DV)';
ODS OUTPUT crosstabs=suic_crosstab_allvars;
ODS OUTPUT chisq=suic_chisq_allvars;
RUN;

*all suicidal ideation;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES
slightly_very_owt*ideation_suic
qnowt*ideation_suic
qnobese*ideation_suic
age*ideation_suic
sex*ideation_suic
grade*ideation_suic
race_eth*ideation_suic
bully*ideation_suic
ebully*ideation_suic
sad*ideation_suic
weight_discord*ideation_suic
unhealthy_control*ideation_suic
/ chisq cl or ;
TITLE 'Descriptive Stats: All IV, confounding, and moderating variables of consideration * suicidal ideation (DV)';
ODS OUTPUT crosstabs=ideation_crosstab_allvars;
ODS OUTPUT chisq=ideation_chisq_allvars;RUN;

*all suicide plan;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES
slightly_very_owt*plan_suic
qnowt*plan_suic
```

```
qnobese*plan_suic
age*plan_suic
sex*plan_suic
grade*plan_suic
race_eth*plan_suic
bully*plan_suic
ebully*plan_suic
sad*plan_suic
weight_discord*plan_suic
unhealthy_control*plan_suic
/ chisq cl or;
TITLE 'Descriptive Stats: All IV, confounding, and moderating variables of consideration * planned suicide (DV)';
ODS OUTPUT crosstabs=plan_crosstab_allvars;
ODS OUTPUT chisq=plan_chisq_allvars;
RUN;

*all suicide attempt;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES
slightly_very_owt*attempt_suic
qnowt*attempt_suic
qnobese*attempt_suic
age*attempt_suic
sex*attempt_suic
grade*attempt_suic
race_eth*attempt_suic
bully*attempt_suic
ebully*attempt_suic
sad*attempt_suic
weight_discord*attempt_suic
unhealthy_control*attempt_suic
/ chisq cl or;
TITLE 'Descriptive Stats: All IV, confounding, and moderating variables of consideration * attempted suicide (DV)';
ODS OUTPUT crosstabs=attempt_crosstab_allvars;
ODS OUTPUT chisq=attempt_chisq_allvars;
RUN;
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                End Frequencies/ChiSq
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                Start Test of Homogeneity for ORs
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/
```

```
PROC FREQ DATA=yrbs.finalyrbs2011; WEIGHT weight;
TABLES

qnobese*slightly_very_owt*suicidality
bully*slightly_very_owt*suicidality
ebully*slightly_very_owt*suicidality
sad*slightly_very_owt*suicidality
weight_discord*slightly_very_owt*suicidality
unhealthy_control*slightly_very_owt*suicidality
age*slightly_very_owt*suicidality
sex*slightly_very_owt*suicidality
grade*slightly_very_owt*suicidality
race_eth*slightly_very_owt*suicidality

qnobese*slightly_very_owt*ideation_suic
bully*slightly_very_owt*ideation_suic
ebully*slightly_very_owt*ideation_suic
sad*slightly_very_owt*ideation_suic
weight_discord*slightly_very_owt*ideation_suic
unhealthy_control*slightly_very_owt*ideation_suic
age*slightly_very_owt*ideation_suic
sex*slightly_very_owt*ideation_suic
grade*slightly_very_owt*ideation_suic
race_eth*slightly_very_owt*ideation_suic
```

```
qnobese*slightly_very_owt*plan_suic
bully*slightly_very_owt*plan_suic
ebully*slightly_very_owt*plan_suic
sad*slightly_very_owt*plan_suic
weight_discord*slightly_very_owt*plan_suic
unhealthy_control*slightly_very_owt*plan_suic
age*slightly_very_owt*plan_suic
sex*slightly_very_owt*plan_suic
grade*slightly_very_owt*plan_suic
race_eth*slightly_very_owt*plan_suic

qnobese*slightly_very_owt*attempt_suic
bully*slightly_very_owt*attempt_suic
ebully*slightly_very_owt*attempt_suic
sad*slightly_very_owt*attempt_suic
weight_discord*slightly_very_owt*attempt_suic
unhealthy_control*slightly_very_owt*attempt_suic
age*slightly_very_owt*attempt_suic
sex*slightly_very_owt*attempt_suic
grade*slightly_very_owt*attempt_suic
race_eth*slightly_very_owt*attempt_suic

/ cmh chisq cmh1 relrisk; exact eqor;
RUN;


/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                                End Test of Homogeneity for ORs
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/




/*-------------------------------------------------------------------------------------------------------------------*/
```

```
/*                                                                                                                    Start Regression
                                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------------------*/



/*-------------------------------------------------------------------------------------------------------------------------------*/
/*                                                                                                  BEGIN SUICIDALITY: FIND REDUCED MODEL: BACKWARD
REG                                                                                                                                 */
/*-------------------------------------------------------------------------------------------------------------------------------*/

*first, test for collinearity among all covariates;
PROC REG DATA=yrbs.finalyrbs2011;
WEIGHT weight;
MODEL suicidality = slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex grade race_eth/ collin collinoint vif;
RUN; QUIT;
*age and grade collinear, don't include grade in models;

*remove grade from model since it's collinear with age;

*FULL MODEL;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8676.589;

*CHUNK TEST;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
```

```
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*according to LRT, chunk test is significant and at least some of interaction terms are significant (-2LL=8649.506, LRT df=9).


*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 1 remove interaction term with qnobese, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8649.559, LRT df=1, LRT stat=0.053, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 2 remove interaction term with weight_discord, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8649.634, LRT df=2, LRT stat=0.128, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 3 remove interaction term with unhealthy_control, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
```

```
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8649.810, LRT df=3, LRT stat=0.304, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 3 remove interaction term with sex, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8650.607, LRT df=4, LRT stat=1.101, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 4 remove interaction term with ebully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8652.458, LRT df=5, LRT stat=2.952, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 5 remove interaction term with bully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
```

```
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8653.399, LRT df=6, LRT stat=3.893, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 6 remove interaction term with race_ethnicity, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8658.512, LRT df=7, LRT stat=9.006, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 7 remove interaction term with sad, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8661.350, LRT df=8, LRT stat=11.844, insignificant change in fit, continue removing interaction terms;
*Likehood ratio=2603.4005, p-value=<0.0001;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8 remove interaction term with age (last term), since Wald test is
significant;
```

```
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Suicidality: Interaction model, weight perception (IV)";
RUN;
*-2LL=8676.589, LRT df=9, LRT stat=27.083, SIGNIFICANT CHANGE IN FIT, KEEP INTERACTION TERM FOR AGE IN MODEL;


*^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^FINAL MODEL^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

suicidality=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^SUICIDALITY^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^;

*BACKWARD ELIMINATION of CONFOUNDING TERMS (age not eligible): PERFORMED IN STATA, SINCE THE INTERACTION TERM
PREVENTS FROM
CALCULATING OR FOR MAIN IV IN SAS;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) bully (ref=last) sad (ref=last) weight_discord (ref=last) age (ref=first) sex (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL suicidality (event='1')=slightly_very_owt bully sad weight_discord age sex slightly_very_owt*age;
TITLE "Suicidality: Final model wo confounding factors, weight perception (IV)";
RUN;
*-2LL=8918.426, Likehood ratio=2346.3250, p-value=<0.0001;


/*---------------------------------------------------------------------------------------------------------------*/
/*                                                                 END SUICIDALITY: FIND REDUCED MODEL: BACKWARD
REG                                                                  */
/*---------------------------------------------------------------------------------------------------------------*/
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                BEGIN IDEATION: FIND REDUCED MODEL: BACKWARD REG
                                                                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/

*first, test for collinearity among all covariates;

PROC REG DATA=yrbs.finalyrbs2011;
WEIGHT weight;
MODEL ideation_suic = slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex grade race_eth/ collin collinoint vif;
RUN; QUIT;
*age and grade collinear, don't include grade in models;

*FULL MODEL;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7593.182;

*CHUNK TEST;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
```

```
*according to LRT, chunk test is significant and at least some of interaction terms are significant (-2LL=7571.939, LRT df=9).


*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 1 remove interaction term with unhealthy_control, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese  slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7571.979, LRT df=1, LRT stat=.04, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 2 remove interaction term with bully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7572.036, LRT df=2, LRT stat=.097, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 3 remove interaction term with qnobese, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
```

```
slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7572.244, LRT df=3, LRT stat=.305, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 4 remove interaction term with sex, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7572.562, LRT df=4, LRT stat=.623, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 5 remove interaction term with weight_discord, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7572.902, LRT df=5, LRT stat=.963, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 6 remove interaction term with ebully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
```

```
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7573.466, LRT df=6, LRT stat=1.527, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 7 remove interaction term with race_ethnicity, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7578.667, LRT df=7, LRT stat=6.728, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8a remove interaction term with age, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7590.930, LRT df=8, LRT stat=18.991, SIGNIFICANT CHANGE IN FIT, KEEP IN MODEL;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8b remove interaction term with sad (last term), since Wald test is
insignificant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
```

```
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age;
TITLE "Ideation: Interaction model, weight perception (IV)";
RUN;
*-2LL=7581.100, LRT df=8, LRT stat=9.161, insignificant change in fit, done removing terms;


*^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^FINAL MODEL W/REDUCED INTERACTION
TERMS^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

ideation_suic=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^SUICIDAL IDEATION^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^;

*BACKWARD ELIMINATION of CONFOUNDING TERMS (age not eligible): PERFORMED IN STATA, SINCE THE INTERACTION TERM
PREVENTS FROM
CALCULATING OR FOR MAIN IV IN SAS;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL ideation_suic (event='1')=slightly_very_owt sad age
slightly_very_owt*age;
TITLE "Ideation: Final model (wo confounding factors), weight perception (IV)";
RUN;
*-2LL=7926.335, Likehood ratio=2126.5407, p-value=<0.0001;


/*--------------------------------------------------------------------------------------------------------------------------------*/
/*                                                                                  END IDEATION: FIND REDUCED MODEL: BACKWARD REG
                                                                                  */
/*--------------------------------------------------------------------------------------------------------------------------------*/
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                BEGIN PLAN: FIND REDUCED MODEL: BACKWARD REG                       */
/*-------------------------------------------------------------------------------------------------------------------*/

*first, test for collinearity among all covariates;

PROC REG DATA=yrbs.finalyrbs2011;
WEIGHT weight;
MODEL plan_suic = slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex grade race_eth/ collin collinoint vif;
RUN; QUIT;
*age and grade collinear, don't include grade in models;

*FULL MODEL;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6931.788;

*CHUNK TEST;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*according to LRT, chunk test is significant and at least some of interaction terms are significant (-2LL=6899.618, LRT df=9).
```

```
*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 1 remove interaction term with bully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6899.665, LRT df=1, LRT stat=.047, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 2 remove interaction term with qnobese, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6899.846, LRT df=2, LRT stat=.228, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 3 remove interaction term with sad, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*ebully slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
```

```
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6900.160, LRT df=3, LRT stat=.542, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 4 remove interaction term with race_ethnicity, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last) unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth slightly_very_owt*ebully slightly_very_owt*weight_discord slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6905.535, LRT df=4, LRT stat=5.917, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 5 remove interaction term with ebully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last) unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth slightly_very_owt*weight_discord slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6906.987, LRT df=5, LRT stat=7.369, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 6 remove interaction term with unhealthy_control, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last) unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
```

```
slightly_very_owt*weight_discord slightly_very_owt*age slightly_very_owt*sex;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6908.856, LRT df=6, LRT stat=9.238, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 7 remove interaction term with weight_discord, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age slightly_very_owt*sex;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6910.686, LRT df=7, LRT stat=11.068, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8a remove interaction term with sex, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6916.150, LRT df=8, LRT stat=16.532, SIGNIFICANT CHANGE IN FIT, KEEP IN MODEL;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8b remove interaction term with age, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
```

```
slightly_very_owt*sex;
TITLE "Plan: Interaction model, weight perception (IV)";
RUN;
*-2LL=6926.048, LRT df=8, LRT stat=26.43, SIGNIFICANT CHANGE IN FIT, KEEP IN MODEL;

*^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^FINAL MODEL^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

plan_suic=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age slightly_very_owt*sex

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^SUICIDE PLANNING^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^;

*BACKWARD ELIMINATION of CONFOUNDING TERMS (age not eligible): PERFORMED IN STATA, SINCE THE INTERACTION TERM
PREVENTS FROM
CALCULATING OR FOR MAIN IV IN SAS;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age slightly_very_owt*sex;
TITLE "Plan: Final model wo interaction, weight perception (IV)";
RUN;
*-2LL=8010.019, Likehood ratio=626.3140, p-value=<0.0001;

/*---------------------------------------------------------------------------------------------------------------------------*/
/*                                                     BEGIN TESTING CRITERIA #3 & 4 MEDIATION FOR ATTEMPT: SAD?
                                                                 */
/*---------------------------------------------------------------------------------------------------------------------------*/

*RULE 3;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
WEIGHT weight ;
TABLES
slightly_very_owt*sad
```

```
/ chisq cl;
TITLE "Testing Rule #3 for mediation: sad mediates rel. btw. perception and plan?";
RUN;
*Rao-Scott Chi Square=63.8262, p-value=<0.001, Passes rule #3;


*RULE 4;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt;
TITLE "Testing Rule #4 for mediation: sad mediates rel. btw. perception and plan?";
RUN;
*OR=1.882, CI=1.671,2.120;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last)
unhealthy_control (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL plan_suic (event='1')=slightly_very_owt sad;
TITLE "Testing Rule #4 for mediation: sad mediates rel. btw. perception and plan?";
RUN;
*OR=1.605, CI=1.384 1.861, DOES NOT FULLY mediate the relationship between weight perception
and plan;

/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                    END TESTING CRITERIA #3 & 4 MEDIATION FOR ATTEMPT: SAD?
                                                      */
/*-------------------------------------------------------------------------------------------------------------------*/

/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                                  END PLAN: FIND REDUCED MODEL: BACKWARD REG
                                                                    */
/*-------------------------------------------------------------------------------------------------------------------*/
```

```
/*-------------------------------------------------------------------------------------------------------------------*/
/*                                                BEGIN ATTEMPT: FIND REDUCED MODEL: BACKWARD REG                    */
/*-------------------------------------------------------------------------------------------------------------------*/

*first, test for collinearity among all covariates;

PROC REG DATA=yrbs.finalyrbs2011;
WEIGHT weight;
MODEL attempt_suic = slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex grade race_eth/ collin collinoint vif;
RUN; QUIT;
*age and grade collinear, don't include grade in models;

*FULL MODEL;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4393.150;

*CHUNK TEST;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*bully slightly_very_owt*ebully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*according to LRT, chunk test is significant and at least some of interaction terms are significant (-2LL=4367.710, LRT df=9).
```

```
*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 1 remove interaction term with ebully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*qnobese slightly_very_owt*bully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4367.717, LRT df=1, LRT stat=.007, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 2 remove interaction term with qnobese, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*sad slightly_very_owt*weight_discord
slightly_very_owt*unhealthy_control slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4367.746, LRT df=2, LRT stat=.036, insignificant change in fit, continue removing interaction terms;


*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 3 remove interaction term with unhealthy_control, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
```

```
slightly_very_owt*bully slightly_very_owt*sad slightly_very_owt*weight_discord slightly_very_owt*age slightly_very_owt*sex
slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4367.876, LRT df=3, LRT stat=.166, insignificant change in fit, continue removing interaction terms;


*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 4 remove interaction term with weight_discord, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*bully slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4368.029, LRT df=4, LRT stat=.319, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 5 remove interaction term with bully, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*sex slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4368.800, LRT df=5, LRT stat=1.09, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 6 remove interaction term with sex, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
```

```
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age slightly_very_owt*race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4369.904, LRT df=6, LRT stat=2.194, insignificant change in fit, continue removing interaction terms;


*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 7 remove interaction term with race_ethnicity, since Wald test is least
significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*sad slightly_very_owt*age;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4378.611, LRT df=7, LRT stat=10.901, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 8 remove interaction term with sad, since Wald test is least significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4380.781, LRT df=8, LRT stat=13.071, insignificant change in fit, continue removing interaction terms;

*BACKWARD ELIMINATION of INTERACTION TERMS, FIRST: Step 9 remove interaction term with age, although the term is significant;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
```

```
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth;
TITLE "Attempt: Interaction model, weight perception (IV)";
RUN;
*-2LL=4393.150, LRT df=9, LRT stat=25.44, SIGNIFICANT CHANGE IN FIT, KEEP IN MODEL;

*^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^FINAL MODEL^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

attempt_suic=slightly_very_owt qnobese bully ebully sad weight_discord unhealthy_control age sex race_eth
slightly_very_owt*age

^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^SUICIDE PLANNING^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^;

*BACKWARD ELIMINATION of CONFOUNDING TERMS (age not eligible): PERFORMED IN STATA, SINCE THE INTERACTION TERM
PREVENTS FROM
CALCULATING OR FOR MAIN IV IN SAS;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last) qnobese (ref=last) bully (ref=last) ebully (ref=last) sad (ref=last) weight_discord (ref=last)
unhealthy_control (ref=last) age (ref=first) sex (ref=last) race_eth (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt weight_discord age race_eth
slightly_very_owt*age;
TITLE "Attempt: Final model wo confounding, weight perception (IV)";
RUN;
*-2LL=5718.256, Likehood ratio=145.4092, p-value=<0.0001;


/*--------------------------------------------------------------------------------------------------------------------------------------*/
/*                                        BEGIN TESTING CRITERIA #3 & 4 MEDIATION FOR ATTEMPT: SAD, UHWC?
                                       */
/*--------------------------------------------------------------------------------------------------------------------------------------*/

*RULE 3;
PROC SURVEYFREQ DATA=yrbs.finalyrbs2011;
STRATA stratum ;
CLUSTER psu ;
```

```
WEIGHT weight ;
TABLES
slightly_very_owt*unhealthy_control
slightly_very_owt*sad
/ chisq cl;
TITLE "Testing Rule #3 for mediation: sad mediates rel. btw. perception and attempt?";
RUN;
*Rao-Scott Chi Square=441.7280, p-value=<0.001;
*Rao-Scott Chi Square=63.8262, p-value=<0.001;

*RULE 4;
PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt;
TITLE "Testing Rule #4 for mediation: sad mediates rel. btw. perception and attempt?";
RUN;
*OR=1.852, CI=1.453 2.359;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last)
unhealthy_control (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt  unhealthy_control;
TITLE "Testing Rule #4 for mediation: sad mediates rel. btw. perception and attempt?";
RUN;
*OR=1.336, CI=1.045 1.709, DOES NOT FULLY mediate the relationship between weight perception
and attempt;

PROC SURVEYLOGISTIC DATA=yrbs.finalyrbs2011;
CLASS slightly_very_owt (ref=last)
bully (ref=last);
WEIGHT weight;
STRATA stratum;
CLUSTER psu;
MODEL attempt_suic (event='1')=slightly_very_owt sad;
```

```
TITLE "Testing Rule #4 for mediation: sad mediates rel. btw. perception and attempt?";
RUN;
*OR=1.489, CI=1.136 1.950 DOES NOT FULLY mediate the relationship between weight perception
and attempt;


/*-------------------------------------------------------------------------------------------------------------*/
/*                                                    END TESTING CRITERIA #3 & 4 MEDIATION FOR ATTEMPT: SAD, UHWC?
                                                  */
/*-------------------------------------------------------------------------------------------------------------*/
```