Physical activity and sports team participation as predictors of suicidal behavior in high school students

Jacquelyn E. O'Connor

University at Albany, State University of New York, jacquelynoc@gmail.com

The University at Albany community has made this article openly available. Please share how this access benefits you.

Follow this and additional works at: https://scholarsarchive.library.albany.edu/legacy-etd

Part of the Psychology Commons

Recommended Citation


This Dissertation is brought to you for free and open access by the The Graduate School at Scholars Archive. It has been accepted for inclusion in Legacy Theses & Dissertations (2009 - 2024) by an authorized administrator of Scholars Archive. Please see Terms of Use. For more information, please contact scholarsarchive@albany.edu.
Physical Activity and Sports Team Participation
as Predictors of Suicidal Behavior in High School Students

By

Jacquelyn E. O’Connor

A Dissertation
Submitted to the University at Albany, State University of New York
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Psychology

School of Education
Department of Educational and Counseling Psychology

Fall 2015
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter/Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>i</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>CHAPTER 1 – INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Demographic Variables Associated with Adolescent Suicidality</td>
<td>2</td>
</tr>
<tr>
<td>Risk Factors Associated with Adolescent Suicidality</td>
<td>2</td>
</tr>
<tr>
<td>Warning Signs Associated with Imminent Suicide Risk</td>
<td>3</td>
</tr>
<tr>
<td>Factors Associated with Reduced Adolescent Suicidality</td>
<td>4</td>
</tr>
<tr>
<td>Physical Activity and Sports Team Participation</td>
<td>6</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>7</td>
</tr>
<tr>
<td>Purpose of the Current Study</td>
<td>8</td>
</tr>
<tr>
<td>CHAPTER 2 – REVIEW OF LITERATURE</td>
<td>10</td>
</tr>
<tr>
<td>Youth Suicidality as a Significant Public Health Problem</td>
<td>12</td>
</tr>
<tr>
<td>Research on Youth Suicidal Behavior</td>
<td>14</td>
</tr>
<tr>
<td>Demographic Variables</td>
<td>15</td>
</tr>
<tr>
<td>Risk Factors and Warning Signs</td>
<td>16</td>
</tr>
<tr>
<td>Protective Factors</td>
<td>20</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>22</td>
</tr>
<tr>
<td>Sports Participation</td>
<td>25</td>
</tr>
<tr>
<td>Physical Activity and Sports Participation: Associative Relationship</td>
<td>27</td>
</tr>
</tbody>
</table>
Critique of the Literature .......................................................................................41
Purpose of the Current Study ..................................................................................45
CHAPTER 3 – METHODOLOGY ...................................................................................46
Participants and Sampling Procedure ....................................................................46
Instrument ..............................................................................................................48
Psychometric Properties .........................................................................................50
Measures ..................................................................................................................52
  Physical Activity .................................................................................................52
  Sports Participation .............................................................................................52
  Suicidality .............................................................................................................53
Procedures ...............................................................................................................53
Statistical Analysis ..................................................................................................54
CHAPTER 4 – RESULTS ...............................................................................................57
  Descriptive Statistics ..........................................................................................57
  Regression Analysis ............................................................................................68
CHAPTER 5 – DISCUSSION .........................................................................................73
  Significant Findings .............................................................................................74
    Physical Activity and Suicidal Behavior ..........................................................75
    Gender, Physical Activity, and Suicidal Behavior ..............................................75
    Sports Team Participation and Suicidal Behavior .............................................76
    Hopelessness and Suicidal Behavior .................................................................77
    Disordered Eating and Suicidal Behavior .........................................................78
    Age and Suicidal Behavior .................................................................................79
Abstract

Youth suicidal behavior is a significant and worldwide public health problem. Although a variety of demographic variables and risk factors have been found to be associated with youth suicidal behavior, research on wellness activities that may be inversely associated with youth suicidal behavior is lacking. Using the Center for Disease Control’s Youth Risk Behavior Surveillance System (YRBSS) data from 2011, this study examined the relationship between physical activity, sports participation, and suicidal behavior in high school students. Results indicated that suicidality did vary by level of physical activity in the sample used in the study ($t = 4.679, p = .000$). Moreover, hopelessness, disordered eating behavior, age, and male physical activity were found to play a statistically significant role in this relationship. Limitations of the current research are presented along with implications of these findings for practice and future research.
Chapter 1

Introduction

Youth suicidal behavior and deaths by suicide represent significant worldwide public health problems. For example, in recent years, 16% of U.S. high school students reported suicidal ideation (i.e., thinking about suicide) and 8% reported attempting suicide (CDC, 2011b). Suicide is ranked as the third leading cause of death among adolescents between the ages of 10 and 19 (CDC, 2009), and enduring a loss from suicide tends to be more intensely traumatic for survivors than the loss from other causes of premature death (Kalischuk & Hayes, 2004; Range & Calhoun, 1990).

Several organizations have called for improvements in youth suicide prevention research in recent years (AFSP & SPRC, 2011; NASP, 2008; U.S. Department of Health, 2001). However, youth suicide prevention researchers are faced with significant challenges. First, it is inherently challenging to do empirical research on suicide because of its (fortunately) low base rate (CDC, 2009). Second, lack of knowledge and fear about suicide contribute to widespread stigma and an associated paucity of funding sources for this area of research (Miller, 2011). Given these challenges, many youth suicide prevention researchers have focused on predictors of suicidal behavior rather than conduct more costly, time consuming, and logistically difficult longitudinal research that would better lend itself to statements of causality.

Ongoing research on predictors of suicidal behavior has yielded some empirical findings in regard to: (a) demographic groups at higher risk for engaging in suicidal behavior, (b) risk factors and warning signs most commonly associated with suicidal
behavior, and (c) protective factors associated with decreased risk for engaging in suicidal behavior (Joiner, 2010; Mazza, 2006; Seeley, Rohde, & Jones, 2010).

**Demographic Variables Associated with Adolescent Suicidality**

Differences in prevalence of suicide deaths and suicidal behavior have emerged by age and gender. For example, adolescents in high school have consistently demonstrated a statistically higher risk for suicide death than younger children, with recent national statistics indicating that suicide deaths are more prevalent among 15 to 19 year olds than among 10 to 14 year olds, accounting for 14.5% (i.e., 1,669 deaths) and 8.3% (i.e., 259 deaths) of deaths in 2009, respectively (CDC, 2009). Suicidal behavior (i.e., having seriously considered attempting suicide, made a suicide plan, or made a suicide attempt) is more prevalent earlier in high school (among 9th and 10th grade students) than later (among 12th grade students), however (CDC, 2011b).

In terms of prevalence differences by gender, adolescent females have been shown to attempt suicide much more frequently than males (Eaton et al., 2006). Adolescent male suicide deaths occur, however, about four times more often than adolescent female suicide deaths, as adolescent males tend to choose more lethal suicide methods (Berman, Jobes, & Silverman, 2006). Furthermore, hopelessness and suicidality have been found to decrease over time in high school for females, but not for males (Sabo, Miller, Melnick, Farrell, & Barnes, 2005; CDC, 2011b).

**Risk Factors Associated with Adolescent Suicidality**

Researchers have identified several risk factors associated with suicidal behavior. Two of the most prominent risk factors include the presence of at least one mental health disorder (Fleischmann, Bertolote, Belfer, & Beautrais, 2005; Joiner, 2010; Mazza, 2006),
and the occurrence of previous suicidal behavior (Borowski, 2001; Joiner et al., 2005). Mental health disorders including mood disorders (i.e., depression, dysthmic, bipolar disorders, and eating disorders), substance-related disorders, and disruptive behavior disorders have been associated with most suicide deaths (Fleischmann, 2005; Harris & Barraclough, 1997; Joiner, 2010; Mazza, 2006). Previous suicidal behavior also places an individual at increased risk for future suicidal behavior, including an increased risk for suicide attempts and dying by suicide (Berman et al., 2006; Borowski et al., 2001, Hawton, Zahl, & Weatherall, 2003; Roberts, Roberts, & Xing, 2010).

Other risk factors that have been empirically linked to youth suicidality include (a) feelings of hopelessness (Beck & Rush, 1978; Forman, Berk, Henriques, Brown, & Beck, 2004; Jeglic, Sharp, Chapman, Brown, & Beck, 2005; Thompson, Mazza, Herting, Randell, & Eggert, 2005); (b) poor problem solving skills; (c) poor coping skills; (d) low self-esteem; (e) academic failures; (f) social isolation; (g) having experienced intense trauma (Mazza, 2006); (h) dysfunctional family environments; (i) parental history of psychopathology or suicidal behavior (Brock, Sandoval, & Hart, 2006; Joiner et al., 2005; Lieberman, Poland, & Cassel, 2008; Randell, Wang, Herting, & Eggert, 2006); (j) the perception that one is a burden to others; (k) the perception that one does not belong (Joiner, 2010; Van Orden, Witte, Selby, Bender, & Joiner, 2008), and (l) having access to firearms or other lethal weapons (Johnson, Barber, Azrael, Clark, & Hemenway, 2010; Shah, Hoffman, Wake, & Marine, 2000).

**Warning Signs Associated with Imminent Suicide Risk**

Whereas risk factors are distal variables that are typically chronic, persistent over time, and can represent increased potential for suicidal behavior (Miller, 2011; Van
Orden et al., 2008), warning signs typically indicate acute affective experiences that are suggestive of an increased probability of a more imminent suicidal crisis (Van Orden et al., 2008) and warrant immediate mental health care. According to expert consensus, warning signs for suicidal behavior include (a) threatening to hurt or kill oneself, (b) looking for ways to kill oneself (e.g., seeking access to pills, weapons, or other means), and (c) talking or writing about death, dying, or suicide (Rudd et al., 2006).

The American Association of Suicidology (AAS, n.d.) also developed a mnemonic for remembering these evidence-based warning signs in the form of IS PATH WARM: I is for ideation, S is for substance abuse, P is for purposelessness, A is for anxiety, T is for trapped (as in feeling trapped), H is for hopelessness, W is for withdrawal, A is for anger, R is for recklessness, and M is for mood changes. It should be noted, however, that warning signs for suicide have not been specifically validated with youth populations (Van Orden et al., 2008) at the time of this writing, and there is limited research on the sensitivity and specificity of youth warning signs that have been more clearly established for adults.

**Factors Associated with Reduced Adolescent Suicidality**

Factors that are associated with reduced adolescent suicidality, often called protective factors, are those that have been empirically demonstrated to be mediating or moderating variables for decreased suicide risk (Gutierrez & Osman, 2008). These protective factors are associated with resilience in the face of adverse experiences. It should be noted that protective factors identified via correlational research do not necessarily cause reductions in negative outcomes; rather, they are correlated or
associated with reductions in negative outcomes. For this reason, protective factors described henceforth will be described in correlational rather than causal terms.

Although some researchers stress that the main focus of effective youth suicide prevention should be on ameliorating risk factors (Pelkonen, Karlsson, & Marttunen, 2011), others contend that prevention of a variety of public health problems can be achieved through a broader focus on both reducing risk factors and deliberately promoting positive, or protective factors (Suldo & Shaffer, 2008). Some refer to this holistic perspective, which also emphasizes that mental and physical wellbeing are inextricably and reciprocally related, as wellness promotion (Kaplan, 2000; Mcloughlin & Kubick, 2004; Miller, Gilman, & Martens, 2008; Peterson, Park, & Seligman, 2006). In particular, protective factors within personal, community, and societal realms have been shown to be inversely related to negative outcomes (Catalano, Haggerty, Oesterle, Fleming, & Hawkins, 2004; Cowen, 2000; Shochet, Dadds, Ham, & Montague, 2006). Development of certain competencies can both increase protective factors and reduce risk factors for a variety of mental health problems (Greenberg et al., 2003), many of which are associated with increased risk of suicidal behavior.

Schools are often in ideal positions to make efforts at preventing mental health problems, including the ones most highly correlated with suicidal behavior (Doll & Cummings, 2008). For example, student participation in Structured Extracurricular Activities (SEAs), such as being a member of an athletic team under the guidance of adult leaders, has been shown to be linked to positive effects on both physical and mental health, help youth establish positive social relationships with peers and adults (Hansen, Larson, & Dworkin, 2003), assist in the development of improved self-esteem (Parfitt &
Eston, 2005), and be related to other positive outcomes such as enhanced academic achievement (Valentine, Cooper, Bettencourt, & DuBois, 2002).

Significantly, many of the positive outcomes of participation in SEAs are similar to those protective factors most significantly correlated with the decreased occurrence of adolescent suicidal behavior, making them potentially relevant for suicide prevention efforts. Protective factors researchers have identified as most closely associated with decreased suicide risk include (a) social connectedness with peers and adults, including help-seeking behavior, and (b) high levels of engagement in productive activities (Berman et al., 2006; Gutierrez & Osman, 2008; Kaminski et al., 2010; Lubell & Vetter, 2006; Roberts et al., 2010). Evidence that these protective factors can be developed and enhanced (Cowen, 2000; Seligman, 2002) holds particular relevance for schools, which have great potential for systematically promoting them, including with those youth at highest risk for suicidal behavior.

Physical Activity and Sports Team Participation

Exercise and sports team membership are two examples of school-based wellness activities that have enormous potential for promotion of productive activity and social connectedness (Miller et al., 2008; Peterson et al., 2006). Both aerobic physical activity (i.e., exercise) and sports participation (i.e., sports team membership) have been associated with a variety of positive outcomes for youth, including improved academic achievement (Fox, Barr-Anderson, Neumark-Sztainer, & Wall, 2010; Fredricks & Eccles, 2006), decreased school disconnectedness (Faulkner, Adlaf, Irving, Allison, & Dwyer, 2009), reduced depressive symptoms (Goodwin, 2003; Gore, Farrell, & Gordon, 2001), and positive social relationships (Hansen et al., 2003). As with outcomes of participation
in other SEAs, it is noteworthy that these positive outcomes are consistent with those factors researchers have deemed most closely associated with decreased risk and enhanced protection against adolescent suicidal behavior.

**Statement of the Problem**

Unfortunately, research on factors inversely related to youth suicidal behavior is limited compared to the research on demographic variables and risk factors (Berman et al., 2006; Miller, 2011). The need for additional research on protective factors is apparent, as prevention of a variety of public health problems has been effectively achieved through wellness promotion approaches, many of which place a dual focus on reducing risk factors and increasing protective factors (Kaplan, 2000; Mcloughlin & Kubic, 2004).

In particular, there is limited research examining the degree to which physical activity and sports team participation, two examples of school-based wellness activities, are related or inversely related to suicidality in high school students, who are at heightened risk for suicidal behavior (CDC, 2009). To date, only three studies have investigated the relationship between various levels of sports participation and suicidality (Brown et al., 2007; Sabo et al., 2005; Taliaferro, Rienzo, Miller, Pigg, & Dodd, 2008a) or physical activity and suicidality (Brown et al., 2007; Taliaferro et al., 2008a). These investigations have yielded generally positive findings, suggesting inverse relationships between physical activity and sports participation and adolescent suicidal behaviors (Brown et al., 2007; Miller, Melnick, Barnes, Farrell, & Sabo, 2005; Sabo et al., 2005; Simon, Powell, & Swann, 2004). In other words, these studies suggest that students who engage in physical activity or participate on sports teams are less likely to engage in
suicidal behavior, including suicidal ideation, suicide planning, attempting suicide, and making multiple suicide attempts. However, inconsistent findings and methodological limitations of the existing research suggest that additional investigation is needed.

Some inconsistencies have emerged between findings regarding the relationship between exercise, sports, and high school student suicidality by gender and level of involvement, with exercise sometimes linked to increased risk for certain suicidal behaviors in females and sports team participation sometimes linked to increased risk for certain suicidal behaviors in males. These mixed findings have resulted in some ambiguity about the level of exercise and sports team involvement that is most protective for males and females (Brown et al., 2007; Taliaferro et al., 2008a). Methodological differences across studies also call for clarification, with physical activity and sports participation sometimes treated as dichotomous rather than multi-categorical variables, discounting possible outcome variance across levels of involvement (Brown et al., 2007; Miller, Barnes, Melnick, Sabo, & Farrell, 2002; Sabo et al., 2005; Taliaferro et al., 2008a). Furthermore, these studies have treated suicidal behavior as a categorical, rather than a continuous outcome variable, which is not aligned with research indicating that suicidal behavior is more appropriately conceptualized as a continuous variable (Brezo et al., 2007). In light of these gaps in the research, replicated and extended exploration of the relationship between high school students’ physical activity, sports participation, and suicidal behavior is warranted.

**Purpose of the Current Study**

The aim of the current study was to contribute to the existing body of empirical knowledge regarding risk and protective factors for the occurrence of adolescent suicidal
behavior. It expanded upon work of other researchers who used national Youth Risk Behavior Surveillance System (YRBSS) data (Brown et al., 2007; Eaton et al., 2012; Sabo et al., 2005; Taliaferro et al., 2008a) by using the most recent YRBSS data available, examining findings pertaining to the relationships between physical activity, sports participation and suicidal behavior in a national sample of high school students, and addressing the methodological limitations of previous research.

This study included two categorical predictor variables with multiple levels (i.e., a physical activity variable and a sports participation variable) and one continuous outcome variable with multiple levels (i.e., a suicidal behavior variable). The research question included sex (i.e., male and female), age (i.e., ages 12 to 18 or older), hopelessness/sadness, and disordered eating items as covariates. Predictor and outcome variables were composed of responses to relevant YRBSS questions. Descriptive statistics and multiple linear regression data analyses were used to compare the rates of suicidal behavior between groups, evaluate the degree to which exposure variables (i.e., physical activity and sports participation) are related to adolescent suicidality, and determine whether covariates play a role in these relationships. The following research question was addressed: Does high school students’ suicidal behavior vary by level of physical activity or sports team participation, and do the covariates of age, gender, hopelessness/sadness, or disordered eating behavior play a role in this relationship?
Chapter 2

Review of Literature

Suicide is defined by the Centers for Disease Control and Prevention as “death caused by self-injurious behavior with any intent to die as a result of the behavior” (CDC, 2011a, Definitions: Self-directed Violence, para. 1). Worldwide, suicide is estimated to account for almost one million deaths per year, and is the second leading cause of death among young people ages 10 to 24 (WHO, 2008). In the United States, suicide is ranked as the tenth leading cause of death, but the third leading cause of death among the nation’s adolescents and young adults ages 10 to 19 (CDC, 2009). This equates to one suicide death every two hours or 12 child or adolescent suicide deaths per day. To put this in context, annual youth suicide deaths in the United States exceed the combined total of youth deaths from cancer, heart disease, and birth defects. Moreover, some sources indicate that these statistics may underestimate the true extent of the problem, as deaths by suicide may be significantly underreported for cultural and religious reasons as well as death misclassifications (Wasserman, Cheng, & Jiang, 2005).

The extent to which youth suicide is a national public health problem is also not evident from suicide fatality data alone. Many young people are affected by suicidal ideation, planning for suicide, and making suicide attempts (i.e., non-fatal self-directed potentially injurious behavior with any intent to die as a result of the behavior) (CDC, 2011a, Definitions: Self-directed Violence, para. 1). For example, youth suicidal ideation, suicide planning, and suicide attempts are far more prevalent than youth suicide fatalities (CDC, 2011b), yet all three comprise serious forms of suicidal behavior. Although frequently conceptualized along a continuum of intensity (Miller, 2011), these
forms of suicidal behavior are not mutually exclusive and do not necessarily occur sequentially (Mazza, 2006). However, planning and attempting suicide are widely seen as more serious and clinically significant than suicidal ideation, unless the ideation is pervasive (Berman et al., 2006; Miller, 2011).

Suicidal ideation was reportedly experienced by 16% of high school students (19% of females and 13% of males) during the 12 months preceding the latest National Youth Risk Behavior Surveillance System administration (CDC, 2011b). Other national studies have indicated that approximately 20% of adolescents have seriously considered suicide (Bridge, Goldstein, & Brent, 2006). Moreover, for each suicide death among young people, it is estimated that approximately 150 children and adolescents make suicide attempts (CDC, 2009; Goldsmith, Pellmar, Kleinman, & Bunney, 2002; McIntosh, 2012). More precisely, an estimated 8% of high school students (10% of females, 6% of males) report having made one or more suicide attempt during the last 12 months (CDC, 2011b), and about 10% of adolescents report having attempting suicide at least once in their lives (Evans, Hawton, Rodham, & Deeks, 2005).

Youth suicide death rates increased between 1960 and 1990 and have remained relatively stable since then (CDC, 2009). The United States Center for Disease Control and Prevention (CDC) and the National Institute of Mental Health (NIMH) collect data and disseminate reports on rates of various causes of death by age group, including trends in death by suicide. Between 1960 and 1990, it was reported that the suicide rate for 15 to 19 year olds increased from 3.6 to 11.3 per 100,000 between 1960 and 1990 (CDC, 2004). For 10 to 14 year olds, the suicide rate increased from .8 to 1.7 per 100,000 over the same time span. More positively, rates declined slightly to 9.9 per 100,000 for 15 to
24 year olds and 1.3 per 100,000 for 10 to 14 year olds in 2001 (CDC, 2010), and reached a 20-year low between 1992 and 2004 (Lubell, Swahn, Crosby, & Kegler, 2004). Even at this point, however, suicide remained a leading cause of death for youth.

The full impact of youth suicidal behavior cannot be understood through a single lens. The suicide of a family member, friend, or peer is associated with higher rates of mental health problems and suicide risk among family and friends of the suicide victim, a group commonly referred to as “survivors” (Miller, Eckert, & Mazza, 2009). Additionally, the impact of a young person’s death by suicide represents a more intensely traumatic loss for survivors than other premature or unexpected youth deaths, as it is complicated by factors such as social stigma and reduced community support (Kalischuk & Hayes, 2004; Range & Calhoun, 1990). Some research indicates that family member survivors of youth suicide experience more intense grief reactions than other survivors (Bailley, Kral, & Dunham, 1999). Unfortunately, possible contagion effects may result when the aftermath of a suicide is handled improperly (Brock, 2002; Miller, 2011), which multiply medical and financial costs as well as the individual and collective angst associated with these tragedies.

**Youth Suicidality as a Significant Public Health Problem**

In recognition of the widespread problem of youth suicide deaths and even greater prevalence of youth suicidal behaviors, suicide prevention has repeatedly been identified as a national priority. The 1979 Surgeon General’s report called for a reduction in rates of suicide among 15 to 24 year olds (U.S. Department of Health, Education, and Welfare, 1979), and the 1999 Surgeon General’s “Call to Action to Prevent Suicide” highlighted a continued need for suicide prevention efforts (U.S. Public Health Service, 1999).
Subsequently, recommendations for the development and implementation of effective school-based suicide prevention programs were put forth as part of the “National Strategy for Suicide Prevention: Goals and Objectives for Action” (U.S. Public Health Service, 2001). The recently updated National Strategy delineates four strategic directions for suicide prevention: 1) create supportive environments that promote healthy and empowered individuals; 2) enhance clinical and community preventive services; 3) promote the availability of timely treatment and support services; and 4) improve suicide prevention surveillance collection, research, and evaluation (U.S. Department of Health, 2012).

Similarly, because they see the importance of the problem of youth suicidal behavior and the need for resources in responding to it, researchers, organizations, and government agencies have worked to make best practice and evidence-based recommendations for youth suicide prevention, intervention, and postvention available. For example, in 2008, the President of the National Association of School Psychologists (NASP) delivered a “Call to Action to Prevent Youth Suicide.” In 2011, the American Foundation for Suicide Prevention (AFSP) and Suicide Prevention Resource Center (SPRC) published “After a Suicide: A Toolkit for Schools.” More recently, the Substance Abuse and Mental Health Services Administration (SAMHSA) published a comprehensive resource entitled, “Preventing Suicide: A Toolkit for High Schools” (2012).

Schools have been viewed as an obvious choice of venue for youth suicide prevention efforts because of their wide access to youth and professionally trained adults. Some have noted that, in the context of recent educational reforms stressing the
importance of utilizing evidence-based interventions, schools are in a position to act now more than ever (Miller et al., 2009). For example, student participation in Structured Extracurricular Activities (SEAs) has been empirically validated for helping youth establish positive relationships (Hansen, Larson, & Dworkin, 2003), improve their physical and mental health (Parfitt & Eston, 2005), and be related to other positive outcomes such as enhanced academic achievement (Valentine, Cooper, Bettencourt, & DuBois, 2002). Schools that engage youth in SEAs are engaging in efforts to prevent mental health problems, including the ones most highly correlated with suicidal behavior.

**Research on Youth Suicidal Behavior**

Effective youth suicide prevention and crisis response is not likely to occur without consideration of research on what leads to suicidal behavior, which students are at greatest risk, and how to tell when suicide risk is heightened. Although the field has made important advancements in recent decades, adolescent suicide prevention researchers face two significant problems. First, it is inherently challenging to do empirical research on suicide because of its (fortunately) low base rate. Second, lack of knowledge and fear about suicide contribute to widespread stigma and an associated paucity of funding sources for this area of research. Would 12 youth fatalities per day (CDC, 2009) hold different significance if the cause was something other than suicide? One researcher (Miller, 2011), foreshadowing the increased national focus on gun violence prevention following the December 2012 shooting at Sandy Hook Elementary School (“The President’s plans,” 2013), contended that if the same number of fatalities from youth suicide resulted from school shootings instead, gun violence “would likely be treated as a national crisis requiring immediate attention” (p. 2). Paradoxically, far fewer
youth deaths are the result of school shootings as compared to youth suicide (CDC, 2009; Robers, Zhang, Truman, & Synder, 2011), and yet gun violence prevention has received significantly more funding and national attention.

Faced with these challenges, many youth suicide prevention researchers have focused on examining demographic variables, risk factors, warning signs, and protective factors associated with youth suicide. Each of these areas is discussed in greater detail below. Risk factors, and to a lesser extent protective factors, have been of particular interest to researchers, as strong associations between particular risk and protective factors and suicide risk have the potential to inform youth suicide prevention efforts.

**Demographic variables.** Who are the young people who die by suicide? Statistics indicating that some adolescent groups have increased risk for engaging in suicidal behavior and dying by suicide are of interest because they represent potential clues for targeting prevention efforts. For example, recent national statistics (CDC, 2009), which are consistent with annual rates from the previous decade, indicate that suicide deaths are more prevalent among 15 to 19 year olds, accounting for 14.5% (i.e., 1,669 deaths), than among 10 to 14 year olds, accounting for 8.3% (i.e., 259 deaths) of deaths in 2009. The prevalence of having seriously considered attempting suicide, made a suicide plan, or made a suicide attempt is slightly higher among 9th and 10th grade high school students than 12th grade high school students (CDC, 2011b).

Although adolescent females attempt suicide more frequently than males (Eaton et al., 2006), adolescent males die by suicide about four times more often than adolescent females, at least in part because they tend to choose more lethal methods (Berman et al.,
Additionally, hopelessness and suicidality have been found to decrease over time in high school for females, but not for males (Sabo et al., 2005; CDC, 2011b).

Sexual minority youth, including lesbian, gay, bisexual, transgender, and questioning (LGBTQ) youth are at an increased risk for suicidal behavior compared to their heterosexual peers, although there is more conclusive evidence for increased risk of suicidal ideation and suicide attempts rather than death by suicide (Friedman, Koeske, Silvestre, Korr, & Sites, 2006; Grossman, & D’Augelli, 2007; Silenzio, Pena, Duberstein, Cerel, & Knox, 2007). Youth in foster care may also be at increased risk for suicidal behaviors (Leslie et al., 2010).

In terms of ethnicity, Native American and Alaska Native youth have the highest rates of ideation, attempts, and deaths by suicide proportionate to their group size (Joe, Canetto, & Romer, 2008; Mazza, 2006). Hispanic, Latino, and Caucasian youth also have elevated youth suicide rates compared to other racial and ethnic groups in the U.S. (AAS, 2009; Berman et al., 2006). In geographic terms, the Western states and Alaska had higher youth suicide rates proportionately than the Eastern states between 2000 and 2006 (CDC, 2010), supporting statistics showing that geographically rural areas tend to have higher youth suicide rates (Berman et al., 2006).

**Risk Factors and Warning Signs.** Risk factors are distal variables that are typically chronic, persistent over time, and can represent increased potential for suicidal behavior (Miller, 2011; Van Orden et al., 2008). In contrast, warning signs are acute affective experiences that can be indicative of an increased probability of a more imminent suicidal crisis.
Researchers have identified several risk factors associated with suicidal behavior. One of the two most prominent risk factors is the presence of at least one mental health disorder, which has been associated with at least 90% of suicide deaths (Fleischmann et al., 2005; Joiner, 2010; Mazza, 2006). The most common mental health disorders present at the time of youth suicide deaths are mood disorders including depression, dysthymia, bipolar disorders, and eating disorders, followed by substance-related disorders and disruptive behavior disorders (Harris & Barraclough, 1997; Fleishmann et al., 2005). Comorbidity between depression and conduct disorder or substance abuse has been associated with double the risk for suicidal behavior compared to the diagnosis of depression alone (Seeley et al., 2010). Moreover, comorbid mental health problems are the rule rather than the exception with suicidal youth; most youth who die by suicide suffer from multiple mental health problems (Seeley et al., 2010; Mazza, 2006; Miller & Taylor, 2005).

The second most significant risk factor that has been associated with suicide is the occurrence of previous suicidal behavior (Borowski et al., 2001; Joiner et al., 2005). Although most individuals who attempt suicide appear to do so only once (Berman et al., 2006), having made a previous suicide attempt puts a person at significantly increased risk of making more serious attempts and dying by suicide (Berman et al., 2006; Borowski et al., 2001, Roberts et al., 2010). For example, one study found that almost half of suicide victims had attempted suicide within the year preceding their deaths (Hawton et al., 2003).

Although not as strongly related to youth suicide as mental health disorders or previous suicide attempts, other important risk factors for youth suicide exist (Moskos,
Achilles, & Gray, 2004). For example, the presence of hopelessness has long been recognized as highly prevalent among youth who make single or multiple suicide attempts (Forman et al., 2004; Jeglic et al., 2005; Rudd, Joiner, & Rajad, 1996) and youth who die by suicide (Beck & Rush, 1978; Thompson et al., 2005). Joiner’s empirically supported interpersonal-psychological theory of suicidal behavior posits two other important risk factors for suicidal thoughts and behaviors: the perception that one is a burden to others (i.e., perceived burdensomeness) and the sense that one does not belong (i.e., sense of low belongingness) (Joiner, 2010; Van Orden et al., 2008).

Still other risk factors for suicidal behavior include those related to environmental experiences. Individuals who have suffered traumatic experiences such as sexual or physical abuse are more likely than their peers to die by suicide (Mazza, 2006), as are youth who are socially isolated, have poor problem solving and coping skills, low self-esteem, academic failures, dysfunctional family environments, parental history of psychopathology or suicidal behavior, access to lethal weapons, or are habitually exposed to violence (Brock et al., 2006; Joiner et al., 2005; Lieberman et al., 2008; Randell et al., 2006). Youth who are exposed to a family member or friend’s suicidal behavior are also considered to have an elevated risk for suicide (Berman et al., 2006; Borowsky et al., 2001; Gould, Greenberg, Velting, & Shaffer, 2006). Finally, one of the single riskiest environmental factors for youth suicide is firearm availability (Johnson et al., 2010; Shah et al., 2000).

Warning signs for suicide represent more imminent risk for suicidal behaviors (Van Orden et al., 2008). According to expert consensus, warning signs that warrant immediate care from a mental health provider include (a) someone threatening to hurt or
kill themselves, (b) someone looking for ways to kill themselves (e.g., seeking access to pills, weapons, or other means), and (c) someone talking or writing about death, dying, or suicide (Rudd et al., 2006). Other possible warning signs include the following: (a) hopelessness; (b) rage, anger, revenge-seeking; (c) reckless actions and risky activities; (d) feeling trapped, as if there is no way out; (e) increasing alcohol or drug use; (f) withdrawing from friends, family, or society; (g) anxiety and/or agitation; (h) sleep disturbances; (i) dramatic mood changes; and (j) perceived lack of reason for living or no sense of purpose in life. The American Association of Suicidology (AAS, n.d.) developed a mnemonic for remembering these evidence-based warning signs on their website, in the form of IS PATH WARM: I is for ideation, S is for substance abuse, P is for purposelessness, A is for anxiety, T is for trapped (as in feeling trapped), H is for hopelessness, W is for withdrawal, A is for anger, R is for recklessness, and M is for mood changes (Jancin, 2006).

There are a few important limitations of the extant research on risk factors and warning signs for youth suicide. First, although the majority of youth who die by suicide can be described as experiencing at least some of the aforementioned risk factors and warning signs prior to their deaths, the majority of youth who exhibit some or even many of these risk factors and warning signs do not die by suicide (Fleischman et al., 2005; Joiner, 2010; Miller, 2011). Second, researchers have not yet identified clear relationships between these predisposing factors and the likelihood of suicidal behaviors. That is, “it is not clear how many of these warning signs, or what combination of them, are the best predictors of suicide” (Miller, 2011, p. 69). Although there is limited research on the sensitivity and specificity of the warning signs, the AAS pneumonic was
created in an effort to improve consistency in appropriately responding to an evidence-based set of warning signs, just as people are prompted to seek medical help if they experience other sets of warning signs. Finally, it should be noted that research on the sensitivity and specificity of warning signs that has been more clearly established for adults has not been specifically validated with youth populations (Van Orden et al., 2008) at the time of this writing.

**Protective factors.** Although some researchers stress that the main focus of effective youth suicide prevention should be on ameliorating risk factors (Pelkonen et al., 2011), others emphasize that mental health generally should be conceptualized as “a complete state of being, consisting not merely of the absence of illness or disorder but also the presence of positive factors such as life satisfaction, self-acceptance, and social contribution” (Suldo & Shaffer, 2008, p. 53), and as such, effective suicide prevention efforts should have an expanded focus on both reduction of risk factors and promotion of protective factors. Strengths and resources on personal, community, and societal levels can buffer against negative outcomes, and many of these protective factors can be developed and enhanced (Cowen, 2000; Seligman, 2002).

Protective factors contribute to resilience in the face of adverse life experiences (Gutierrez & Osman, 2008). However, readers should be cautioned against interpreting correlational research findings as causal, as some links between protective factors and positive outcomes may be explained by reverse causality. For example, while participating in structured extracurricular activities may appear to contribute positively to mental health, it may be the case that people with good mental health are more likely to
participate in structured extracurricular activities. As such, protective factors will be described herein in terms of their associations with positive outcomes.

Relatively little research exists about protective factors specific to adolescent suicide as compared with risk factors specific to adult suicide (Berman et al., 2006; Miller, 2011). To date, researchers have demonstrated that the following are associated with reduced risk for adolescent suicidal behavior: family connectedness (Cheng et al., 2009; Eisenberg, Ackard, & Resnick, 2007; Kaminski et al., 2010), perceived family support (Randell et al., 2006), perceived parental involvement, consistent school attendance (Cheng et al., 2009), connectedness with school (Kaminski et al., 2010), positive relationships with school personnel and other adults (Lubell & Vetter, 2006; Toumbourou & Gregg, 2002), social problem solving, help-seeking, an active coping style (Berman et al., 2006; Roberts et al., 2010), self-esteem, and social support from peers and parents (Sharaf, Thompson, & Walsh, 2009). Other factors that have been correlated to reduced risk for a variety of negative outcomes in adolescence include positive self-concept, high levels of engagement in productive activities, warm relationships and guidance from adults, and responsive schools (Doll & Cummings, 2008).

There are multiple factors associated with increased and reduced likelihood of mental health problems, including those mental health problems that typically underlay suicidal behavior (Conyne, 2010). Clearly, adolescent suicide occurs as a result of a complicated constellation of factors, and researchers have not found any simple panacea for the problem. Both risk and protective factors have been found to play a role in more than one outcome, and each may have multiplicative rather than additive effects (Conyne,
2010; Durlak, 1998; Roberts et al., 2010). More specifically, enhancing competencies in one area, such as problem solving skills or increasing community connectedness, can potentially promote strength and resilience in other areas as well. For example, school connectedness has been associated with healthy youth development (Catalano et al., 2004), reduced risk for current and future mental health problems, especially depression (Shochet et al., 2006), and protection against health risk behaviors (Dornbusch, Erickson, Laird, & Wong, 2001; Resnick et al., 1997).

Many recognize that schools are in ideal positions to make efforts at preventing a variety of mental health problems while simultaneously promoting healthy behavior. For example, student participation in Structured Extracurricular Activities (SEAs), such as being a member of an athletic team under the guidance of adult leaders, has been linked to several outcomes that are similar to those protective factors most significantly correlated with the occurrence of adolescent suicidal behavior, making them potentially relevant for suicide prevention efforts.

*Physical activity.* Although experimental research on the impact of exercise on child and adolescent depression is limited and the question of causality is therefore yet to be determined (Biddle & Asare, 2011; Larun, Nordheim, Ekeland, Hagen, & Heian, 2006), many researchers have examined correlational relationships between aerobic physical activity and health. Increased physical activity has been linked to improved health and prevention of chronic diseases and premature death (Warburton, Nicol, & Bredin, 2006), and persistent physical activity in childhood and adolescence has been associated with higher levels of physical activity in adulthood (Telemo et al., 2005). Researchers have established strong relationships between physical activity and disease
prevention, improvements in bodily health, and enhancements in cognitive functioning (Haskell et al., 2007; Hillman, Erickson, & Kramer, 2008; Warburton et al., 2006). Physical activity has also been linked with academic achievement for youth in grades six through 12 (Fox et al., 2010) and less school disconnectedness in youth in grades seven through 12 (Faulkner et al., 2009). Also of interest is a finding pertaining to the relationship between physical activity and adolescent sexual risk behaviors. Specifically, higher levels of exercise have been found to be negatively associated with sexual risk for females but positively associated with sexual risk for males (Miller et al., 2002). This finding is noteworthy because it suggests that gender differences may exist in regards to which particular activities are associated with decreased suicide risk.

In addition to these associations with positive health and cognitive outcomes, many researchers have found associations between certain levels of aerobic physical activity and mental well being, suggesting that physical activity can have a positive effect on mood and may be related to reduced risk for mood disorders. For example, one experiment found that for a group of adults with mild to moderate major depressive disorder, certain levels of aerobic exercise (5 days a week with 17.5 kcal/kg/week) resulted in a reduction in depression levels (Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). After twelve weeks, the treatment group’s depression levels were significantly lower than those of a control group as well as a second treatment group with a lower level of aerobic exercise. Interestingly, the effects and remission rates of exercise treatment in this study were similar to those reported for antidepressant medication and cognitive behavioral therapy – both of which are evidence-based interventions for mood disorders. Similar results were found with a sample of 18 to 20 year old females (n=59)
with mild to moderate depressive symptoms; five 50-minute group jogging sessions per week for a period of eight weeks led to significantly lower depressive scores compared to usual daily activities over the same time span, in addition to reductions in cortisol and epinephrine levels (Nabkasorn et al., 2005). In another study that used a national sample of 15 to 54-year-olds (n=8,098), self-reported regular physical activity was associated with reduced odds of major depressive disorders and anxiety disorders (Goodwin, 2003).

In a sample of sixth graders (n=1,397), physical activity was not significantly correlated with fewer depressive symptoms, but a modest inverse relationship was found between sedentary behavior and depressive symptoms (Johnson et al., 2008). Vigorous physical activity was found to be significantly associated with fewer depressive symptoms in a rural sample (n=852) of 9th and 10th graders (Prasad, St-Hilaire, Wong, Peterson, & Loftin, 2010). A sample of 11 to 14-year-olds (n=2,789) was found to have lower odds of experiencing depressive symptoms the more frequently they exercised (Rothon et al., 2010). Specifically, an increase in physical activity of approximately one hour per week was associated with an 8% decrease in the odds of depressive symptoms among both boys and girls, although this relationship was no longer significant in a three-year longitudinal analysis. In a six-year study with adolescent females (n=496), physical activity was associated with a modestly reduced risk for developing depressive symptoms, and depressive symptoms were modestly predictive of reduced future physical activity (Jerstad, Boutelle, Ness, & Stice, 2010). Another study demonstrated a relationship between adolescent physical activity and lower levels of self-reported psychological distress 15 years later for two large (n=15,452 and 14,018) cohorts (Sacker & Cable, 2005).
Sports participation. Because sports participation takes place in the context of a social network and has strong, culturally constructed gender norms (Miller et al., 2002), it seems important to consider the role of sports participation apart from physical activity. However, until recently, many researchers conflated physical activity and sports participation in investigations of their relationship with a variety of risk and protective factors (Miller et al., 2002). The few studies that have focused on sports participation on its own have found generally positive correlations with psychologically protective factors and mixed relationships with risk behaviors.

As with physical activity, with many personal factors at play, sports participation does not seem to be universally linked to reduced prevalence of adolescent risk behaviors. For example, higher risk-taking and sensation-seeking adolescents may choose higher-risk sports (e.g., high contact, higher likelihood of injury) and extracurricular activities, whereas lower risk-taking and sensation seeking adolescents may choose safer (e.g., low contact) sports and extracurricular activities (Dever, 2012; Franques et al., 2003). As such, personal characteristics have confounded findings about whether, in general, athletes are more or less prone to engaging in risky behavior such as substance abuse. To date, these findings have been inconsistent. Some suggest a link between adolescent sports participation and increased alcohol use (Darling, Caldwell, & Smith, 2005; Eccles & Barber, 1999) while others suggest that adolescent sports participation is associated with reduced alcohol use (Fredricks & Eccles, 2006; Hellandsjo Bu, Watten, Foxcroft, Ingebrigtsen & Relling, 2002; Leaver-Dunn, Turner, & Newman, 2007). Still other studies show variation in the relationship between adolescent sports participation and substance abuse by gender, with a decreased risk of substance
abuse for female athletes but not male athletes (Denham, 2011; Dever, 2012).

In terms of association with risky sexual behavior, both sports participation and physical activity were found to be inversely associated with sexual risk in females. Male sports participants did not always face lower levels of sexual risk, however (Miller et al., 2002). In particular, an association between sports participation and increased levels of sexual risk were found for African-American males (Miller et al., 2002).

Participation in individual and team sports has been consistently and positively associated with academic achievement for high school students (Bradley, Keane, & Crawford, 2013; Fox et al., 2010; Fredricks & Eccles, 2006). This positive association has been shown to be independent of other possible explanations for academic achievement, such as background characteristics of athletes or GPA requirements for sports team membership (Fox et al., 2010; Miller et al., 2005). Adolescent participation in sporting activities has also been associated with other protective factors including positive social relationships with peers and adults, enhanced emotional development (Hansen et al., 2003), and improved self-esteem (Parfitt & Eston, 2005).

Adolescent sports activity has been independently linked to positive mental health outcomes as well. A study on high school students’ (n=1,036) sports involvement suggested a mild inverse relationship with depressive symptoms in males and females although this relationship became insignificant after the authors controlled for levels of parental and peer support in their analysis (Gore et al., 2001). Sports participation also yielded a small, yet significant inverse relationship with females’ reports of experiencing depressed feelings related to their low grade point averages. Another study found that a moderate level of sports involvement (three to six hours per week) was associated with
significantly less depression than low (two hours or less per week) and high (seven or more hours per week) levels of sports involvement in a suburban sample (n=89) of high school seniors (Sanders, Field, Diego, & Kaplan, 2000).

Physical Activity and Sports Participation: Associative Relationship with Suicidality. Investigations of the relationship between physical activity, sports participation, and risk for suicidality have tended to focus specifically on non-high school populations. Simon and colleagues (2004) examined the relationship between nearly lethal suicide attempts (NLSAs) and physical activity involvement in a sample of 153 adolescents and young adults aged 13 to 34 who had made highly lethal suicide attempts or sustained attempt-induced injuries that would have been fatal without medical intervention. Suicide attempt survivors and community control subjects from the same catchment area, enlisted through random digit dial telephone calls, were interviewed. A subset of the interview questions addressed physical activity participation within the month prior to the NLSA, the primary type of physical activity in which they participated, and the duration and frequency of the physical activity. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) and feelings of hopelessness were assessed using the Beck Hopelessness Scale. Other potentially confounding factors were also assessed, including gender, age, race/ethnicity, depressive symptoms, feelings of hopelessness about the future, alcoholism within the past year, body mass index, and social support used within the past 30 days.

The results showed that, even after controlling for potentially confounding variables, any level of physical activity (i.e., regardless of frequency, intensity, or usual
duration of their primary physical activity) was strongly related to reduced risk for NLSA. The control group and attempt survivor group reported significantly different levels of physical activity participation in the past month (85% of control subjects and 48% of attempt survivors reported being physically active in the past month). Strikingly, the risk for NLSAs was found to be five times higher among those who had not been physically active during the past month (Simon et al., 2004). The authors postulated that physiological or mental health benefits of physical activity (e.g., hormonal changes, reduced stress, improved cognitive functioning) may have accounted for those robust associations.

Taliaferro, Rienzo, Pigg, Miller, and Dodd (2008b) examined associations between levels of strengthening and aerobic exercise and risk of hopelessness, depression, and suicidal behavior among a group of college students from 18 to 25 years of age (n=43,499). They used data from the 2005 National College Health Assessment (NCHA), authored by American College Health Association (ACHA) researchers. The NCHA inquires about student’s health habits, behaviors, and perceptions regarding a variety of constructs including weight, nutrition, exercise, and mental health. For the purposes of their study, Taliaferro and colleagues categorized participants as feeling hopeless if they responded that they had “felt things were hopeless” at least once within the past school year, as feeling depressed if they responded that they had “felt so depressed that it was difficult to function” at least once within the past year, and as suicidal if they responded that they had seriously considered attempting suicide or had actually attempted suicide at least once within the past year (p. 429). Reported frequencies of aerobic (i.e., “vigorous exercise for at least 20 minutes or moderate
exercise for at least 30 minutes”) and strengthening (i.e., exercises to tone muscles, “such as push-ups, sit-ups, or weight lifting”) activities were grouped into four categories: 0 times per week, 1 to 2 times per week, 3 to 5 times per week, and 6 to 7 times per week.

The results of this study indicated that, for both males and females, some aerobic or strengthening activity each week was related to reduced risk of hopelessness and depression compared to no aerobic or strengthening activity (Taliaferro et al., 2008b). Higher levels of aerobic activity were linked to reduced suicide risk for both groups as well. As aerobic and strengthening activities were highly correlated, the authors also examined the effects of each activity on levels of hopelessness, depression, and suicidal activity while controlling for the other. For males, strengthening activities had no significant correlation with hopelessness, depression, or suicidal behavior when the analysis controlled for aerobic activity. For females, strengthening activities had no significant correlation with suicidal behavior. Low and moderate levels of strengthening activities (1 to 5 times per week) were related to lower likelihood of depression for women, but frequent strengthening activity (6 to 7 times per week) was related to increased hopelessness. When strengthening activities were controlled for, all levels of aerobic activity remained significantly associated with lower likelihood of hopelessness, depression, and suicidal behavior in both males and females.

Four studies were found that have evaluated the relationship between suicidality, physical activity, and sports participation in samples of high school-age students. Brosnahan and colleagues (2004) examined a sample of predominantly Hispanic 9th and 10th grade high school students in Nueces County, Texas (n=1,391). They found that those students who engaged in six or more sessions of physical activity per week were at
a significantly lower risk for considering suicide than those who engaged in lower levels of weekly physical activity. Reduced risk for considering suicide, although not at statistically significant levels, was also experienced by students who engaged in three to five days of physical education per week, as well as for students who played on at least one sports team during the past year. Suicide planning was found to be significantly less likely among students who engaged in the highest level of vigorous physical activity, strength and toning activity, and six or more sessions of physical activity per week. For unclear reasons, the researchers found no association between physical activity and suicide attempts, but they cautioned against over-interpretation of this finding, as previous researchers (Unger, 1997) have found inverse associations between physical activity and suicidal thoughts and behaviors in high school students.

A study by Sabo and colleagues (2005) used national data from the Youth Risk Behavior Survey (YRBS) to investigate the relationship between various levels of sports participation and suicidality in high school students. Brown and colleagues (2007) and Taliaferro and colleagues (2008a) used more recent YRBSS data to investigate the same relationship, as well as the relationship between various levels of physical activity and suicidality in high school students. Specifics pertaining to the researchers’ definitions of variables are summarized in Table 1, along with the covariates used in each study.
<table>
<thead>
<tr>
<th>Point of Comparison</th>
<th>Sabo et al., 2005</th>
<th>Brown et al., 2007</th>
<th>Taliaferro et al., 2008a</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRBSS Information</td>
<td>1997 YRBSS data</td>
<td>2003 YRBSS data</td>
<td>2005 YRBSS data</td>
</tr>
<tr>
<td>n=16,262</td>
<td>n=10,530</td>
<td>n=13,857</td>
<td></td>
</tr>
<tr>
<td>Outcome Variables &amp; Definitions</td>
<td>Seriously Considered Suicide</td>
<td>Suicidal Ideation</td>
<td>Felt Sad or Hopeless</td>
</tr>
<tr>
<td></td>
<td>Seriously considered attempting suicide during last 12 months (dichotomous variable)</td>
<td>Seriously considered attempting suicide during last 12 months or made a suicide plan and/or made serious suicide attempt during last 12 months (dichotomous variable)</td>
<td>Felt sad or hopeless almost everyday for two weeks in a row (dichotomous variable)</td>
</tr>
<tr>
<td>Made Suicide Plan</td>
<td>Made a plan about how to attempt suicide during the last 12 months (dichotomous variable)</td>
<td>Suicide Attempt(s)</td>
<td>Thought About Suicide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ever attempted suicide (dichotomous variable)</td>
<td>Seriously considered attempting suicide during last 12 months (dichotomous variable)</td>
</tr>
<tr>
<td>Attempted Suicide</td>
<td>Attempted suicide during the last 12 months (dichotomous variable)</td>
<td></td>
<td>Planned Suicide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Made a suicide plan during last 12 months (dichotomous variable)</td>
</tr>
<tr>
<td>Injured in Suicide Attempt</td>
<td>Ever had suicide attempt that resulted in an injury, poisoning, or overdose that had to be treated by a doctor or nurse (dichotomous variable)</td>
<td></td>
<td>Attempted Suicide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ever attempted suicide (dichotomous variable)</td>
</tr>
<tr>
<td>Multiple Suicide Attempts</td>
<td>Attempted suicide more than once (dichotomous variable)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Predictor Variables & Definitions | Athletic Participation (AP) Number of sports teams played on in last 12 months that were run by school, not including PE classes; and Number of sports teams played on in last 12 months that were run by organizations outside of school (dichotomous variable):  
  - "non-athletes"—did not participate on any teams in the last year  
  - "athletes"—did participate on one or more teams in or out of school in the last year | Sports Participation (SP) Number of sports teams played on in the last 12 months (dichotomous variable):  
  - "sports team participants"—participants on one or more team in the last year  
  - "non-sports team participants"—did not participate on any teams in the last year | Sports Participation (SP) Number of sports teams played on in the last 12 months (categorical variable with three levels):  
  - "nonathletes"—did not participate on any teams in the last year  
  - "moderately involved athletes"—participants on 1-2 teams in the last year  
  - "highly involved athletes"—participants on 3+ teams in the last year |
| — Vigorous Intensity Physical Activity (PA) Number of days within the last seven days that participants reported exercising or participating in PA for at least 20 minutes that made them sweat or breathe hard | — Moderate Intensity PA Number of days within the last seven days that participants reported participating in PA for at least 30 minutes that did not make them sweat or breathe hard (categorical variable with five levels):  
  - "0x/week"  
  - "1-2x/week"  
  - "3-5x/week"  
  - "6-7x/week" |
categorized according to the highest level of PA reported:

- "frequent, vigorous PA" = vigorous intensity 6+ x/week
- "regular, vigorous PA" = vigorous intensity 3-5 x/week
- "moderate PA" = moderate intensity 5+ x/week
- "insufficient PA" = moderate intensity 1-4 x/week
- "inactive" = 0 moderate or vigorous intensity in last week

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Age</th>
<th>Race</th>
<th>Geographic Region of School</th>
<th>Lifestyle Behaviors (i.e., cigarette smoking, alcohol use, drug use, unhealthy weight control practices)</th>
<th>Personal Characteristics (i.e., concordance of body mass index and weight perception, feeling sad/hopeless)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanicity (i.e., urban, suburban, or rural school location)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Class (i.e., parental educational attainment: did not finish high school coded as 10 years of education, graduated from high school coded as 12 years, some education after high school coded as 14 years, and graduated from college coded as 16 years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Descriptive statistics by gender were quite consistent across the three YRBSS samples used in these studies (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), as summarized in Table 2. About one-third of male and female respondents reported that for at least 20 minutes between three and five times in the last week, they had exercised or participated in physical activity that made them sweat or breathe hard (34-35% of males, 34-38% of females). More frequent physical activity (i.e., six to seven times in the last week) was reported by about one-third of male respondents and about one-fifth of female respondents (34-36% of males, 19-20% of females). In terms of sports participation, a majority of male respondents and about half of female respondents reported participating on at least one sports team in the last year (61-68% of males, 47-51% of females). Descriptive statistics on suicidality were provided in one of these three studies (Taliaferro et al., 2008a) and indicated that suicidal ideation, planning, and attempts were less common in male than female respondents, which is consistent with prior research.
<table>
<thead>
<tr>
<th>Point of Comparison</th>
<th>Sabo et al., 2005</th>
<th>Brown et al., 2007</th>
<th>Taliaferro et al., 2008a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Statistics</td>
<td>Athletic Participation</td>
<td>Suicidal Ideation: 19% total (14% of males, 23% of females)</td>
<td>Thought About Suicide: 17% (12% of males, 22% of females)</td>
</tr>
<tr>
<td></td>
<td>Athletes: 68% of males, 51% of females</td>
<td>Suicide Attempt(s): 7% (4% of males, 11% of females)</td>
<td>Planned Suicide: 13% (10% of males, 17% of females)</td>
</tr>
<tr>
<td></td>
<td>Highly-Involved Athletes: 29% of males, 17% of females</td>
<td>Sports Participation</td>
<td>Attempted Suicide: 9% (6% of males, 12% of females)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sports Participants: 64% of males, 47% of females</td>
<td>Multiple Suicide Attempts: 4% (3% of males, 5% of females)</td>
</tr>
<tr>
<td></td>
<td>Physical Activity Level</td>
<td></td>
<td>Sports Participation</td>
</tr>
<tr>
<td></td>
<td>Inactive: 8% of males, 13% of females</td>
<td></td>
<td>Sports Participants: 61% of males, 48% of females</td>
</tr>
<tr>
<td></td>
<td>Insufficient: 18% of males, 28% of females</td>
<td>Moderately Involved (1-2 teams): 44% of males, 39% of females</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate (at least 5 days/week): 3% of males, 5% of females</td>
<td>Highly Involved (3+ teams): 17% of males, 9% of females</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular vigorous (3-5 days/week): 35% of males, 34% of females</td>
<td>Physical Activity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequent vigorous (6-7 days/week): 36% of males, 20% of females</td>
<td>No Physical Activity: 13% of males, 23% of females</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-2x/week: 16% of males, 23% of females</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-5x/week: 34% of males, 38% of females</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6-7x/week: 37% of males, 19% of females</td>
<td></td>
</tr>
</tbody>
</table>
Approaches to statistical analysis and associated findings are summarized in Table 3. In terms of statistical approaches, each group of researchers employed logistic regression analyses to determine the degree to which physical activity alone (Brown et al., 2007; Taliaferro et al., 2008a), sports participation alone (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), or the combination of physical activity and sports participation (Brown et al., 2007; Taliaferro et al., 2008a) were linked to membership in groups of students who reported suicidal ideation or suicidal attempts.

Across both studies that included physical activity as a predictor variable (Brown et al., 2007; Taliaferro et al., 2008a), male adolescents who reported a high level of physical activity (i.e., six or more times in the last week) had significantly reduced odds of single or multiple suicide attempts. Across all three studies, sports participation was linked to significantly reduced odds of having had serious thoughts about suicide in the last year for both males and females. In two of these studies (Brown et al., 2007; Taliaferro et al., 2008a), having participated on at least one sports team in the last year was also associated with significantly reduced odds of having attempted suicide for males and females. However, these positive findings alone do not represent the full picture.

Some inconsistent findings emerged from preliminary research with regard to certain levels of physical activity or sports participation having inverse relationships with suicidal behavior. For example, in one study (Taliaferro et al., 2008a), a low level of physical activity (i.e., exercising one to two days in the last week) was found to be significantly predictive of hopeless thoughts in females, and female reports of exercising in order to lose weight were related to increased rates of suicidal ideation. Moreover, females who reported exercising in the last week were found to be significantly more
likely to report restricting their calorie intake and taking diet supplements to lose weight. Indeed, research has suggested that for both male and female high school students, disordered eating behavior is associated with both depressive symptoms and suicidal ideation, while body image only contributes to depressive symptoms (Brausch & Gutierrez, 2009). These results speak to the complex relationships between body image, eating habits, mental health problems, and suicidal behavior (Thome & Espelage, 2004). They also highlight the importance of considering various levels of physical activity and sports participation and their relationships with suicidality separately in males and females, and suggest that it may be important to account for disordered eating as a covariate when investigating the relationship between exercise and adolescent suicidal behavior.

Similarly, despite finding that athletes had significantly lower rates of suicidal ideation and planning than non-athletes, Sabo and colleagues’ (2005) results indicated that being a male athlete was significantly associated with increased odds of having sustained injury resulting from a suicide attempt. The researchers postulated that this finding might be explained by male athletes’ propensity toward “hegemonic masculinity” (e.g., violence-proneness, stoicism). They also discussed the possibility of depression being less chronic in athletes than non-athletes, with athletes at potentially elevated risk for experiencing acute sports team related episodes that induce depression (e.g., being cut from a team). This conceptualization may help to explain their finding that athletes have lower risk for experiencing depressive symptoms; however, they called for more research to further investigate these social psychological processes. Sabo and colleagues also highlighted that from a public health perspective it may be important to know that males
and females who are highly involved athletes may present with reduced risk for suicidal ideation, violating the traditional continuum of suicide risk.

It is noteworthy that these anomalous findings were far outnumbered by results indicating that adolescent physical activity and sports participation were inversely associated with suicidality. Such findings were described previously, and also include single study support for the following: frequent, vigorous physical activity (i.e., exercising six or more times per week) was associated with reduced odds of suicide planning in males (Taliaferro et al., 2008a); regular, vigorous physical activity (i.e., exercising three to five days in the last week) was associated with lower odds of females having attempted suicide in the last year (Brown et al., 2005); and athletic participation at any level was associated with reduced odds of suicide planning in females (Sabo et al., 2005).
<table>
<thead>
<tr>
<th>Point of Comparison</th>
<th>Sabo et al., 2005</th>
<th>Brown et al., 2007</th>
<th>Taliaferro et al., 2008a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Analysis</td>
<td>Logistic Regression for comparing athletes’ versus non-athletes’ odds of engaging in each suicidal behavior</td>
<td>Hierarchical Sequential/Logistic Regression Models for analyzing association of PA/SP with outcome variables&lt;br&gt; • Model 1: adjusting for covariates&lt;br&gt; • Model 2: Model 1 plus adjusting for PA and SP in respective analyses&lt;br&gt; • Model 3: Model 1 plus adjusting for feeling sad/hopeless&lt;br&gt; • Model 4: Full Model (Model 1, 2, and 3) stratified by sex</td>
<td>Logistic Regression for analyzing whether various levels of PA and SP relate to the risk of feeling hopeless, suicidal thoughts, suicide plans, suicide attempts, or multiple suicide attempts&lt;br&gt; • controlled for PA during SP analysis and for SP during PA analysis</td>
</tr>
<tr>
<td>Results</td>
<td>Athletic Participation&lt;br&gt; “Athletes”&lt;br&gt; • significantly associated with reduced odds of suicidal ideation for males&lt;br&gt; • significantly associated with suicide attempt resulting in injury for males&lt;br&gt; • significantly associated with reduced odds of</td>
<td>Sports Participation&lt;br&gt; “Sports Team Participants”&lt;br&gt; • significantly associated with reduced odds of suicidal ideation and suicide attempts in males (in Model 1)&lt;br&gt; • significantly associated with reduced odds of suicide ideation in females (in Model 1)&lt;br&gt; • significantly associated with reduced odds of suicide</td>
<td>Sports Participation&lt;br&gt; “Moderately Involved Athletes”&lt;br&gt; • significantly associated with reduced odds of hopelessness, thoughts about suicide, planning suicide, and attempting suicide in males&lt;br&gt; • significantly associated with hopelessness, thoughts about suicide, planning suicide, and multiple suicide attempts in females</td>
</tr>
</tbody>
</table>
suicidal ideation for females
• significantly associated with reduced odds of making a suicide plan for females
“Moderately Involved Athletes”
• significantly associated with reduced odds of making a suicide plan for females
“Highly Involved Athletes”
• significantly associated with reduced odds of suicidal ideation for males
• significantly associated with suicide attempt resulting in injury for males
• significantly associated with reduced odds of suicidal ideation for females
• significantly associated with reduced odds of making a suicide plan for females
attempts in females (in Models 1 and 2)
“Non-Sports Team Participants”
Physical Activity
“Frequent, Vigorous PA”
• significantly associated with reduced odds of suicidal ideation in males (in all Models)
• significantly associated with reduced odds of suicide attempts in males (in Model 1)
“Regular, Vigorous PA”
• significantly associated with reduced odds of suicide attempts in females (in Model 1)

“Highly Involved Athletes”
• significantly associated with reduced odds of hopelessness, thoughts about suicide, and planning suicide in males
Physical Activity
“1-2x/week”
• significantly associated with increased odds of hopelessness in females compared to inactive females
“6-7x/week”
• significantly associated with reduced odds of planning suicide and reduced odds of attempting suicide multiple times in males
Critique of the Literature

There is limited available research on the degree to which physical activity and sports team participation, two examples of school-based wellness activities, are related to increased or decreased risk for adolescent suicidal behavior. Most preliminary investigations suggest that physical activity and sports participation are inversely related to adolescent suicidal behavior (Brown et al., 2007; Miller et al., 2004; Sabo et al., 2005; Simon et al., 2004; Taliaferro et al., 2008a). However, additional investigation is needed to clarify certain methodological issues and results as they pertain specifically to high school students – the school-age group at highest risk for suicidal behavior.

Most researchers to date (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a) have conducted evaluations by gender, which seems important to continue in current research. Suicidal behavior has a longstanding history of being more prevalent in high school age youth (i.e., ages 15 to 19) than younger groups (i.e., ages 10 to 14). In 2009, it accounted for 14.5% (i.e., 1,669 deaths) and 8.3% (i.e., 259 deaths) of deaths in each group, respectively (CDC, 2009). Recognizing that various levels of physical activity and sports participation play different roles for males and females is also important due to known gender differences in suicidality. Adolescent females attempt suicide more frequently than males (Eaton et al., 2006), and adolescent males are known to die by suicide about four times more often than adolescent females (Berman et al., 2006). Furthermore, ambiguous findings about gender differences in various levels of physical activity and sports participation, such as some athletic participation associated with reduced odds of suicide planning in females but not males (Brown et al., 2007; Taliaferro et al., 2008a), support the need for further clarification in this area.
Separate evaluations of physical activity and sports participation in terms of their impact on suicidal behavior, as employed by Brown and colleagues in 2007 and by Taliaferro and colleagues in 2008, are also important. The inherent differences between sports participation and physical activity (i.e., the social networks and culturally constructed gender norms associated with sports participation) may result in differences in their relationship with adolescent suicidal behavior (Miller at al., 2002). In fact, preliminary research has supported the idea that any level of sports participation is correlated with reduced odds of suicidal ideation and attempts in males and females (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), while only high levels of physical activity in non-sports team contexts were associated with reduced odds of suicide attempts in males (Brown et al., 2007; Taliaferro et al., 2008a). Therefore, it seems appropriate to analyze and potentially corroborate findings on the contributions of physical activity and sports participation as they relate to the likelihood of adolescent suicidality.

Findings from research examining the level of exercise or sports team involvement and its impact on different types of suicidal behavior have been inconsistent. Some worrisome results have also emerged. For example, two studies indicated that level of physical activity or sports participation may have a non-linear relationship with adolescent suicidal behavior, or alternatively, could be understood as violating the assumption that suicidal behaviors advance along a continuum of severity (Mazza, 2006). More specifically, one study showed that physical activity was significantly associated with reduced likelihood of suicidal ideation and planning, but had no significant
association with the more extreme suicidal behavior of attempting suicide (Miller et al., 2004).

Another study indicated that despite athletes’ significantly lower rates of suicidal ideation and planning, being a male athlete was significantly associated with increased odds of having sustained injury resulting from a suicide attempt, especially if the male reported being on three or more sports teams (Sabo et al., 2005). Consideration of the relationship between disordered eating behavior and physical activity, sports participation, and suicidal behavior is also indicated, as some research has shown that frequent exercise is correlated with disordered eating behavior in females (Taliaferro et al., 2008a). Additional investigation is needed to clarify the relationships between various levels of physical activity, sports participation, and suicidal behavior in high school students.

Studies on physical activity and sports participation as predictors of adolescent suicidal behavior have used different variable categories, making it difficult to compare results across studies, as summarized in Table 1. For example, sports participation has been considered a dichotomous variable by some researchers (Brown et al., 2007) and as a categorical variable with three levels (i.e., non-athlete, athlete on 1 or 2 teams in the past year, or athlete on 3 or more teams in the past year) by others (Sabo et al., 2005; Taliaferro et al., 2008a). Especially in light of different findings about associative relationship with adolescent suicidality by level of sports team involvement (Sabo et al., 2005), it seems important to replicate analyses by level to provide support or opposition for these findings.
Similarly, some researchers (Brown et al., 2007) have collapsed multiple suicidal behaviors into one dichotomous outcome variable (i.e., a dichotomous Suicidal Ideation variable encompassing both seriously considering attempting suicide during last 12 months and making a suicide plan). These researchers reported substantial overlap among students who endorsed either of these items as the reason they were collapsed into one variable. However, as research has consistently shown a difference between rates of adolescent suicidal ideation and suicide attempts, and engaging in suicide planning typically is considered more serious and clinically significant than suicidal ideation (Berman et al., 2006; Miller, 2011), it is important not to collapse them into one side of a dichotomous variable. Furthermore, conceptualization of suicidality as a continuous variable may be more appropriate than conceptualization as a categorical variable, according to some researchers’ analysis of Aikake and Bayesian information criteria (Brezo et al., 2007). Researchers have consistently conceptualized suicidal behavior along a continuum of intensity (Mazza, 2006), which offers further support for treating this outcome variable as continuous in the current study.

Finally, in terms of approach to statistical analysis, each group of researchers using YRBSS data employed logistic regression analyses to predict the odds or risk of group membership based on physical activity and/or sports participation (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a). The goal of logistic regression is to predict the probability of group membership. This study used multiple linear regression to measure the strength of the predictive relationship and examine the degree to which physical activity or sports participation was predictive of adolescent suicidality.
**Purpose of the Current Study**

The aim of this study was to update and expand the existing body of empirical knowledge regarding protective and risk factors for the occurrence of adolescent suicidal behavior. Specifically, it addressed methodological issues of existing research, focused on clarifying inconsistent findings, and made use of the latest Youth Risk Behavior Surveillance System (YRBSS) data (Eaton et al., 2012) to analyze the relationships between physical activity, sports participation and suicidal behavior in a national sample of high school students.

The following research question was addressed: Does high school student suicidality vary by level of physical activity or sports team participation, and do the covariates of age, gender, hopelessness/ sadness, or disordered eating behavior play a role in this relationship?
Chapter 3

Methods

This study used the 2011 Youth Risk Behavior Surveillance System (YRBSS) dataset to analyze the relationships between physical activity, sports participation and suicidal behavior in a national sample of high school students. Below are descriptions of the 2011 YRBSS and its participants along with data analysis techniques for the current study.

Participants and Sampling Procedure

Participants were 15,425 high school students who completed the YRBSS. The 2011 YRBSS includes a national survey, 41 state surveys, and 21 large urban school district surveys conducted among students in grades 9–12 (Eaton et al., 2012). Public and private school students were recruited using a three-stage cluster sample design that produced a nationally representative sample of students in grades 9–12. Eaton and colleagues (2012) provide the following description of 2011 YRBSS sampling techniques: “the first-stage sampling frame consisted of 1,276 primary sampling units (PSUs), consisting of counties, subareas of large counties, or groups of smaller, adjacent counties. The 1,276 PSUs were categorized into 16 strata according to their metropolitan statistical area (MSA) status (i.e., urban city) and the percentages of black and Hispanic students in the PSUs. From the 1,276 PSUs, 57 were sampled with probability proportional to overall school enrollment size for the PSU. In the second stage of sampling, 194 schools with any of grades 9–12 were sampled with probability proportional to school enrollment size. The third stage of sampling consisted of random sampling in each of grades 9–12, one or two classrooms from either a required subject
(e.g., English or social studies) or a required period (e.g., homeroom or second period). All students in sampled classes were eligible to participate. Schools, classes, and students that refused to participate were not replaced” (p. 2).

The 2011 YRBSS used three strategies to oversample black and Hispanic students in order to allow for separate analyses of data from these groups, which would otherwise be underrepresented. These strategies included using larger sampling rates to “select PSUs that were in high-black and high-Hispanic strata” using a modified measure or size in efforts to increase the chances of sampling schools with “disproportionately high minority enrollment” and using “samples of two classes per grade rather than one… in schools with a high minority enrollment” (p. 2).

YRBSS data sets were all checked for inconsistencies, and when a participant’s own responses conflicted with each other both responses were set to “missing,” removed from the data set, and not statistically inputted (Eaton et al., 2012, p. 3). Seventy-eight out of 15,503 data sets failed quality control checks, yielding a total of 15,425 usable national questionnaires. The state YRBSS included between 1,147 and 13,201 surveys per state, and the large urban school district YRBSS included between 1,013 and 11,570 questionnaires each. Student response rates were 87% for the national YRBSS, between 60% to 88% for the states, and between 61% to 86% for the large urban school districts.

Weighting was applied to those national, state, and large urban school district surveys with a representative sample of students, appropriate documentation, and an overall response rate of 60% or higher (Brener et al., 2004; Brener et al., 2012). Specifically, a weight was applied to each record so that the ultimate sample would be proportionate to national population proportions for the national YRBSS and would be
representative of all students in grades 9–12 attending public and private schools in each jurisdiction for the state and large urban school district surveys. The weighted count of students equals the total sample size. In 2011, questionnaire data from 41 states and 21 large urban school districts were weighted to match national population proportions (Eaton et al., 2012).

**Instrument**

The YRBSS was developed by the Centers for Disease Control and Prevention (CDC) to monitor six “interrelated and preventable” categories of health-risk behaviors: (a) behaviors that contribute to unintentional injuries and violence, (b) tobacco use, (c) alcohol and other drug use, (d) sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases (STDs) including HIV infection, (e) unhealthy dietary behaviors, and (f) physical inactivity (Brener et al., 2012). It was developed for the purposes of monitoring the prevalence and co-occurrence of health risk behaviors (Brener et al., 2004).

The 2011 national YRBSS questionnaire items that were included in this study’s analysis included respondents’ sex, age, and items pertaining to physical activity (i.e., question 79), sports participation (i.e., question 83), and suicidal behavior (i.e., questions 25 through 28). A hopelessness item (i.e., question 24) was included as a covariate to limit potential confounding effects, as the presence of hopelessness has long been recognized as highly prevalent among youth who make single or multiple suicide attempts (Forman et al., 2004; Jeglic et al., 2005) and youth who die by suicide (Beck & Rush, 1978; Thompson et al., 2005). Furthermore, given some worrisome findings about weight control, exercise practices, and suicidal behavior (Brausch & Gutierrez, 2009;
Taliaferro et al., 2008a) and disordered eating as a risk factor for suicidal behavior (Harris & Barraclough, 1997), positive responses to one or more items pertaining to unhealthy weight control or disordered eating behaviors in the past 30 days (i.e., questions 69 through 71) were also covaried. The three items used to establish this disordered eating behavior variable were derived from the only YRBSS items pertaining to weight control practices and risky dietary behaviors. These behaviors constitute part of diagnostic criteria for eating disorders, but the combination of responses to these items do not constitute a diagnosable eating disorder, as information about the duration, severity, and other related contextual factors are not included.

Inclusion of these covariates also responds to previous researchers’ calls for investigating how suicidal behavior varies with other health risk behaviors for athletes and non-athletes (Sabo et al., 2005). The full items and response formats, organized by their variable category for the current study, are included in Table 4.

Table 4

<table>
<thead>
<tr>
<th>Items</th>
<th>Responses</th>
</tr>
</thead>
</table>
| Q1. How old are you? | a) 12 years old 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 old or older |
| Q2. What is your sex? | a) female  
b) male |
| Q79. During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spend in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time). | a) 0 days  
b) 1 day  
c) 2 days  
d) 3 days  
e) 4 days  
f) 5 days |
Q83. During the past 12 months, on how many sports teams did you play? (Count any teams run by your school or community groups).

- a) 0 teams
- b) 1 team
- c) 2 teams
- d) 3 or more teams
- g) 6 days
- h) 7 days

Q25. During the past 12 months, did you ever seriously consider attempting suicide?

- a) yes
- b) no

Q26. During the past 12 months, did you make a plan about how you would attempt suicide?

- a) yes
- b) no

Q27. 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

Q28. If you attempted suicide during the past 12 months, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?

- a) I did not attempt suicide during the past 12 months
- b) yes
- c) no

Q24. 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

Q69. During the past 30 days, did you go without eating for 24 hours or more (also called fasting) to lose weight or keep from gaining weight?

- a) yes
- b) no

Q70. 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.)

- a) yes
- b) no

Q71. During the past 30 days, did you vomit or take laxatives to lose weight or to keep from gaining weight?

- a) yes
- b) no

**Psychometric properties.** As described by Brener and colleagues (2004), two test-retest evaluations of YRBSS item reliability indicated that at least three quarters of the items had acceptable or strong reliability after two weeks (kappas ≥ 61%). Responses from students in grade nine through twelve were found to be more reliable than responses from students in grade seven, which dictated the CDC’s focus on high school students as the target population for future questionnaires. In the first reliability evaluation (1992),
no statistically significant differences emerged between reports of health risk behaviors, but in the second evaluation (1999) approximately ten questions emerged as having questionable reliability; these questions were revised or deleted from future questionnaires.

Although no assessment of YRBSS questionnaire response accuracy has been conducted to date, consideration of various factors that may influence adolescents’ self-reports was summarized in a literature review conducted by the CDC (Brener, Billy, & Grady, 2003). This review found that adolescent self-reports of health-risk behaviors are subject to cognitive and situational factors that influence response accuracy. Theorists postulate that basic cognitive processes that influence self-reports include (a) comprehension (i.e., question interpretation), (b) retrieval (i.e., recollection), (c) decision-making (i.e., judging adequacy of retrieved information), and (d) response generation (depending on judged adequacy of recollection) (Eisenhower, Mathiowetz, & Morganstein, 1991). Situational factors are understood to influence response accuracy when certain response options are perceived as more socially desirable than others (DeMaio, 1984; Sudman & Bradburn, 1974).

Existing research on the reliability and validity of the inferences drawn on the basis of self-reports for physical activity, sports participation, and suicidal behavior shows some variability. For self-reported physical activity, moderate to high reliability has been established across numerous studies (Sallis & Saelens, 2000), with greater reliability found regarding the self-reported number of days exercised per week after shorter intervals in comparison to longer ones (Sallis, Buono, Roby, Micale, & Nelson, 1993). When self-reports were compared to school team rosters, sports team
participation was determined to be very accurately reported by adolescents (Aaron et al., 1995). Suicidal behaviors, including suicide attempts, are reported with high reliability by adolescents (DeMan & Leduc, 1994). They have also been shown to be reported differently depending on the mode of question administration (i.e., with a higher prevalence of reporting in paper-and-pencil surveys than structured interviews), which may be an effect of socially desirable responding when respondents perceive a lack of anonymity or privacy (Brener et al., 2003; Klimes-Dougan, 1998; Velting, Rathus, & Asnis, 1998).

The current study utilized adolescents’ paper and pencil survey responses to YRBSS items pertaining to physical activity, sports participation, and suicidal behavior. The reliability and validity of the instrument used for this study likely reflect the same moderate to high reliability and validity of each of its components. This allowed for stronger assertions to be made than would have been possible if any of these components had reliability and validity findings that were less desirable.

Measures

The 2011 national YRBSS included items that composed the measures to examine this study’s research question. The actual wording of the items is shown on Table 4. Measures included two ordinal predictor variables with multiple levels and one continuous outcome variable with multiple levels.

Physical activity. The first predictor variable (physical activity) was represented by YRBSS question 79, yielding a possible value range from zero to seven that represents the quantity of reported days of at least 60 minutes of physical activity in the past week.
Scores on this variable yielded an 8-point ordinal scale of physical activity; it was treated as a continuous variable in the multiple regression.

**Sports participation.** The second predictor variable (sports participation) was represented in four levels of responses to YRBSS question 83: (a) no sports team involvement; (b) involvement on one team; (c) involvement on two teams; or (d) involvement on three or more sports teams in the past year. These four response options provided an ordinal scale to measure this item; it was treated as a continuous variable in the multiple regression.

**Suicidality.** The outcome variable of adolescent suicidal behavior was based on responses to YRBSS questions 25 through 28, interpreted as one continuous variable representing degrees of suicidality. Specifically, reporting no suicidal behavior was assigned a value of 0, considering suicide was assigned a value of 1, planning suicide was assigned a value of 2, attempting suicide was assigned a value of 3, making multiple suicide attempts was assigned a value of 4, and making suicide attempts that required medical intervention was assigned a value of 5. The most intense suicidal behavior reported by a respondent (i.e., the response assigned the highest value) was considered the dependent variable in this study. This measure represented where the respondent fell on a continuum of suicidality that ranged from zero to five, and was used as this study’s continuous suicidal behavior outcome variable because it is made up of a series of six ordered outcomes.

**Procedures**

YRBSS data from representative samples of high school students have been collected every odd year since 1991 via national school-based surveys and school-based
state, territorial, tribal, and large urban school district surveys. The 2011 YRBSS standard questionnaire used for this study consisted of 86 items. One class period, or approximately 35 minutes, was needed for students to provide all of their responses for the YRBSS. Responses were recorded on a computer-scannable questionnaire booklet or a separate answer sheet. Participation was anonymous, voluntary, and followed local parental permission policies.

**Statistical Analysis**

Various assumptions were evaluated and met, and this confirmed the appropriateness of regression as an approach to statistical analysis. Assumptions that the outcome variable (i.e., adolescent suicidal behavior) was on a continuous scale, and that the predictor variables (i.e., physical activity and sports team participation) were either continuous or categorical, were satisfied. Independence of errors was assessed through an evaluation of the Durbin-Watson statistic, and was determined to be within an acceptable range. This indicated that errors (i.e., residuals) in the 2011 YRBSS data set were sufficiently independent from each other. An examination of the residual plots indicated that assumptions of linearity and homoscedasticity were met. Tests for multicollinearity indicated that a very low level of multicollinearity was present between physical activity and sports participation ($VIF = 1.0$ for each). Consequently, the assumption of absence of multicollinearity was determined to be satisfied.

The assumption of normality was met for physical activity (skewness = -.2, kurtosis = -1.4) and sports participation (skewness = .7, kurtosis = -.8), but was violated for adolescent suicidal behaviors (skewness = 2.45, kurtosis = 5.33). A square root transformation (i.e., square root of $1/(x+1)^{\frac{1}{2}}$, with the constant value of one added to
each score to bring the smallest value to at least one) was used. Square root transformation is recommended when the distribution is moderately different from normal (Tabachnick & Fidell, 2007). Application of this transformation to the suicidal behavior outcome variable resulted in improved skewness and kurtosis values (-1.61 and .78, respectively). Consequently, the transformed suicidal behavior variable was used in this analysis. The transformed suicidal behavior variable had a value of 1.0 representing no suicidal behavior, .50 representing suicidal ideation, .33 representing suicide planning, .25 representing one suicide attempt, .20 representing multiple suicide attempts, and .16 representing an attempt requiring medical intervention made within the last year.

After addressing the necessary statistical assumptions, a multiple linear regression analysis was conducted to address this study’s research question by first regressing the transformed suicidal behavior variable against physical activity and sports team participation. This first model was then compared to a second model that included the covariates of gender (i.e., male and female), age (i.e., 12 through 18 or older), hopelessness/sadness (i.e., YRBSS item 24), and disordered eating behavior (i.e., a composite variable of YRBSS items 69 through 71). Furthermore, descriptive statistics were used to compare the rates of suicidal behavior by level of physical activity and sports team participation. The results are presented by sex and age.

The approach outlined herein served to illuminate and characterize the links between particular levels of physical activity and sports team participation and adolescent suicidal behavior using the latest YRBSS data (CDC, 2011). It also extended previous findings via methodological improvements including separate analyses of physical activity and sports participation and their relationships with adolescent suicidality,
separate consideration of suicidal ideation and suicide planning based on differences in clinical significance, consideration of additional covariates that the literature indicates may be highly related to suicidal behavior, and use of multiple linear regression analysis rather than logistic regression analysis.
Chapter 4

Results

To address the question of whether high school students’ suicidality varied by their physical activity or sports team participation, and whether covariates of age, gender, hopelessness/ sadness, and disordered eating behavior played a role in these relationships, statistical analyses were conducted.

Descriptive Statistics

Of the 2011 YRBSS high school student respondents (n = 15,363), 20.1% reported engaging in some level of suicidal behavior in the last year. The highest intensity suicidal behavior reported was seriously considering attempting suicide for 4.9% of the sample, making a plan about how they would attempt suicide for 7.5% of the sample, making at least one suicide attempt in the last year for 3.2% of the sample, making two or more suicide attempts in the last year for 2.2% of the sample, and making a suicide attempt that required medical intervention for 2.3% of the sample.

Hopelessness/ sadness (i.e., feeling so sad or hopeless almost every day for at least two weeks in a row that they stopped doing some usual activities) was reported by 29.4% of respondents. One or multiple types of disordered eating behavior in the past 30 days (i.e., fasting for at least 24 hours; taking diet pills, powders, or liquids without a doctor’s advice to lose weight or keep from gaining weight; or vomiting or taking laxatives to lose weight or keep from gaining weight) were reported by 16.5% of respondents.

Frequencies and percentages of demographic variables by highest intensity suicidal behavior reported are presented in Table 5. Consistent with previous research (Eaton et al., 2006), females more commonly reported engaging in all levels of suicidal
behavior (i.e., ideation, planning, and attempting suicide) than males. Data from this sample also show that suicide planning was the highest intensity suicidal behavior most common in adolescents.
<table>
<thead>
<tr>
<th>Age</th>
<th>No Suicidal Behavior</th>
<th>Suicidal Ideation</th>
<th>Suicide Planning</th>
<th>One Suicide Attempt</th>
<th>Two or More Suicide Attempts</th>
<th>Suicide Attempt Requiring Medical Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 years old and</td>
<td>n = 19</td>
<td>n = 2</td>
<td>n = 8</td>
<td>n = 0</td>
<td>r = 3</td>
<td>n = 12</td>
</tr>
<tr>
<td>younger</td>
<td>43.2%</td>
<td>4.5%</td>
<td>18.2%</td>
<td>0.0%</td>
<td>6.8%</td>
<td>27.3%</td>
</tr>
<tr>
<td>13 years old</td>
<td>n = 20</td>
<td>n = 0</td>
<td>n = 2</td>
<td>n = 0</td>
<td>r = 1</td>
<td>n = 1</td>
</tr>
<tr>
<td></td>
<td>83.3%</td>
<td>0.0%</td>
<td>8.3%</td>
<td>0.0%</td>
<td>4.2%</td>
<td>4.2%</td>
</tr>
<tr>
<td>14 years old</td>
<td>n = 1,237</td>
<td>n = 84</td>
<td>n = 112</td>
<td>n = 55</td>
<td>r = 38</td>
<td>n = 35</td>
</tr>
<tr>
<td></td>
<td>79.2%</td>
<td>5.4%</td>
<td>7.2%</td>
<td>3.5%</td>
<td>2.4%</td>
<td>2.2%</td>
</tr>
<tr>
<td>15 years old</td>
<td>n = 2,741</td>
<td>n = 170</td>
<td>n = 268</td>
<td>n = 120</td>
<td>r = 81</td>
<td>n = 90</td>
</tr>
<tr>
<td></td>
<td>79.0%</td>
<td>4.9%</td>
<td>7.7%</td>
<td>3.5%</td>
<td>2.3%</td>
<td>2.6%</td>
</tr>
<tr>
<td>16 years old</td>
<td>n = 3,206</td>
<td>n = 197</td>
<td>n = 327</td>
<td>n = 147</td>
<td>r = 95</td>
<td>n = 89</td>
</tr>
<tr>
<td></td>
<td>78.9%</td>
<td>4.9%</td>
<td>8.1%</td>
<td>3.6%</td>
<td>2.3%</td>
<td>2.2%</td>
</tr>
<tr>
<td>17 years old</td>
<td>n = 3,168</td>
<td>n = 204</td>
<td>n = 277</td>
<td>n = 110</td>
<td>r = 90</td>
<td>n = 72</td>
</tr>
<tr>
<td></td>
<td>80.8%</td>
<td>5.2%</td>
<td>7.1%</td>
<td>2.8%</td>
<td>2.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>18 years old or older</td>
<td>n = 1,882</td>
<td>n = 96</td>
<td>n = 165</td>
<td>n = 59</td>
<td>r = 32</td>
<td>n = 48</td>
</tr>
<tr>
<td></td>
<td>82.5%</td>
<td>4.2%</td>
<td>7.2%</td>
<td>2.6%</td>
<td>1.4%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

| Total                | n = 12,273           | n = 753           | n = 1,159       | n = 491             | r = 340                     | n = 347                                         |
|                      | 79.9%                | 4.9%              | 7.6%            | 3.2%                | 2.2%                        | 2.2%                                          |
Frequencies and percentages of reported physical activity and sports team participation by gender and age are presented in Table 6. Consistent with previous research (Brown et al., 2007; Taliaferro et al., 2008a), most respondents reported engaging in physical activity at least three days per week (i.e., 75.4% of males, 71.1% of females, 73.9% of 13 year olds, 70.1% of 14 year olds, 70.2% of 15 year olds, 67.3% of 16 year olds, 65.1% of 17 year olds, and 62.4% of 18 year olds).
<table>
<thead>
<tr>
<th>Gender</th>
<th>0 days in the past week</th>
<th>1 day in the past week</th>
<th>2 days in the past week</th>
<th>3 days in the past week</th>
<th>4 days in the past week</th>
<th>5 days in the past week</th>
<th>6 days in the past week</th>
<th>7 days in the past week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>n = 1,451</td>
<td>n = 778</td>
<td>n = 898</td>
<td>n = 942</td>
<td>n = 779</td>
<td>n = 915</td>
<td>n = 471</td>
<td>n = 1,325</td>
</tr>
<tr>
<td></td>
<td>19.2%</td>
<td>10.3%</td>
<td>11.9%</td>
<td>12.5%</td>
<td>10.3%</td>
<td>12.1%</td>
<td>6.2%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Males</td>
<td>n = 842</td>
<td>n = 408</td>
<td>n = 581</td>
<td>n = 678</td>
<td>n = 668</td>
<td>n = 959</td>
<td>n = 577</td>
<td>n = 2,718</td>
</tr>
<tr>
<td></td>
<td>11.3%</td>
<td>5.5%</td>
<td>7.8%</td>
<td>9.1%</td>
<td>9.0%</td>
<td>12.9%</td>
<td>7.8%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 years old and younger</td>
<td>n = 16</td>
<td>n = 6</td>
<td>n = 2</td>
<td>n = 2</td>
<td>n = 1</td>
<td>n = 1</td>
<td>n = 1</td>
<td>n = 11</td>
</tr>
<tr>
<td></td>
<td>40.0%</td>
<td>15.0%</td>
<td>5.0%</td>
<td>5.0%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>27.5%</td>
</tr>
<tr>
<td>13 years old</td>
<td>n = 1</td>
<td>n = 2</td>
<td>n = 3</td>
<td>n = 6</td>
<td>n = 4</td>
<td>n = 4</td>
<td>n = 0</td>
<td>n = 3</td>
</tr>
<tr>
<td></td>
<td>4.3%</td>
<td>8.7%</td>
<td>13.0%</td>
<td>12.1%</td>
<td>8.9%</td>
<td>13.0%</td>
<td>8.1%</td>
<td>29.1%</td>
</tr>
<tr>
<td>14 years old</td>
<td>n = 192</td>
<td>n = 114</td>
<td>n = 143</td>
<td>n = 170</td>
<td>n = 135</td>
<td>n = 196</td>
<td>n = 122</td>
<td>n = 441</td>
</tr>
<tr>
<td></td>
<td>12.7%</td>
<td>7.5%</td>
<td>9.5%</td>
<td>11.2%</td>
<td>8.9%</td>
<td>13.0%</td>
<td>8.1%</td>
<td>29.1%</td>
</tr>
<tr>
<td>15 years old</td>
<td>n = 442</td>
<td>n = 259</td>
<td>n = 307</td>
<td>n = 337</td>
<td>n = 349</td>
<td>n = 482</td>
<td>n = 261</td>
<td>n = 954</td>
</tr>
<tr>
<td></td>
<td>13.0%</td>
<td>7.6%</td>
<td>9.1%</td>
<td>9.9%</td>
<td>10.3%</td>
<td>14.2%</td>
<td>7.7%</td>
<td>28.1%</td>
</tr>
<tr>
<td>16 years old</td>
<td>n = 610</td>
<td>n = 294</td>
<td>n = 389</td>
<td>n = 438</td>
<td>n = 377</td>
<td>n = 488</td>
<td>n = 257</td>
<td>n = 1,093</td>
</tr>
<tr>
<td></td>
<td>15.5%</td>
<td>7.5%</td>
<td>9.9%</td>
<td>11.1%</td>
<td>9.6%</td>
<td>12.4%</td>
<td>6.5%</td>
<td>27.7%</td>
</tr>
<tr>
<td>17 years old</td>
<td>n = 629</td>
<td>n = 320</td>
<td>n = 393</td>
<td>n = 419</td>
<td>n = 366</td>
<td>n = 453</td>
<td>n = 280</td>
<td>n = 982</td>
</tr>
<tr>
<td></td>
<td>16.4%</td>
<td>8.3%</td>
<td>10.2%</td>
<td>10.9%</td>
<td>9.5%</td>
<td>11.8%</td>
<td>7.3%</td>
<td>25.6%</td>
</tr>
<tr>
<td>18 years old or older</td>
<td>n = 406</td>
<td>n = 190</td>
<td>n = 243</td>
<td>n = 249</td>
<td>n = 216</td>
<td>n = 248</td>
<td>n = 126</td>
<td>n = 557</td>
</tr>
<tr>
<td></td>
<td>18.2%</td>
<td>8.5%</td>
<td>10.9%</td>
<td>11.1%</td>
<td>9.7%</td>
<td>11.1%</td>
<td>5.6%</td>
<td>24.9%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of Respondents</td>
<td>n = 2,296</td>
<td>n = 1,185</td>
<td>n = 1,480</td>
<td>n = 1,621</td>
<td>n = 1,448</td>
<td>n = 1,872</td>
<td>n = 1,047</td>
<td>n = 4,041</td>
</tr>
<tr>
<td>% of Total</td>
<td>15.3%</td>
<td>7.9%</td>
<td>9.9%</td>
<td>10.8%</td>
<td>9.7%</td>
<td>12.5%</td>
<td>7.0%</td>
<td>27.0%</td>
</tr>
</tbody>
</table>
Frequencies and percentages of reported sports participation by gender and age are presented in Table 7. A greater percentage of male than female respondents reported participating on at least one sports team (61.4% compared to 48.7%). A greater percentage of males participated on three or more sports teams than females (16.4% compared to 9.3%). Greater percentages of adolescents (ages 14 and older) reported participating on one sports team than on more than one sports team.
<table>
<thead>
<tr>
<th>Gender</th>
<th>0 teams in the past year</th>
<th>1 team in the past year</th>
<th>2 teams in the past year</th>
<th>3+ teams in the past year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>n = 3,843</td>
<td>n = 1,820</td>
<td>n = 1,065</td>
<td>n = 701</td>
</tr>
<tr>
<td></td>
<td>51.2%</td>
<td>25.2%</td>
<td>14.2%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Males</td>
<td>n = 2,835</td>
<td>n = 1,900</td>
<td>n = 1,400</td>
<td>n = 1,201</td>
</tr>
<tr>
<td></td>
<td>38.6%</td>
<td>25.9%</td>
<td>19.1%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 years old or younger</td>
<td>n = 15</td>
<td>n = 7</td>
<td>n = 7</td>
<td>n = 12</td>
</tr>
<tr>
<td></td>
<td>36.6%</td>
<td>17.1%</td>
<td>17.1%</td>
<td>29.3%</td>
</tr>
<tr>
<td>13 years old</td>
<td>n = 8</td>
<td>n = 7</td>
<td>n = 3</td>
<td>n = 3</td>
</tr>
<tr>
<td></td>
<td>38.1%</td>
<td>13.3%</td>
<td>14.3%</td>
<td>14.3%</td>
</tr>
<tr>
<td>14 years old</td>
<td>n = 622</td>
<td>n = 412</td>
<td>n = 253</td>
<td>n = 216</td>
</tr>
<tr>
<td></td>
<td>41.4%</td>
<td>27.4%</td>
<td>16.8%</td>
<td>14.4%</td>
</tr>
<tr>
<td>15 years old</td>
<td>n = 1,345</td>
<td>n = 849</td>
<td>n = 632</td>
<td>n = 523</td>
</tr>
<tr>
<td></td>
<td>40.2%</td>
<td>25.4%</td>
<td>18.9%</td>
<td>15.6%</td>
</tr>
<tr>
<td>16 years old</td>
<td>n = 1,703</td>
<td>n = 1,043</td>
<td>n = 656</td>
<td>n = 506</td>
</tr>
<tr>
<td></td>
<td>43.6%</td>
<td>26.7%</td>
<td>16.8%</td>
<td>12.9%</td>
</tr>
<tr>
<td>17 years old</td>
<td>n = 1,854</td>
<td>n = 930</td>
<td>n = 592</td>
<td>n = 421</td>
</tr>
<tr>
<td></td>
<td>48.8%</td>
<td>24.5%</td>
<td>15.6%</td>
<td>11.1%</td>
</tr>
<tr>
<td>18 years old or older</td>
<td>n = 1,128</td>
<td>n = 541</td>
<td>n = 324</td>
<td>n = 220</td>
</tr>
<tr>
<td></td>
<td>51.0%</td>
<td>24.4%</td>
<td>14.6%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Total</td>
<td>n = 6,675</td>
<td>n = 3,789</td>
<td>n = 2,467</td>
<td>n = 1,901</td>
</tr>
<tr>
<td></td>
<td>45.0%</td>
<td>25.5%</td>
<td>16.6%</td>
<td>12.8%</td>
</tr>
</tbody>
</table>
Descriptive statistics for rates of highest intensity suicidal behavior reported by level of physical activity and sports team participation are summarized in Tables 8 and 9. Figure 1 provides a graphic representation of the percentages of respondents reporting each level of physical activity and sports team participation by their highest intensity suicidal behavior in the past year. Respondents who exercised zero days in the past week represented a greater percentage of those who reported engaging in each type of suicidal behavior than respondents who exercised five days in the past week. In general, lower percentages of respondents reporting each type of suicidal behavior represented those who reported participating on one sports team than those who reported participating on no sports teams in the last year.
<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>No Suicidal Behavior</th>
<th>Suicidal Ideation</th>
<th>Suicide Planning</th>
<th>One Suicide Attempt</th>
<th>Two or More Suicide Attempts</th>
<th>Suicide Attempt Requiring Medical Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 days</td>
<td>n = 1,712</td>
<td>n = 148</td>
<td>n = 240</td>
<td>n = 77</td>
<td>n = 61</td>
<td>n = 67</td>
</tr>
<tr>
<td></td>
<td>74.3%</td>
<td>6.4%</td>
<td>10.4%</td>
<td>3.3%</td>
<td>2.6%</td>
<td>2.9%</td>
</tr>
<tr>
<td>1 day</td>
<td>n = 904</td>
<td>n = 66</td>
<td>n = 112</td>
<td>n = 45</td>
<td>n = 32</td>
<td>n = 31</td>
</tr>
<tr>
<td></td>
<td>76.0%</td>
<td>5.5%</td>
<td>9.4%</td>
<td>3.8%</td>
<td>2.7%</td>
<td>2.6%</td>
</tr>
<tr>
<td>2 days</td>
<td>n = 1,125</td>
<td>n = 95</td>
<td>n = 117</td>
<td>n = 64</td>
<td>n = 37</td>
<td>n = 44</td>
</tr>
<tr>
<td></td>
<td>75.9%</td>
<td>6.4%</td>
<td>7.9%</td>
<td>4.3%</td>
<td>2.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>3 days</td>
<td>n = 1,295</td>
<td>n = 71</td>
<td>n = 132</td>
<td>n = 63</td>
<td>n = 33</td>
<td>n = 36</td>
</tr>
<tr>
<td></td>
<td>79.4%</td>
<td>4.4%</td>
<td>8.1%</td>
<td>3.9%</td>
<td>2.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>4 days</td>
<td>n = 1,161</td>
<td>n = 77</td>
<td>n = 104</td>
<td>n = 46</td>
<td>n = 39</td>
<td>n = 27</td>
</tr>
<tr>
<td></td>
<td>79.4%</td>
<td>5.3%</td>
<td>7.2%</td>
<td>3.2%</td>
<td>2.7%</td>
<td>1.9%</td>
</tr>
<tr>
<td>5 days</td>
<td>n = 1,538</td>
<td>n = 85</td>
<td>n = 120</td>
<td>n = 56</td>
<td>n = 43</td>
<td>n = 35</td>
</tr>
<tr>
<td></td>
<td>81.9%</td>
<td>4.5%</td>
<td>6.4%</td>
<td>3.0%</td>
<td>2.3%</td>
<td>1.9%</td>
</tr>
<tr>
<td>6 days</td>
<td>n = 888</td>
<td>n = 53</td>
<td>n = 52</td>
<td>n = 32</td>
<td>n = 16</td>
<td>n = 11</td>
</tr>
<tr>
<td></td>
<td>84.4%</td>
<td>5.0%</td>
<td>4.9%</td>
<td>3.0%</td>
<td>1.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>7 days</td>
<td>n = 3,387</td>
<td>n = 145</td>
<td>n = 267</td>
<td>n = 103</td>
<td>n = 72</td>
<td>n = 84</td>
</tr>
<tr>
<td></td>
<td>83.5%</td>
<td>3.6%</td>
<td>6.6%</td>
<td>2.5%</td>
<td>1.8%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

<p>| Total             | n = 12,010           | n = 740           | n = 1,144        | n = 486             | n = 333                    | n = 335                                    |
|                   | 79.8%                | 4.9%              | 7.6%             | 3.2%                | 2.2%                       | 2.2%                                       |</p>
<table>
<thead>
<tr>
<th>Sports Team Participation</th>
<th>No Suicidal Behavior</th>
<th>Suicidal Ideation</th>
<th>Suicide Planning</th>
<th>One Suicide Attempt</th>
<th>Two or More Suicide Attempts</th>
<th>Suicide Attempt Requiring Medical Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0 teams</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 5,169</td>
<td>n = 400</td>
<td>n = 564</td>
<td>n = 233</td>
<td>n = 179</td>
<td>n = 161</td>
<td></td>
</tr>
<tr>
<td>77.1%</td>
<td>6.0%</td>
<td>8.4%</td>
<td>3.5%</td>
<td>2.7%</td>
<td>2.4%</td>
<td></td>
</tr>
<tr>
<td><strong>1 team</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 3,091</td>
<td>n = 167</td>
<td>n = 281</td>
<td>n = 120</td>
<td>n = 77</td>
<td>n = 64</td>
<td></td>
</tr>
<tr>
<td>81.3%</td>
<td>4.4%</td>
<td>7.4%</td>
<td>3.2%</td>
<td>2.0%</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td><strong>2 teams</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 2,057</td>
<td>n = 100</td>
<td>n = 160</td>
<td>n = 71</td>
<td>n = 40</td>
<td>n = 47</td>
<td></td>
</tr>
<tr>
<td>83.1%</td>
<td>4.0%</td>
<td>6.5%</td>
<td>2.9%</td>
<td>1.6%</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td><strong>3+ teams</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 1,565</td>
<td>n = 71</td>
<td>n = 125</td>
<td>n = 57</td>
<td>n = 34</td>
<td>n = 58</td>
<td></td>
</tr>
<tr>
<td>81.9%</td>
<td>3.7%</td>
<td>6.5%</td>
<td>3.0%</td>
<td>1.8%</td>
<td>3.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of Respondents</td>
<td>n = 11,882</td>
<td>n = 738</td>
<td>n = 1,130</td>
<td>n = 481</td>
<td>n = 330</td>
<td>n = 330</td>
</tr>
<tr>
<td>% of Total</td>
<td>79.8%</td>
<td>5.0%</td>
<td>7.6%</td>
<td>3.2%</td>
<td>2.2%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
Figure 1. Highest intensity suicidal behavior reported by level of physical activity and sports participation. Graphic representations of YRBSS 2011 respondents’ self-reported behaviors (CDC, 2011).
**Regression Analysis**

To determine whether physical activity or sports team participation were predictive of suicidal behavior and to evaluate the role of covariates in these relationships, a regression analysis was conducted. Two models of linear regression were compared, the first without covariates of age, gender, hopelessness/sadness, and disordered eating behavior, and the second with all covariates included. The second model contributed statistically significantly more information about suicidal behavior than the first model \((F (6,14,621) = 625.464, p = .000)\). As depicted in Table 10, the combination of predictors and covariates included in Model 2 explained 21% of the variability in the suicidal behavior outcome variable \((R^2 = .210; \text{ADJ } R^2 = .209)\).

**Table 10**

*Model Summary of Multiple Linear Regression Analysis*

<table>
<thead>
<tr>
<th></th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of Estimate</th>
<th>(F)</th>
<th>df 1</th>
<th>df 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>.007</td>
<td>.007</td>
<td>.274</td>
<td>50.933</td>
<td>2</td>
<td>14,627</td>
</tr>
<tr>
<td>Model 2</td>
<td>.210</td>
<td>.209</td>
<td>.244</td>
<td>485.093</td>
<td>8</td>
<td>14,621</td>
</tr>
</tbody>
</table>

Review of the model summary showed a significant linear relationship between the predictor and outcome variables included in each model. The model summary also revealed that Model 2 (i.e., all covariates included) represented a statistically significant improvement (i.e., change in Adjusted \(R^2\)) over Model 1 (i.e., physical activity and sports participation as predictors; no covariates included) as summarized in Table 11 (Adjusted \(R^2\) Change = .203, \(F\) change = 625.464). Therefore, Model 2, \(F (8, 14,621) = 485.093, p = .000\) was used to evaluate this study’s research question.
The inversely transformed suicidal behavior variable was used for this analysis. In other words, because the suicidal behavior variable was inverted, negative beta values are interpreted as increases in suicidal behavior and positive beta values are interpreted as decreases in suicidal behavior. Results of the regression equation described herein will be described in a way that reflects this, and will appear to describe relationships in the direction opposite the coefficients summarized in Table 11.

Table 11

Predictors of Suicidal Behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>.408**</td>
<td>[.380, .436]</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>.006**</td>
<td>[.003, .008]</td>
</tr>
<tr>
<td>Sports Participation</td>
<td>-.001</td>
<td>[-.006, .005]</td>
</tr>
<tr>
<td>Age</td>
<td>.011**</td>
<td>[.007, .014]</td>
</tr>
<tr>
<td>Gender</td>
<td>.018</td>
<td>[-.002, .038]</td>
</tr>
<tr>
<td>Gender x PA</td>
<td>-.004*</td>
<td>[-.008, -.001]</td>
</tr>
<tr>
<td>Gender x SP</td>
<td>.004</td>
<td>[.004, .013]</td>
</tr>
<tr>
<td>Hopelessness/ Sadness</td>
<td>.230**</td>
<td>[.221, .239]</td>
</tr>
<tr>
<td>Disordered Eating Behavior</td>
<td>-.122**</td>
<td>[-.133, -.111]</td>
</tr>
</tbody>
</table>

$R^2$ 50.933  
$F$ 485.093  
$\Delta R^2$ over Model 1 .203  
$\Delta F$ over Model 1 625.464**

Note. N = 14,630. CI = confidence interval. PA = physical activity. SP = sports participation.  
* p < .05. ** p < .01.

The demographic variables of gender (i.e., male and female) and age (i.e., 12 through 18 or older), and covariates of hopelessness/ sadness (i.e., YRBSS item 24) and disordered eating behaviors (i.e., positive responses to one or more YRBSS items, 69 through 71, pertaining to unhealthy weight control practices) were included in the regression equation. An examination of individual coefficients as predictors of suicidal
behavior (Table 11) reveals that after allowing for the linear effects of the other variables in the model, the predictor variables that explained most of the variability in suicidal behavior were as follows, in order of their relative importance: hopelessness/ sadness ($\beta = .382$), eating disordered behavior ($\beta = -.165$), physical activity ($\beta = .054$), age ($\beta = .047$), and the interaction between gender and physical activity ($\beta = -.043$).

Examination of the regression equation indicated that sports team participation was not significantly associated with suicidal behavior ($t = -.318, p > .05$), but physical activity was significantly associated with suicidal behavior and at different levels for males and females (Gender X Physical Activity, $t = -2.408; p = .016$). For males, when physical activity in the past week increased by one unit, highest level of suicidality reported decreased by .006 ($t = 4.679, p = .000$). For females, the same increase in physical activity in the past week was only associated with a decrease in suicidality of .002 ($t = -2.408; p = .016$). This interaction is graphically represented using the 2011 YRBSS data in Figure 2.
Figure 2. Highest intensity suicidal behavior reported: Graphic Representation of the Interaction between Gender and Physical Activity in YRBSS 2011 respondents (CDC, 2011).
For affirmative responses to the one YRBSS item about hopelessness/sadness in the last year, the suicidal behavior outcome variable decreased by .230 ($t = 49.733, p = .000$). In other words, as hopelessness/sadness increased, suicidality significantly decreased in this study’s participants.

The model indicates that affirmative responses about engaging in at least one type of disordered eating behavior in the past 30 days were associated with a .122 ($t = -21.671, p = .000$) increase in suicidality.

In terms of respondents’ ages, a one unit increase was associated with a .011 ($t = 6.402, p = .000$) unit decrease in suicidality. Participants’ being one year older was associated with a slight decrease in the degree of suicidal behavior they reported.
Chapter 5

Discussion

The current study extends previous research on adolescent suicidal behavior and its relationship with physical activity and sports participation (Brown et al., 2008; Sabo et al., 2005; Taliaferro et al., 2008a). More recent YRBSS data and improvements in methodology were used to provide an updated examination of this topic and allow for clarification of some previous researchers’ anomalous findings (CDC, 2011). Methodological changes included: (a) treatment of physical activity and sports participation as separate variables in order to speak to each of their associative relationships with adolescent suicidality; (b) addition of the covariates of disordered eating behavior and hopelessness/ sadness, each of which have been linked to suicidal behavior; (c) treatment of suicidal behavior as a continuous rather than categorical variable, as recommended by previous researchers (Brezo et al., 2007) and supported by widespread conceptualization of suicidal behavior along a continuum of intensity (Mazza, 2006); and (d) use of multiple linear regression analysis rather than logistic regression analysis to allow for treatment of suicidal behavior as one, continuous outcome variable.

Unlike previous studies (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), the current study included a discussion of the assumptions required for conducting the proposed statistical analysis. Moreover, a transformed suicidal behavior variable allowed for a more powerful analysis. The results of the current analysis, which differed in some ways from previous research, serve as useful additions to research on youth suicide prevention and have implications for both researchers and practitioners.
Significant Findings

The prevalence of suicidal behavior reported by the 2011 YRBSS respondents (N = 15,363) was, on the whole, similar to other recent national data. Relatively similar percentages (20.1%) of high school students represented in the current data set reported engaging in some level of suicidal behavior as in previous samples, in which 16-20% reported at least having considered suicide in the past year (CDC, 2011b; Bridge, Goldstein, & Brent, 2006).

Respondents’ reports about their physical activity and sports team participation were also similar to previous findings (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), with most respondents reporting that they engaged in physical activity at least three days in the last week, and most males (61.4%) and about half of females (48.8%) reporting participation on at least one sports team. High frequencies of physical activity (i.e., seven times per week) and sports team participation (i.e., participation on three or more teams in the last year) were more common among males (36.6% and 16.4%, respectively) than females (17.5% and 9.3%, respectively), representing another parallel with previous research.

The model summary indicated that the full model (i.e., with physical activity, sports team participation, and all covariates included) accounted for 21% of the variability in adolescent suicidal behavior. This represented a statistically significant improvement over the model that considered physical activity and sports participation alone as predictors of suicidal behavior. Examination of individual coefficients revealed that after accounting for the effects of the other variables in the regression model, the
predictors that explained the most variability in suicidal behavior were hopelessness/sadness, disordered eating behavior, physical activity, and age.

**Physical Activity and Suicidal Behavior.** This analysis revealed that adolescent suicidality did vary by physical activity in the past week, but did not vary by sports team participation in the last year. Previous researchers found that physical activity was associated with a significantly lower risk of various intensity suicidal behaviors in adolescents, from ideation to attempts (Brosnahan et al., 2004; Brown, et al., 2007; Taliaferro et al., 2008a; Unger, 1997). The inverse relationship between physical activity and suicidal behavior that emerged in this study – that for each additional day of physical activity in the past week, suicidal behavior decreased by a very small amount – provides additional support for these findings.

**Gender, Physical Activity, and Suicidal Behavior.** Two previous studies associated physical activity with reduced likelihood of suicide attempts in males (Brown et al., 2007; Taliaferro et al., 2008a), and only one of these studies linked physical activity with reduced odds of suicide attempts in females (Brown et al., 2007). The current study indicated that the interaction between gender and physical activity was statistically significant. The direction of the relationship was the same for males and females, although it was not statistically significant for females. For males, reports of additional days of physical activity in the past week were significantly associated with a very small decrease in suicidality. Females’ reports of additional days of physical activity were not significantly associated with changes in respondent suicidality.

These findings not only take demographics, hopelessness/sadness, and disordered eating behavior into account, but also sports team participation, which is likely similar in
many respects to physical activity. This represents a difference from previous research, and may have helped to allow for a different, clearer view of the relationship between physical activity and suicidal behavior; specifically, additional exercise was linked to reduced suicidal behaviors for males in this sample, but not females. However, it should be noted that this statistically significant finding could be due to the large sample size of the YBRSS (2011), and that the interaction lacks meaningfulness terms of practical differences between males’ and females’ physical activity and suicidal behavior.

Sports Team Participation and Suicidal Behavior. Why is it that sports team participation was not significantly associated with suicidal behavior in the current study? Previous research on sports participation consistently linked it to reduced odds of suicidal ideation in the last year (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a), and two of these studies linked it to significantly reduced odds of attempting suicide (Brown et al., 2008; Taliferro et al., 2008a). It could be that previous researchers’ (Brown et al., 2007; Sabo et al., 2005; Taliaferro et al., 2008a) use of fewer covariates (i.e., excluding hopelessness/sadness and disordered eating behavior, and not accounting for physical activity in their analyses) or the type of statistical analysis they employed (i.e., logistic regression analyses to examine of individual types of suicidal behavior rather than treating suicidal behavior as one continuous outcome variable) played a role. Alternatively, this study’s nonsignificant findings about sports team participation as a predictor of suicidal behavior could be due to differences in the dataset used, a combination of changes from previous research, or because there actually is no statistically significant relationship between high school student sports team participation and suicidal behavior.
Hopelessness/ Sadness and Suicidal Behavior. Other researchers have described hopelessness as highly prevalent among youth who make single or multiple suicide attempts (Forman et al., 2004; Jeglic et al., 2005), and have suggested that depression is one of the most prominent risk factors for suicidal behavior (Fleischmann et al., 2005). For the current sample, however, as reports of hopelessness/ sadness increased, reports of suicidal behavior were found to decrease.

It is possible that this counterintuitive finding may be reflective of a lack of validity of this study’s hopelessness variable. Hopelessness/ sadness was represented by one YRBSS item (Question 24), as follows: 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? As such, the question might have measured something different than a feeling of hopelessness; it also queried about respondent sadness and participation in usual activities.

It may be the case that respondents who are truly depressed and hopeless would not have the insight to accurately report that they have felt so sad or hopeless for two or more weeks in the past year that they stopped partaking in typical activities, but that they would be able to report feelings of extreme sadness or hopelessness if these questions had been asked independently from the inquiry about impact on activity level. This item may actually represent a construct of insight more than a construct of hopelessness; if this were true, its inverse association with suicidality would make better sense. In any case, this study’s use of one item to represent hopelessness clearly offers a weaker representation of the construct than those used by others, such as those which have used a
20-item Beck Hopelessness Scale to represent it (Beck, Weissman, Lester, & Trexler, 1974; Rudd, et al., 1996).

Alternatively, it is possible (albeit less plausible) that the finding (i.e., as hopelessness/ sadness increased, suicidality decreased) is valid, given that other investigations about the role of hopelessness in suicidality have not taken some important covariates (that were included in this study) into account. There is at least theoretical support for the idea that individuals who are hopeless, sad, or withdrawn (as represented by YRBSS Question 24) would be less likely to engage in more intense forms of suicidal behavior because of the extraordinary effort (i.e., rejecting deeply ingrained self-preservation instincts) required for these acts (Joiner, 2010).

**Disordered Eating and Suicidal Behavior.** Eating disorders are one of the most common mental health disorders present at the time of youth suicide deaths (Harris & Barraclough, 1997; Fleishman et al., 2005). For the purposes of this study disordered eating behavior was defined as reporting fasting, taking diet supplements without a doctor’s orders, and purging to lose weight or keep from gaining weight in the past 30 days. The three YRBSS items used to establish this study’s disordered eating behavior variable do not independently or as a group meet diagnostic criteria for an eating disorder. However, their association with an increase in suicidal behavior is aligned with previous research demonstrating that eating disorders represent a prominent risk factor for suicidality; affirmative responses about engaging in at least one type of disordered eating behavior in the past 30 days were associated with an increase in suicidality.

These YRBSS items were the only ones (other than physical activity) that asked respondents to reflect back just 30 days; all other items responses were based on the last
12 months. It is possible that the potential for this variable’s reduced sensitivity (i.e., respondents who had engaged in disordered eating behavior more than a month ago, but still within the year, would have been counted as not having disordered eating behavior) was counterbalanced by the use of three separate items, allowing for a more discriminating result about whether or not respondents had engaged in disordered eating behavior. As such, the association with increased suicidal behavior seems likely to be valid.

**Age and Suicidal Behavior.** Previous national statistics indicated that suicide deaths are more prevalent among 15 to 19 year olds than among 10 to 14 year olds (CDC, 2009). However, prevalence of suicidal behavior (i.e., ideation, planning, and attempting) has been higher among 9th and 10th grade high school students than 12th grade high school students (CDC, 2011b). The current study’s findings on age and suicidal behavior lent support to the latter finding about suicidal behavior; for every additional year of age, suicidal behavior decreased slightly.

**Limitations**

Some limitations of the current study are due to the nature of the YRBSS data itself. Specifically, the fact that the data are self-reported introduces potential problems with response reliability and accuracy. Additionally, the use of cross-sectional data limits the discussion of findings to correlational relationships between variables measured. For instance, physical activity may mediate suicidality, or alternatively, adolescents experiencing suicidality may be less likely to exercise. Furthermore, the large adolescent sample consists only of students who attend school, thereby excluding adolescents who may be in alternative placements (e.g., due to emotional or behavioral problems).
Another important limitation of the current study involves questions about the regression model. Although important covariates were added (i.e., hopelessness/sadness and disordered eating behaviors) due to their relatedness to exercise, sports team membership, and suicidal behavior according to previous research, it is possible that inclusion of other risk factors (e.g., substance abuse) and protective factors (e.g., help-seeking behavior) for suicidal behavior could further improve the regression model. Relatedly, while one item that addresses hopelessness, sadness, and withdrawal for two consecutive weeks in the last year (YRBSS item 24) was important to include in this analysis, there is some question as to whether this item provided a satisfactorily valid representation of a true hopelessness construct. Likewise, while the three items used to establish this study’s disordered eating behavior variable do pertain to weight control practices and risky dietary behaviors, it should be noted that the combination of these three items provides only some, not all, information pertaining to diagnostic criteria for an eating disorder.

Finally, beyond statistical significance is the consideration of what variables are practically significant. Statistical significance is different from its practical significance, especially given this YRBSS’ large sample size (N = 15,425). For example, a very small decrease in suicidal behavior for every additional day per week of physical activity does not represent meaningful movement along a continuum of more severe to a less severe suicidal behavior. Statistically significant findings should not be disregarded, especially if corroborated by previous studies. However, the fact that even statistically significant findings do not necessarily represent a practically meaningful difference in level of suicidal behavior is notable.
Implications for Future Research

Future researchers may wish to consider the inclusion of other risk factors (e.g., substance abuse) and protective factors (e.g., help-seeking behavior) for suicidal behavior and their role in a regression model. Moreover, future researchers may wish to improve upon the usefulness and validity of a one-item hopelessness construct (i.e., YRBSSS Question 24). Further investigation regarding the relationships between physical activity, sports team participation, and suicidal behavior within other populations (e.g., those including adolescents in alternative school placements due to emotional or behavioral needs) is also warranted, as it would better represent the entire adolescent population at risk for suicidal behavior.

In terms of deepening the understanding of the roles that physical activity, sports team participation, and other variables play in adolescent suicidality, there is an ongoing need for direct assessment of researchers’ postulations about the mechanisms (e.g., social support and integration, self-esteem, body image) through which they may be helpful or harmful for adolescents (Taliaferro et al., 2008a). A questionnaire that probes for more information on protective factors as well as risk factors would better allow researchers to understand associations between them. For example, it may be the case that certain levels of sports team participation, which is one example of a structured extracurricular activity shown to enhance connectedness (Hansen, Larson, & Dworkin, 2003; Parfitt & Eston, 2005), may make adolescents more likely to engage in help-seeking behavior, which has been correlated with reduced risk for suicidal behavior (Berman et al., 2006; Kaminski et al., 2010; Lubell & Vetter, 2006; Roberts et al., 2010). The current study demonstrated that covariates themselves (i.e., hopelessness/ sadness, disordered eating
behavior) can account for more variance in suicidal behavior than physical activity or sports team participation, offering support for the importance of accounting for these variables in future regression model investigations.

Additional research is also needed to investigate the temporal and causal relationships between physical activity and suicidality (Brown et al., 2007). Investigations of causality cannot be conducted using cross-sectional data like the one used in the current study; longitudinal research designs would allow for such investigations by monitoring youth who exercise, participate on sports teams, and report suicidal behavior over time. Longitudinal research designs would also help to illuminate the direction of causality between these variables and any differences in their protectiveness for various demographic groups.

**Implications for Practice**

Adolescents who engage in aerobic activity have been found to have enhanced cognitive functioning (Haskell et al., 2007; Hillman, Erickson, & Kramer, 2008; Warburton et al., 2006), academic achievement (Fox et al., 2010), less school disconnectedness (Faulkner et al., 2009), improved physical health (Warburton, Nicol, & Bredin, 2006), and alleviation of depressive disorders and symptoms (Goodwin, 2003; Nabkasorn et al., 2005; Sacker & Cable, 2005). The current study corroborates previous findings for males but not females (Brown et al., 2007; Taliaferro et al., 2008a) that increases in physical activity are also associated with statistically significant decreases in adolescent male suicidal behavior. Given these findings, promotion of opportunities to engage in and commit to opportunities for physical activity seems warranted. Students, families, and school and community personnel may wish to expand opportunities for
physical activity that increase heart rate and breathing for at least 60 minutes per day. Efforts that link physical activity to positive mental health outcomes (and related mental health initiatives) may help to make the case for their regular inclusion in school and community activity offerings.

The nonsignificant relationship between sports team participation and suicidality in this study should not be interpreted as discounting the other possible positive or negative effects of sports team membership for adolescents. Students, families, and school personnel should be aware that sports team participation is considered to be one form of Structured Extracurricular Activities (SEAs). SEAs have been shown to benefit youth at risk for depression and suicidal behavior via enhanced social connectedness with peers and adults, improved self-esteem, and engagement in productive activities (Hansen, Larson, & Dworkin, 2003; Parfitt & Eston, 2005). It is possible that SEAs may also promote other factors associated with reduced risk for adolescent suicidal behavior, including family connectedness (Cheng et al., 2009; Eisenberg, Ackard, & Resnick, 2007; Kaminski et al., 2010), perceived family support (Randell et al., 2006), perceived parental involvement, consistent school attendance (Cheng et al., 2009), connectedness with school (Kaminski et al., 2010), positive relationships with school personnel and other adults (Lubell & Vetter, 2006; Toumbourou & Gregg, 2002), social problem solving, help-seeking, an active coping style (Berman et al., 2006; Roberts et al., 2010), self-esteem, and social support from peers and parents (Sharaf, Thompson, & Walsh, 2009). This study found a nonsignificant relationship between sports team participation and suicidality, but did not investigate other possible positive outcomes of sports team participation such as those described here as being promoted through SEA participation.
In terms of determining adolescent suicide risk, it should be noted that there is no evidence to suggest that lack of exercise or sport team membership are risk factors for suicide. Instead, it may behoove students, families, and school personnel to be aware that the presence of at least one mental health disorder (Fleischmann et al., 2005; Joiner, 2010; Mazza, 2006) and the occurrence of previous suicidal behavior (Borowski, 2001; Joiner et al., 2005) are variables much more clearly associated with future suicidal behavior. Furthermore, current guidelines for assessing imminent suicide risk should be shared and utilized, especially in schools, where prevention efforts offer great promise.

Finally, school personnel should be encouraged to offer wellness promotion programs and activities that focus on preventing a variety of health problems through reducing risk factors and increasing protective factors (Kaplan, 2000; Mcloughlin & Kubick, 2004). These programs can effectively promote both physical and mental health, thereby potentially decreasing the risk for youth suicidal behavior.

Conclusion

The current study used 2011 YRBSS data to examine physical activity and sports participation as predictors of adolescent suicidal behavior. Descriptive statistics from the 2011 YRBSS dataset were supportive of previous findings (Eaton et al., 2006) on the prevalence of suicidal behavior and the frequencies of exercise and sports participation among adolescents. This study revealed that increases in male physical activity accounted for significant decreases in suicidal behavior, when accounting for the roles of gender, age, hopelessness/sadness, and disordered eating behavior. This was not found for females. Sports team participation was not related to suicidality for males or females. Consideration of covariates resulted in an improved understanding of the relationship
between physical activity, sports team participation, and adolescent suicidal behavior. In fact, the covariates of hopelessness/sadness and disordered eating behavior were found to account for even greater changes in suicidal behavior than physical activity itself.

This study updated and expanded the existing body of empirical knowledge regarding protective factors for the occurrence of adolescent suicidal behavior. It outlined several noteworthy methodological improvements that future researchers may wish to utilize, and it shed light on the role of covariates in the relationship between physical activity, sports team participation, and suicidal behavior in high school students. For males in the current sample, increased physical activity was associated with reduced suicidal behavior. Furthermore, hopelessness/sadness was associated with less suicidality and disordered eating behavior was associated with more suicidality for the current sample. Continued investigation of the mechanisms through which protective factors may be inversely associated with suicidal behavior is warranted, given the significance of youth suicidal behavior as a significant and ongoing public health problem.
References


http://www.cdc.gov/ncipc/wisqars/default.htm

http://webappa.cdc.gov/sasweb/ncipc/leadcaus10_us.html


Suicide & Life-Threatening Behavior, 35(3), 239-250. doi: 10.1521/suli.2005.35.3.239


http://store.samhsa.gov/shin/content//SMA01-3517/SMA01-3517.pdf


