ABSTRACT

OTTEM, RANDOLPH ADRIAN. Estimating the Impact of Traditional Bullying Victimization in High School on Academic Achievement. (Under the direction of Dr. Stephen Porter).

Although reports suggest that rates of bullying victimization in U.S. schools is in decline (Musu-Gillette, Zhang, Wang, Zhang, & Oudekerk, 2016), research continues to demonstrate that the harmful effects of bullying persist beyond the victimization, resulting in lower levels of academic achievement (Hanish & Guerra, 2002; Ponzo, 2013) and diminished human capital accumulation (Brown & Taylor, 2008; Drydakis, 2014). However, most research to date does not account for differences between the characteristics of bullied and non-bullied students that may affect both the probability of bullying victimization and academic outcomes. To address different probabilities of being a victim of bullying, this study uses inverse probability weights (IPWs) to estimate the effects of bullying victimization on student outcomes.

This study uses data from the Education Longitudinal Study of 2002 (ELS), which includes individual characteristics of the students and their families, as well as longitudinal student outcomes. This study includes approximately 9,300 students, from all 50 states and the District of Columbia, who were in grade 10 during academic year 2001–02. Three types of models were run to test the relationship between bullying victimization and academic outcomes: (1) bivariate regression models without IPWs, (2) bivariate regression models with IPWs estimated using only exogenous covariates, and (3) bivariate regression models with IPWs estimated using exogenous and possibly endogenous covariates. These models tested outcomes including self-efficacy in mathematics, scores on a mathematics assessment, GPAs

in grades 11 and 12, high school graduation, and immediate enrollment in postsecondary education.

Results of the bivariate regression models without IPWs indicate that female students bullied at least once exhibited lower levels of mathematics self-efficacy ($d = -0.135$), lower scores on the mathematics assessment ($d = -1.479$), GPA in grade 11 ($d = -0.106$), and GPA in grade 12 ($d = -0.110$). Female students bullied more than twice also exhibited lower levels of mathematics self-efficacy ($d = -0.276$), lower scores on the mathematics assessment ($d = -3.376$), GPA in grade 11 ($d = -0.260$), and GPA in grade 12 ($d = -0.210$). No significant results were noted for high school graduation or immediate enrollment in postsecondary education.

Results of the bivariate models with IPWs indicate that the academic outcomes among male and female students who reported being bullied are not significantly different from students who reported no bullying victimization. Implications of the current study and directions for future research are also discussed.

Estimating the Impact of Traditional Bullying Victimization in High School on Academic Achievement

by
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BIOGRAPHY

Randolph A. Ottem was born in San Diego, California, and grew up in California, Arizona, and New Mexico. He received bachelor's and master's degrees in Criminal Justice from Northern Arizona University in 1998 and 2002, respectively. Despite having little experience in the field of education beyond being a student, he was fortunate to be hired to work in the Education and Workforce Development at RTI, International in 2004. After working in education research for seven years, he decided to go back to school, enrolling in the Educational Research and Policy Analysis program at North Carolina State University in the fall of 2011.

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CHAPTER 1

INTRODUCTION

Schools tend to represent safe places for most students. The pervasiveness of bullying victimization, however, suggests that bullying is common in schooling, not only in the United States, but across the globe as well. In fact, "bullying is now recognized as a widespread and often neglected problem in schools around the world, and one that has serious implication for children who are victimized by bullies" (Swearer, Espelage, Vaillancourt, & Hymel, 2010, p. 38). The 2015 Indicators of School Crime and Safety report suggests that incidents of bullying occurred at least weekly at approximately 16 percent of public schools reported during academic year 2012–13, and that rates of bullying among students aged 12 to 18 declined by seven percent between 2005 and 2015 (Musu-Gillette et al., 2016). Until rates of victimization are minimized, the effects of bullying victimization on academic achievement should remain a focus area.

Several high-profile cases, such as the shooting at Columbine High School in 1999, made issues of school violence, including bullying victimization, a part of the national discourse on education. While these cases are tragic, they often do not represent the true nature of bullying victimization due to both the extreme violence and the heavy media attention afforded them (Limber, Olweus, & Luxenberg, 2013). Prior to 2001 the majority of the studies on bullying victimization and its detrimental effects were conducted outside of the U.S. (Nansel et al., 2001). However, the number of studies of school violence in the U.S. has increased since the Columbine High School shooting in 1999 (Wong & Schonlau, 2013).

The relationship between bullying victimization and academic achievement is complex due to the factors that determine both who becomes a bully and who becomes a

victim. The study of bullying victimization is further complicated because the definition of bullying is somewhat is subjective, which suggests that some research labels certain behaviors as bullying behaviors, while others do not (Olweus, 1993).

The literature views the phenomenon of bullying victimization through a psychological, sociological, or social-ecological perspective. These perspectives describe and explain the characteristics of the perpetrators, the victims, or the relationship between the two. Psychological studies often examine the effects that bullying has on victims, such as changes in levels of psychological distress and how victims use various coping strategies. Studies taking psychological or sociological perspectives have found that bullying victims are more likely to have low self-esteem (Limber et al., 2013), suffer from emotional distress and social marginalization (Buhs & Ladd, 2001; Juvonen, Graham, & Schuster, 2003; Turner, Exum, Brame, & Holt, 2013), and bring weapons to school (Dukes, Stein, & Zane, 2010; Glew, Fan, Katon, & Rivara, 2008).

The social-ecological perspective "offers a holistic view of bullying, but within this framework are situated process-oriented theories of attitude and behavior change in children and adolescents" (Swearer et al., 2010). Simply put, a social-ecological perspective views bullying victimization as the result of the contextual interactions between students and their surroundings, such as school and home environments and each other (Swearer et al., 2010; Thornberg, 2015b).

Across social science perspectives, bullying victimization may lead to subsequent lasting negative psychological effects on the student, that may in turn diminish both academic achievement (Hanish & Guerra, 2002; Ponzo, 2013) and human capital

accumulation over the course of the victim's lifetime (Brown & Taylor, 2008; Drydakis, 2014).

The negative effects of bullying victimization may also extend beyond victimized students to affect education production through peer effects (Oreopoulos, Brown, & Lavecchia, 2014). In some cases, victimization leads to students with "aggressive behavior, delinquency, and attention problems" (Hanish & Guerra, 2002, p. 86), and as the number of such students in a class increases, academic achievement of the all students in that class decreases (Carrell & Hoekstra, 2010; Figlio, 2005; Zimmer & Toma, 2000). Victimized students may disrupt the learning process for his or her classmates by acting out in class; however, the disruptions may also be subtle. For instance, victimized students who are disengaged from the learning process may require more personal attention from the teacher, which means less time for instruction for the other students in the classroom. Therefore, when victimized students are in the classroom, there is a chance that their presence alone will lower the academic achievement of the all students in the classroom.

The economic returns to education are well documented. For example, students who take algebra and geometry in high school (H. Rose & Betts, 2004), and those who obtain an associates degree (Jepson, Trotske, & Coomes, 2014) earn a higher salaries than students who do not take algebra or geometry, or those who do not obtain a degree higher than a high school diploma. It is, therefore, important to advance the understanding about how certain aspects of education production, such as bullying victimization, may diminish these returns. Developing a deeper understanding about the characteristics of the perpetrators and victims of bullying is key to curbing bullying behaviors in schools and remedying negative effects of victimization.

Purpose of the Study

It is important to examine the effects of bullying on academic outcomes so appropriate actions can be taken to address any diminished academic achievement resulting from bullying victimization. Many studies use cross sectional data to examine characteristics of bullying victims, which makes examining the causal direction of key characteristics difficult. The purpose of this study, therefore, is to investigate the impact of bullying victimization on several academic outcomes, including (1) student attitudes about their own academic abilities, (2) scores on a low-stakes mathematics assessment, (3) grade point averages, (4) high school graduation, and (5) immediate enrollment in postsecondary education. This current study will add to the literature on bullying victimization by answering this research question: What are the longitudinal impacts of bullying victimization on academic outcomes after applying inverse probability weights to account for differences between bullied and non-bullied students?

Bullies choose victims who they perceive as different, weaker, and unlikely to fight back (F. D. Adams & Lawrence, 2011; Peguero & Williams, 2013; Smith, Madsen, & Moody, 1999). Therefore, bullying victimization is not a completely stochastic process (Juvonen & Graham, 2014); targeted students have a higher probability of victimization than those who are not targeted. In addition to the victimization, the identifying characteristics of bullied students, such as parental involvement (Anaya, Zamarro, & Stafford, 2017; Atik & Güneri, 2013; Park, Stone, & Holloway, 2017) and socioeconomic status (Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011), may also explain differences observed in outcomes. In the current study, I used statistical weights based on the inverse

probability of bullying victimization to address the non-random nature of bullying victimization.

Significance of the Study

This study is significant because bullying victimization often has long-lasting negative effects and victims suffer the damaging consequences of bullying after the bullying ends (F. D. Adams & Lawrence, 2011; Juvonen & Graham, 2014). Research suggests that a relationship exists between the maltreatment and (1) a lower grade point average and (2) difficulty completing homework assignments (Slade & Wissow, 2007). The effects of bullying victimization during elementary and secondary school years may continue beyond high school graduation and into the college setting (R. E. Adams, Bartlett, & Bukowski, 2010). For example, victims of bullying are more likely to be depressed by age 23, compared with students who were never bullied (Nansel et al., 2001).

Few studies on the effects of bullying victimization use the appropriate statistical methods to address the selection bias associated with the differential likelihoods of bullying victimization. In random assignment, there is an expectation that treatment and comparison groups will appear similar across observable and unobservable characteristics (e.g., the proportion of female students in treatment group will be similar to the proportion of females in the comparison group). Austin (2011) states that "treatment selection is often influenced by subject characteristics. As a result, baseline characteristics of treated subjects often differ systematically from those of untreated subjects" (p. 400). When characteristics are different at baseline, those characteristics, in addition to the treatment, may produce differences observed between the outcomes of the treatment and comparison groups. Statistical methods,

such as propensity score matching and inverse probability weighting, may reduce selection bias.

Without such statistical methods, studies on bullying victimization are often limited to reporting descriptive and inferential statistics (Wong & Schonlau, 2013). The current study adds to the bullying victimization literature by using inverse probability weights to reduce the selection bias associated with a nonrandom treatment assignment. This study then estimates the extent to which bullying victimization in grade 10 affects academic outcomes through the end of high school and into postsecondary education.

Overview of the Current Study

To answer the research question, this study uses data from the Education Longitudinal Study of 2002 (ELS), which includes both student- and school-level data. The core of the ELS data file comprises survey data collected from students who were in grade 10 during the academic year 2001–02. The ELS data file also includes survey data from parents and school administrators, teachers, and librarians. The students who participated in the base year data collection in 2002 also participated in up to three additional follow-up data collections. The data file also includes measures of academic achievement, including

- math and reading assessment data, collected specifically for ELS;
- grade point averages for each year in high school;
- high school graduation outcomes; and
- data on postsecondary enrollment.

The current study uses inverse probability weights to address selection bias among the sampled students to estimate the impact of bullying victimization on measures of academic achievement. To create these weights, this study identified observational

characteristics in the bullying victimization literature to estimate the probability of each student to be bullied. Students who have not been bullied but who have a greater likelihood of bullying victimization are weighted more heavily than those with a lesser likelihood of bullying victimization. The process of weighting transmogrified the data such that the group of non-bullied comparison students resembles the groups of bullied students on important observable characteristics, such as sex, race and ethnicity, and socioeconomic status.

For the purpose of this study, I use the definition of bullying described by Volk, Dane, & Marini (2014), which states "bullying is aggressive goal-directed behavior that harms another individual within the context of a power imbalance" (p. 328). The definition includes three main points:

1. Aggressive goal-directed behaviors. The aggressive behavior has an intent that is proactive, rather than reactive.
2. Power imbalance. The bully is more powerful, either physically or socially, than the victim.
3. Harm. The intent of the bullying is to cause harm for the sake of causing promoting the reputation of the bully or diminishing the reputation of the victim. Harm also suggests that repetitive bullying victimization is more harmful than a single instance.

Limitations

Despite the comprehensiveness of the data used in the current study, there are a few limitations that must be considered when interpreting the results herein. First, the ELS did not collect data on some characteristics of bullying victims identified in the literature as affecting bullying victimization, including height, weight, and other physical characteristics.

Thus, results possibly suffer from omitted variable bias because the models used to estimate the probability of bullying victimization do not include all factors that predict bullying victimization.

Second, the ELS student questionnaire did not provide a definition of bullying for the student sample. The student questionnaire asked "In the first semester or term of this school year, how many times did any of the following happen to you? Someone bullied me or picked on me." Because this questionnaire item provided neither a definition of bullying, nor a list of behaviors that constitute bullying, students defined bullying given their own understandings of bullying. This is problematic when interpreting subsequent results, because students will likely not have used the same definition for bullying. As a result, the current study defines bullying in broad terms based on the assumption that the student participating in ELS likely had varying definitions of bullying.

The third limitation results from the timing of treatment variable and the covariates used to estimate the probability of bullying victimization. The use of inverse probability weights is valid when the treatment in question—bullying victimization in this instance—is exogenous to the covariates used to estimate the probability of receiving the treatment. This study includes several possibly endogenous covariates. One example of a covariate that is possibly endogenous to the treatment assignment is the number of friends. While some research suggests that friends may provide a buffer against bullying victimization, research also suggests that classmates may ostracize victims of bullying. While the former suggests that the number of friends predicts the probability of bullying victimization, the latter suggests that bullying victimization predicts the number of friends. This study is unable to determine whether a student has few friends is more likely to be bullied or the student has

few friends because he or she was a previous victim of bullying. To address this confounding factor, I ran each model first including only a set of exogenous predictor covariates. Then I ran the models again including the set of exogenous and a set of possibly endogenous variables.

The final limitation is that some students in this sample may have a history of bullying victimization prior to reporting being bullied in grade 10. Depending on when these students were bullied, grade 9 GPA in the propensity score models may be endogenous to the treatment. For example, if a student was bullied in grades 9 and 10, then GPA in grade 9 may not be exogenous covariate. I chose to leave grade 9 GPA in the all models (i.e., exogenous only, and exogenous and possibly endogenous covariates) because prior academic achievement is important predictor of both the bullying victimization and academic outcomes. In addition, research suggests that GPA interacts with other covariates used to predict bullying victimization, such as race and ethnicity and socioeconomic status.

Summary

This study uses inverse probability weights to correct the selection bias due to a non-random treatment (i.e., bullying victimization) among students to estimate the impact of bullying victimization on academic outcomes. In chapter 2, I provide a review of the bullying victimization literature. I then present in chapter 3 a detailed description of the statistical methods I used to address the research question. I present the results of the analyses in chapter 4. Lastly, I discuss in chapter 5 the implications of this research, limitations of the study, and directions for future research work.

CHAPTER 2

LITERATURE REVIEW

Research consistently demonstrates the negative effects of bullying victimization. Victims of bullying exhibit higher levels of depression and anxiety (Espelage & Swearer, 2003; Juvonen & Graham, 2014; Stapinski, Araya, Heron, Montgomery, & Stallard, 2015) and lower levels of self-esteem (Kowalski & Limber, 2013) and self-efficacy (Andreou, Vlachou, & Didaskalou, 2005). Bullied students may cause disruptions in their classrooms, which may in turn extend negative effect on the classmates of victimized students (Carrell & Hoekstra, 2010; Figlio, 2005; Zimmer & Toma, 2000), or victims of bullying may avoid school altogether (Hutzell & Payne, 2012; Juvonen & Graham, 2014).

The term bullying describes several, often dissimilar, behaviors from engaging in physical violence to spreading rumors. As such, definitions about what constitutes bullying vary across the literature. The first section in this review begins with a discussion about the various definitions of bullying victimization in the literature. The second section then reviews the literature to identify student- and school-level characteristics that may increase the likelihood of bullying victimization. The third section discusses the research conducted on the relationship between bullying victimization and academic achievement.

Definitions of Bullying

The term bullying comprises a range of distinctive behaviors; there is no single, all-inclusive definition of bullying found in the literature. Definitions of bullying generally refer to aggressive behaviors of one person (i.e., the bully) directed at another (i.e., the victim) with the intent of causing physical, psychological, or social harm (Eslea & Mukhtar, 2000; E.

R. Hong, Neely, & Lund, 2014; Schmidt & Bagwell, 2007; Volk et al., 2014; Woods & Wolke, 2004).

While definitions of bullying vary across the literature, most studies do include the most salient points about what constitutes bullying behaviors. The central theme of most definitions is that bullying comprises aggressive behaviors that are intentionally perpetrated by a stronger individual or group against a weaker individual. Definitions of bullying tend to differ in the details of bullying behaviors. For example, definitions may specify that victimization occurs more than once over time; however, not all definitions specify such a requirement. Other details, such as specifying the type of bullying—for example, whether the bullying is direct or indirect—may be included when required by the study.

Given the variation among definitions of bullying used in the literature, a similar amount of variation exists among the definitions provided to participants of bullying research. For example, Gregory, Huang, and Fan (2011) conducted a survey of students in grade nine as part of the Virginia High School Safety Study (VHSSS). The survey questionnaire presented students with a definition of bullying, which was a direct quote from Cornell (2011, p. 1)

> Bullying is defined as the use of one's strength or status to injure, threaten, or embarrass another person. Bullying can be physical, verbal, or social. It is not bullying when two students of about the same strength argue or fight. (p. 142)

While the wording of the definition includes the intent of the bully, the types of behaviors, and asymmetric power relationships between the bully and victim, it lacks a requirement that bullying occurs multiple times. The questionnaire, however, asked if the victimization occurred in the prior month, and response options included, never, once or

twice, about once per week, and several times per week, so the questionnaire did collect limited data about repeated victimizations.

Studies do not always provide a definition of bullying behaviors when collecting data on bullying victimization, leaving study participants to define bullying for themselves. For example, the study that provides the data for the current research, the Education Longitudinal Study of 2002 (ELS), asked participants to indicate whether they had been a victim of bullying or had been picked on during the previous semester. The ELS student questionnaire did not include a definition of bullying behaviors and required students to make their own interpretation about the meaning of bullying.

There are three overarching concepts that researchers may use to define bullying. First, there is an asymmetric power relationship (Olweus, 1993, 1995), such as a stronger or more popular bully and a weaker or less popular victim. Second, bullying aggression occurs frequently over time. Third, bullying is "goal-directed" (Volk et al., 2014, p. 329). Definitions of bullying do not always explicitly each of these concepts, which may lead to some ambiguity about how a study framed bullying.

Definitions of bullying often suggest that a power differential, or asymmetric power relationship, exists between the bully and the victim (Olweus, 1993, 1995). Juvonen and Graham (2014) state that "bullying involves targeted intimidation or humiliation. Typically, a stronger or socially more prominent person (a)buses her/his power to threaten, demean, or belittle another" (p. 161). This asymmetric power relationship distinguishes bullying from other types of non-bullying, proactive aggressions (Volk et al., 2014). In this context, the act of bullying weaker students serves to increase the bully's interpersonal dominance over the

victim (Espelage & Swearer, 2003), or to increase the bully's social status among his or her friends (Hanish, Kochenderfer-Ladd, Fabes, Martin, & Denning, 2004).

Definitions may also stipulate that bullying transpires when such harmful acts happen over a period of time. For example, Bejerot and Mörtberg (2009) define bullying as "repeated physical or verbal interactions" (p. 170) and Nansel et al. (2001), suggest that "bullying is a specific type of aggression in which...occurs repeatedly over time " (p. 2094). However, even a single harmful act coupled with a power differential may affect the victim for some time after the incident due to the fear of additional harmful acts (Juvonen & Graham, 2014). In turn, even a single bullying incident may undermine the victim's "ability to attend to, and focus on, academic tasks, especially following a bullying episode or after being threatened with an imminent attack" (Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010).

Volk, Dane, & Marini (2014) state that the third component is that bullying is "goal-driven." This term suggests that there is intention behind an act of bullying to cause interpersonal harm or hostility to the victim, or to disturb the victim (Bejerot & Mörtberg, 2009; Nansel et al., 2001; Ponzo, 2013; Swearer et al., 2010; Volk et al., 2014).

In sum, this study views bullying as harmful, aggressive behaviors committed by a stonger student or group of students against a weaker student. The purpose of bullying behaviors is proactive and serves to increase the social status of the bullies or lower the status of the victims.

Types of Bullying Behaviors

Bullying behaviors typically fall into one of two categories: direct and indirect bullying. Direct bullying refers to physical aggression, such as fighting (Berthold & Hoover, 2000; Glew et al., 2008; Hammig & Jozkowski, 2013; Peguero, 2009a, 2011; Peguero &

Williams, 2013); and verbal aggression, such as humiliating, ridiculing, and threatening behaviors (Juvonen, Nishina, & Graham, 2000). Indirect bullying, sometimes referred to as relational bullying, describes nonviolent, exclusionary behaviors, such as spreading rumors, sabotaging reputations, and ostracizing others (Patton, Hong, Williams, & Allen-Meares, 2013; Putallaz, Grimes, Foster, Kupersmidt, & John, 2007; Toblin, Schwartz, Hopmeyer Gorman, & Abouezzeddine, 2005; Williams & Peguero, 2013).

In addition to direct and indirect bullying behaviors, some studies also include sexual harassment as a third type of bullying (Patton et al., 2013). Researchers often consider cyberbullying, a relatively new phenomenon, as a separate classification altogether (Kowalski & Limber, 2007, 2013; Merrill & Hanson, 2016). The current study does not consider sexual harassment as a separate type of bullying. It also does not consider cyberbullying separately, because the data used in the current study cover a period of time before cyberbullying was as prevalent as it is now.

Definitions of bullying may also differ among the types of behaviors that constitute bullying. For example, a bystander may not be able to discern whether a fight between two students stems from a simple interpersonal disagreement or from a history of aggressive, violent acts between a stronger student and a weaker student. The American Educational Research Association (AERA, 2013) suggests that even acts of victimization stemming from gang or other criminal activities may fit the strictest definitions of bullying. As such, AERA (2013) recommends that, "since it is not fully clear to what extent [non-bullying] victimization and bullying overlap, the public and researchers should assess both victimization and bullying behaviors" (p. 7).

Characteristics of Bullying Victims

Although the relationship between bullies and victims is complex, observable characteristics may jointly identify students who have a higher probability of bullying victimization including student-level demographics. Research also suggests that observable school-level characteristics, such as the size and diversity of the student population, the school locale, and school climate, may also affect the probability of bullying victimization. Certain characteristics, such as personality traits and physical characteristics may not be directly observable using survey data. For instance, research suggests that students have a higher probability of victimization when their physical appearance is different from other students (Thornberg, 2015a). Other factors that may increase the risk of bullying victimization, such as height and weight, can only be collected through specific data collection instruments (Voss & Mulligan, 2000). The following sections describe the constructs that may predict bullying victimization.

Sex

The probability of bullying victimization differs between male and female students. For example, female students experience bullying victimization at lower rates than their male counterparts (Berthold & Hoover, 2000; Carbone-Lopez, Esbensen, & Brick, 2010; Demaray & Malecki, 2003; Nansel et al., 2001; Peguero, 2011; Popp, Peguero, Day, & Kahle, 2014; Seals & Young, 2003). Berthold and Hoover (2000) found that about 42 percent of male students reported being bullied, whereas approximately 30 percent of female students also reported being bullied. Male students are also more likely than female students to suffer repeated victimizations over time (Hanish & Guerra, 2000).

Other research suggests that the nature of the relationship between sex and bulling victimization has changed over the past decade. Specifically, bullying victimization increased among females from approximately 21 percent in 2009 to 25 percent in 2015 (Pontes, Ayres, Lewandowski, & Pontes, 2018). During the same time, bullying victimization decreased among males from approximately 19 to 16 percent. Other studies found that 18 percent of male students reported bullying victimization in the past 12 months, compared to 20 percent of female students (Hammig & Jozkowski, 2013).

Bullying victimization rates for both sexes tend to peak during the middle grades (i.e., in grades six through eight). Rates of direct bullying tend to decrease thereafter among female students, but increase thereafter among male students (Dukes et al., 2010). However, other research suggests that the rates of bullying victimization among females decline steadily between grades 3 and 12, while the rates for males decline until grade 10 where and remain steady in grades 11 and 12 (Limber et al., 2013).

Bullying victimization tends to affect academic achievement differently based on the sex of the victim. While indirect bullying victimization tends to affect the academic achievement of male and female students equally (Hammig & Jozkowski, 2013), direct bullying tends to have a larger negative impact on the academic achievement of female students than male students (Popp et al., 2014).

Race and Ethnicity

The majority of research on the relationship between race and bullying victimization often suggests that White students are more likely to be victims of bullying than Black, Hispanic, Asian, and Native American students (Glew et al., 2008; Hanish & Guerra, 2000; Kann et al., 2014; Pontes et al., 2018; Williams & Peguero, 2013). The Indicators of School

Crime and Safety, however, reports that 25 percent of Black students, 22 percent of White students, and 17 percent of Hispanic students reported bullying victimization in 2015 (Musu-Gillette et al., 2016) .

Other student characteristics affect the relationship between race and bullying victimization. For example, Peguero and Williams (2013) found that students who break racial stereotypes were victims of bullying more often than students who meet racial stereotypes. The authors suggest that high achieving Black students, and Black students who did not participate in interscholastic sports, were more likely to experience to be bullied. Asian and Hispanic students who did participate in interscholastic sports, on the other hand, were more likely to be bullied. The differences in victimization rates, however, may be attributed to differences in rates of reporting victimizations. For example, research suggests that Black and Hispanic students may be less likely to report bullying victimization than White students (Williams & Peguero, 2013).

Students in certain racial groups may experience bullying differently based on the region of the United States in which they live. For example, the odds of being a victim of interpersonal violence at school was significantly higher for Latino students living in the Midwest, and Asian students living in the Northeast, while the odds of such victimization was lower among Asian students living in the Midwest (Peguero, 2009a).

English Language Learners

The level of fluency among students who recently came to the U.S. from a non-English speaking country may be more likely to be the victims of bullying. Recent immigrants, the children of recent immigrants, and English language learners in general are

bullied more often by classmates due to an increased difficulty assimilating into the school culture and the local community (Figlio, 2005; Peguero, 2009b; Ponzo, 2013).

Students with Disabilities

Research on bullying victimization among special education students tends to exclude students from the general population, making it difficult to compare the two types of students. The findings from such studies cannot be extrapolated to the larger population. Among the studies with both disabled students and students from the general school population, however, special education students and students with disabilities are more likely to be victimized than students in general school populations (C. Rose, Espelage, Aragon, & Elliott, 2011; Swearer, Wang, Maag, Siebecker, & Frerichs, 2012). Compared to students in the general population, students in special education are more likely to be victims of direct bullying, no more likely to be victims of indirect bullying, and more likely to be bullied repeatedly with a greater frequency of victimizations (Hartley, Bauman, Nixon, & Davis, 2014).

The type of disability may be a factor for predicting which students are more likely to be victimized. Students who had disabilities affecting their social skills had a greater risk of being bullied than students with disabilities not affecting social skills (Bejerot & Mörtberg, 2009). Autistic students specifically have an increased risk of being bullied than students who are not autistic. Similarly, students with visually observable disabilities may be more likely to be victims of bullying than students in the general population or students whose disabilities are not visually observable (Swearer et al., 2012). Like the relationship between friendship networks and victimization, students with disabilities are also more likely to be

bullied when they may lack the skills to keep close friends or to avoid the situations that might lead to bullying victimization (C. Rose et al., 2011).

Early Childhood Education

Although research has not focused directly on the relationship between early childhood education and bullying victimization during adolescence, participation in early childhood education programs may affect the likelihood that students will be bullied later in their academic careers. Programs such as Head Start, preschool, and kindergarten often contribute to the foundation of social skills and interpersonal behaviors (Deming, 2009; J. Heckman, Pinto, & Savelyev, 2013). For example, students who attend an early childhood education program often have better social-emotional outcomes than students who do not. Research suggests that students who participated in early childhood education are less likely to be held back and less likely to be placed in special education programs in high school (McCoy et al., 2017). It is possible that the benefits of early childhood education could also reduce the probability of bullying victimization.

Academic Achievement

Research demonstrates a correlation between bullying victimization and lower academic achievement. However, studies are often unable to determine the direction of a causal relationship between victimization and academic achievement. Specifically, lower levels of academic achievement, such as grade point average, may be either the cause or the effect of bullying victimization (Hammig & Jozkowski, 2013; Iyer et al., 2010; Wienke Totura et al., 2008).

There is a lack of research on the relationship between academically advanced students and bullying victimization. Although gifted students are no more likely to be victims

of bullying than other high-achieving students (Peters & Bain, 2011), there is no research to date investigating the differences in rates of bullying victimization between gifted or high-achieving students and students who are not considered academically advanced.

Academic achievement may affect the likelihood of bullying victimization differently based on other characteristics, such as race and ethnicity. Gifted or academically advanced Black and Hispanic students, for example, may have greater risk of bullying victimization (Williams & Peguero, 2013). Consequently, these students may underperform academically to avoid accusations of "acting White" (Horvat & Lewis, 2003).

To date, very little research has investigated the effect of grade retention on bullying victimization. On such study found that students who were held back at least one grade are more likely to be victims of bullying (Crothers et al., 2010). Crothers et al. (2010) also propose that late-entry students are also more likely to experience victims of bullying. This suggests that the mechanism driving victimization is more about the fact that the student is considered old for their grade level than it is about grade retention specifically.

Family Composition

Although not researched directly, the composition of the student's family may affect the probability of bullying victimization. For example, students who live in single parent households may be more likely to be victims of bullying than students from two-parent households. Similarly, students who have more siblings may be more likely to be victims of bullying than students with fewer siblings. In each of these examples, single parent households and the number of siblings living in the household may affect a student's probability of bullying victimization due to an overall reduction in available parenting resources (Downey, 1995).

Socioeconomic Status

The relationship between socioeconomic status and bullying victimization is not fully understood. While studies have indicated that students from low-income families are more likely to be victims of bullying behaviors than students from higher-income families (Glew et al., 2008; Ponzo, 2013), studies have also found no relationship between socioeconomic status and bullying victimization.

Extracurricular Activities

Participation in certain extracurricular activities may affect the probability of bullying victimization. For example, students participating in band, chorus, and student government tend to have a higher probability of bullying victimization, whereas student-athletes tend to have a lower probability of bullying victimization (Peguero, 2008). Dane-Staples, Lieberman, Ratcliff, & Rounds (2013) suggest that the confidence that students develop by participating in sports accounts for the difference in the rates of bullying victimization across different types of extracurricular activities.

Interpersonal Relationships

Building and maintaining friendships is a critical aspect of childhood development. Students who have few friends are more likely to be victims of bullying than students with more friends (Bollmer, Milich, Harris, & Maras, 2005; Boulton, Trueman, Chau, Whitehand, & Amatya, 1999; Estell et al., 2008; Hugh–Jones & Smith, 1999; Kendrick, Jutengren, & Stattin, 2012; Schmidt & Bagwell, 2007; Wang, Iannotti, & Nansel, 2009). Research on the impact of friendship networks suggests that the level of protection provided by friendships may be due to the quality, or strength, of the friendships, rather than the quantity of friends.

Students who do not have a best friend are more likely to be bullied than students who do have a best friend (Boulton et al., 1999; Hodges, Boivin, Vitaro, & Bukowski, 1999).

The friendship protection hypothesis put forth by Boulton et al. (1999) suggests that friendships provide a buffer between bullies and potential victims. How friendships affect a student's likelihood of being victimized, however, is not well understood. Hodges et al. (1999) state that "when a friend is being victimized, some friends may respond by telling the teacher, whereas others may respond by fighting back" (p. 99). The possibility exists, therefore, that while friendships may not provide a buffer against a single victimization, they may provide a buffer against repeated victimization. Whether the protection provided by friendships is due to the quantity or the quality of a student's friends, victims of bullying generally perceive less support from their peers (Demaray & Malecki, 2003). Similarly, students with higher levels of perceived support from friends exhibited lower levels of bullying victimization (Kendrick et al., 2012).

The absence of a friendship network or a best friend may be a proxy for students with underdeveloped social skills. Hong and Espelage (2012) suggest that students who are bullied may lack the appropriate social skills to mitigate peer conflicts and avoid peer rejection. Further, bullies may target victims who appear socially isolated or lacking social skills (Cook, Williams, Guerra, Kim, & Sadek, 2010; Nansel et al., 2001), because bullies who victimize students with friends risk retaliation or other sanctions, such as being reported to school officials, whereas students with few or no friends may be seen as posing less of a risk to the bully (Pelligrini & Long, 2003, Chapter 6, Section 4, para. 5).

In terms of interpersonal relationships, family dynamics may also affect the probability of bullying victimization. Relationships between parents and their children can

serve as either a strong source of stress or a strong source of support (Murray-Harvey & Slee, 2010), which suggests that a student's home environment may be predictive of lower levels of bullying victimization (Eriksen, Nielsen, & Simonsen, 2014). Students from dysfunctional homes are more likely to be bullied, especially when the source of the dysfunction is parents who provide an insufficient level of communication and a lack of teaching appropriate problem solving skills (Eşkisu, 2014). Overall, students who have a higher level of attachment to their parents are less likely to be victims of bullying (Cook et al., 2010; Fite, Cooley, Williford, Frazer, & DiPierro, 2014; King, 2006; Ledwell & King, 2013; Wang et al., 2009).

High School Characteristics

The relationship between several school-level covariates and bullying victimization is uncertain. Juvonen and Graham (2014) highlight how very little is known about the school-level characteristics that aggravate or mitigate bullying behaviors within the school setting. One explanation might be a lack of consistent results across the literature. Another explanation may be because researchers often conceptualize school-level characteristics as controlling variables. As such, there are very few findings for school-level characteristics in the literature, and fewer explanations about how such characteristics affect bullying victimization.

The possibility exists that school-level characteristics promote or discourage bullying behaviors among students (Juvonen & Graham, 2014). School-level covariates can control for specific school characteristics that may also impact academic outcomes. The fundamental school-level covariates of interest include

- school size;

- school is in an urban, suburban, town, or rural community;
- the racial diversity of the student population; and
- the percentage of students eligible for free or reduced-price meals; and
- school climate.

Student population size. The size of a school's student population may affect the level of student victimization; although, the way that student population size affects violence is unclear (Gottfredson & DiPietro, 2010). Schools with student populations larger than 2,000 students tend to have higher rates of violence, because as the population rises, the level of frustration also rises among the students (Leung & Ferris, 2008). However, Cornell, Gregory, Huang, & Fan (2012) found a low correlation between school size and bullying victimization, and several studies have found that larger schools tend to have fewer instances of bullying (Gottfredson & DiPietro, 2010; Hanish & Guerra, 2000; Williams & Peguero, 2013).

Gottfredson & DiPietro (2010) propose two ways that large schools may decrease victimization:

> On the one hand, larger schools more often have the capacity to specialize programs and services to more efficiently meet the diverse needs of their students. They may be more capable of identifying problems and interventions to reduce potential security threats. On the other hand, in schools in which less specialization is used, the typical teacher teaches a smaller number of different students and is able to develop more personal relationships with them. (p. 83)

Bowes et al. (2009) suggest that bullying victimization is more prevalent at schools with large student populations, because supervising students outside of the classroom setting

(e.g., during the time between class periods) is inherently more difficult at larger schools. Reducing the number of students per teacher reduces victimization rates, because adults at large school may have more trouble asserting their authority than adults at smaller school (Gottfredson & DiPietro, 2010). This corresponds with the supposition that direct supervision over students at large schools is inherently more difficult and leads to increased victimization rates (Bowes et al., 2009).

School locale. Few studies have focused on rates of bullying victimization by school locale, and the few studies conducted to date demonstrate conflicting results. For example, Smokowski, Evans, and Cotter (2014) suggest that schools located in urban areas tend to have lower rates of bullying victimization than schools in rural locales. The Indicators of School Crime and Safety: 2013, however, reported that 27 percent of urban schools, 20 percent of suburban schools, and 21 percent of rural schools reported bullying incidents occurred at least once a week during academic year 2009–10 (Robers, Zhang, & Truman, 2014). Other studies, such as Nansel, et. al (2001), found no significant differences among rates of bullying at urban, suburban, town, and rural schools.

Racial and ethnic diversity. The racial and ethnic composition of a school may influence rates of bullying victimization at the school, although the direction of the effect is unclear. For example, students in ethnically diverse schools report feeling higher levels of safety and social satisfaction in school (Juvonen, Nishina, & Graham, 2006) and lower levels of bullying (Gottfredson & DiPietro, 2010; Hanish & Guerra, 2000; Peguero & Williams, 2013; Williams & Peguero, 2013). Conversely, research has also suggested that bullying victimization is more prevalent in heterogeneous classrooms (Vervoort, Scholte, & Overbeek, 2009). Further, students who identify with a race that makes up a smaller

proportion of the student population are more likely to be bullied than students who identify with the races that make up larger proportions (Graham, 2016). Juvonen & Graham (2014) advise that future research should focus on the effects that the racial and ethnic composition of the student body has on victimization rates among the students in each group.

Free or reduced-price meals. The percentage of the student population that is eligible for free or reduced-price meals is often used as a proxy measure to estimate school-level socioeconomic status and tend to show, at most, a weak correlation with rates of bullying. Rates of bullying reported in academic year 2009–10 were not significantly different for schools with 25 percent or less of its population eligible for free or reduced-price meals compared with schools with 75 percent or more of its population eligible for free or reduced-price meals (Robers et al., 2014). Other studies have shown that the percentage of students eligible for free or reduced-price meals is only weakly associated with rates victimization rates (Wolke, Woods, Stanford, & Schulz, 2001).

School climate. School climate is "a potentially important—yet incompletely explored—social mechanism for explaining links between structural characteristics like violence, and outcomes like academic achievement" (McCoy, Roy, & Sirkman, 2013, p. 129), as well as the strongest potential predictor of bullying rates in a school (Juvonen & Graham, 2014). School climate refers to a school's quality of life; including student and faculty perceptions of safety; relationships; and teaching or learning (McCoy et al., 2013). Students who attend schools with higher levels of disorder are more likely to report not feeling safe at school (Perumean-Chaney & Sutton, 2012). Since bullies have been found to be almost twice as likely to report not feeling safe at their school (Glew et al., 2008), it is

possible that schools with higher levels of disorder will also have higher rates of bullying behaviors than schools with lower levels of disorder.

Previous Research on Bullying Victimization and Academic Achievement

Given the variation among the definitions of bullying victimization, the different ways that male and female students are bullied, and the different ways that bullying victimization affects students, studies on bullying victimization and academic outcomes are often more dissimilar than they are similar.

Paths from Bullying Victimization to Academic Outcomes

Victimization may lower academic achievement through two primary paths. In the first path, bullying increases the levels of depression and anxiety in its victims (Olweus, 1993). Subsequently, higher levels of depression and anxiety may decrease motivation and concentration in the classroom, which can result in lowered academic achievement. Related to this first path, Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson (2010) suggest a direct path exists between victimization and decreased classroom motivation without increasing depression or anxiety levels.

The second pathway suggests that bullying victimization increases levels of fear (Patton, Woolley, & Hong, 2012), which then may result in lower levels of classroom engagement (Hammig & Jozkowski, 2013; Slade & Wissow, 2007), increased avoidance behaviors, such as truancy (Hammig & Jozkowski, 2013; Hutzell & Payne, 2012) or, in some cases, dropping out of school (Cornell et al., 2012). Truancy and dropping out of school may then have negative repercussions on the student's academic outcomes.

Measuring Bullying Victimization

The ability of researchers to analyze bullying victimization data may be due, in part, to how the data collection instruments define, present, and measure bullying behaviors. Data to identify bullied students are regularly collected as self-reports made by students; as nominations made by peers, teachers, or parents; or as observations made by a researcher. Further, data collection instruments may ultimately dictate how researchers can identify specific aspects of bullying victimization such as the existence of power differentials between students, or whether bullying occurred only once or repeatedly over time.

Several studies move beyond using only self-reports to identify bullying victims. Peer nomination is an accepted identification strategy that involves using classmates to identify bullying victims (Olweus, 2013). The number of peer nominations received theoretically represents the prevalence of bullying victimization. Nomination strategies in general avoid a potential problem of over- and underreporting of bullying victimization observed in self-reported victimization (Hutzell & Payne, 2012). However, Olweus (2013) notes several challenges associated with its use, including a lack of rigorous inquiry into the correlation between self-reports and peer nomination, primarily because bullying victimization can often be subtle such that classmates may not be aware that it is occurring. For example, Juvonen, Wang, and Espinoza (2011) identified bullying victims through a combination of self-reports and peer nominations of victimization. Although they did not report on the correlation between the methods, their results demonstrate similar results for GPA using each identification strategy. Pellegrini and Bartini (2000) collected data using two pairs of self-reports and peer nominations and found that results were weak or moderately correlated at .18 and .47.

Huang, Cornell, and Cornell (2015) conducted two RCTs to examine how the presentation of a definition of bullying and question order affect student responses. The first RCT examined the effect of providing a definition of bullying before the asking specific and general questions about bullying victimization. They found no difference between rates of bullying victimization when a definition of bullying was included with the questionnaire items. The second RCT examined the effect of the ordering of general and specific questions about bullying victimization. They found that bullying victimization rates were higher among students who received the specific questions first than students who received the general question first.

Another aspect of measuring bullying victimization deals with the idea that bullying only occurs if there are multiple instances of victimization over time. The bullying victimization literature demonstrates inconsistencies when collecting data about the frequency of bullying victimization. For example, Brown and Taylor (2005) identify bullied students using a 3-point scale of "never," "sometimes," and "often," whereas Strøm, Thoresen, Wentzel-Larsen, and Dyb (2013) use "never," "about once a week," and "many times a week." Glew, Fan, Katon, and Rivara (2008) administered a survey about bullying victimization, specifying that "bullying includes any bad thing one person could do or say to or about another person that happens more than once" (p. 124). However, when asking about the frequency of bullying victimization, they included response options "none," "only once or twice," "2 or 3 times a month," "about once a week," "several times a week." Other researchers, such as Adams and Lawrence (2011); Juvonen, Wang, and Espinoza (2011); and Ponzo (2013) do not specify the frequency of bullying victimization.

Effects of Bullying Victimization on Achievement

Research often suggests that a negative relationship exists between bullying victimization and academic outcomes (Cornell et al., 2012; Hammig & Jozkowski, 2013; Ponzo, 2013; Strøm et al., 2013). Studies have used a variety of metrics to measure the change associated with bullying victimization, including test scores, letter grades, and graduation or dropout rates.

Ponzo (2013) found that bullied students had significantly lower mathematics, science, and reading scores than students who had not been bullied. Compared to non-bullied students, scores for bullied students were nine to 10 points lower in mathematics, 10 to 13 points lower in reading, and 11 to 12 points lower in science.

Hammig and Jozkowski (2013) found that male students who had been threatened in the prior year were almost four times as likely to report earning grades of mostly Ds and Fs than As and Bs. Female students who were victims of bullying in the prior year were 1.6 times as likely to report earning grades of mostly Ds and Fs than grades of mostly As and Bs. Strøm, Thoresen, Wentzel-Larsen, and Dyb (2013) found that students at schools with higher levels of bullying victimization also had lower grades overall.

Cornell, Gregory, Huang, and Fan (2012) used negative binomial regression models to examine the effect a school-wide measure of the prevelance of teasing and bullying on dropout rates. The results of the models suggest that schools with higher rates of teasing and bullying predicted 25.9 dropouts, while schools with lower rates of teasing and bullyingpredicted 19.1 dropouts.

Strøm, Thoresen, Wentzel-Larsen, and Dyb (2013) examined the effect that frequency of bullying victimization has on academic achievement. They found that students

who reported more frequent occurrences of bullying had poorer academic achievement. They also found that the effect of bullying victimization was approximately a 1-point decrease in grades as students moved from reporting being bullied "sometimes" to "about once a week," or from reporting being bullied "about once a week" to "many times a week."

Contrary to most of the bullying victimization literature, Ma, Phelps, Lerner, and Lerner (2009) found no direct link between bullying victimization and academic achievement. They did, however, find that feelings of academic competence among victims of bullying tend to decrease over time, so the longer students are bullied, the less competent they feel in academic areas.

Research often demonstrates that a relationship generally exists between bullying victimization and academic achievement. This relationship, however, may be due more to instances of relational bullying than overt bullying because the former interferes with the victim's ability to concentrate in class to a greater extent than direct bullying victimization, and may have longer lasting effects than direct bullying victimization (Fite et al., 2014; Woods & Wolke, 2004).

Summary

This review of the literature illustrates that bullying is a complex phenomenon demonstrated by the inconsistent definitions of bullying victimization provided in the literature and study questionnaires. Based on the results of bullying victimization studies, the ability to predict bullying victimization using observational data is unclear. Studies have reported contradicting results about relationships between victimization and some student characteristics. While some studies have identified similarities among the demographic characteristics of bullying victims, other studies have found no relationship—or a conflicting

relationship—between the same demographic characteristics and victims of bullying. It is possible that these contradictions may be due, in part, to a lack of clarity about what constitutes bullying behaviors among researchers and study respondents alike.

CHAPTER 3

METHODS

This study uses a quasi-experimental method, inverse probability weights, to examine the impact of bullying victimization on selected measures of academic achievement. The victimization literature suggests that observable characteristics exist among students that may predict an increased likelihood to be threatened, hit, or bullied. The literature is unclear about how some of the student- and school-level characteristics determine why certain students are victims of bullying behaviors while others are not. The literature is clear, though, that the negative outcomes of victimization may persist beyond victimization well into late adolescence and adulthood.

Bullying victimization literature demonstrates a relationship exists between bullying victimization and negative academic outcomes, although the extent to which victimization impacts academic outcomes is less clear. Therefore, the research question for this study is: What are the longitudinal impacts of bullying victimization on academic outcomes after applying inverse probability weights to account for differences between bullied and non-bullied students? To answer this research question, I begin this chapter with a description of the data file used in the study and the sampling design used to collect the data. Then I provide a description of research design used to analyze the data in the current study, including statistical methods and the variables used.

Data and Sampling Design

The Education Longitudinal Study of 2001 (ELS) used a complex, two-stage sampling process to identify a sample of students who were in grade 10 during the 2001–02 academic year (Ingels, Pratt, Rogers, Siegel, & Stutts, 2004). The first sampling stage

developed of a framework for identifying and selecting high schools from public and private high schools in all 50 states and the District of Columbia. In the second sampling stage, schools that agreed to participate provided lists of all students enrolled in grade 10 during the academic year 2001–02. ELS collected base year data from students and contextual data from the students' parents and guardians, beginning in the spring semester of 2002. ELS also collected longitudinal data from the student sample at 2, 4, and 10 years after the base year data collection in 2002.

The analysis sample used in the current study represents a subsample of the approximately16,200[1] students who participated in ELS in 2002. To identify the analysis sample for this study, I first restricted the ELS sample to the 16,000 students who were in grade 10 during the academic year 2001–02. The models I used for this analysis included data from collected from both students and their parents; therefore, I restricted the analysis sample to include the 14,700 cases with a completed student questionnaire, and among those cases, I further restricted the analytic sample to the 12,000 cases with a student and parent questionnaire. Lastly, I excluded students who attended private schools, because the makeup of the student populations at public schools tends to be different from private schools. For example, compared to private schools, public high schools tend to have larger student populations ($t = 17.79, p < .05$), larger student to teacher ratios ($t = 3.74, p < .05$), and

[1] The ELS restricted-use data file includes personally-identifiable data, and the U.S. Department of Education's Institute of Education Sciences (IES) requires that whole numbers be rounded to the nearest 10, 100, or 1,000 for dissemination.

higher percentages of minority students ($t = 3.63, p < .05$).[2] Table 1 displays the characteristics of students included in the current study.

Table 1

Characteristics of ELS Students Included in Analytic Sample

Student Characteristics	Number of Students in ELS sample
Students in ELS sample	16,200
Students in grade 10	16,000
Cases with a completed student questionnaire	14,700
Cases with a completed parent questionnaire	12,000
Students in public schools	9,300

The sex of the student impacts both the likelihood that the student will be a victim of bullying and whether a bullied student is a victim of direct or relational bullying, as discussed in Chapter 2. Thus, I created two analytic samples based on the sex of the students, and males and females are analyzed separately in the dissertation.

Research Design

Estimating the effect of a treatment requires comparing the potential outcomes of study subjects who received the treatment to their counterfactual potential outcomes. A counterfactual potential outcome is the outcome for the treated individual when they do not receive treatment. Because it is impossible to simultaneously both receive and not receive a treatment, causal analyses must use experimental or quasi-experimental methods to identify appropriate counterfactuals.

[2] I conducted the t-tests using NCES's PowerStats tool (nces.ed.gov/datalab/powerstats/default.aspx) to analyze data from the 2012 Schools and Staffing Survey.

An experimental study design with randomized treatment assignment can determine causality because treatment and comparison groups selected at random will have the same distributions of observed and unobserved characteristics, and thus the same distribution of potential outcomes. For example, the proportion of males in a treatment group selected at random should be statistically similar to the proportion of males in the comparison group. Random assignment, therefore, allows researchers to attribute differences between the outcomes of treatment and comparison groups to the treatment itself, because treatment assignment is the only difference between the groups that could affect the outcome.

However, studies using non-random observational data suffer from selection bias when the probability of receiving a treatment varies among study subjects. In observational data, the characteristics of the subjects receiving the treatment are likely different from those not receiving the treatment because some subjects have sought treatment while others may have avoided it. When the differences between groups extend beyond treatment assignment, the treatment assignment alone cannot explain observed differences in outcomes. Propensity score analysis is a quasi-experimental method that allows researchers to address and correct selection bias in observational data. In the current study, I used inverse probability weights as a quasi-experimental method to reduce the selection bias associated with the treatment assignment, because bullying victims are not randomly chosen.

Estimating Treatment Effects

To describe the effects of a treatment, researchers use the average treatment effect, which is an estimate of the treatment effect across all treatment and control cases. In bullying victimization research, the average treatment effect might be useful for studies examining the effects of victimization beyond those who are bullied. For example, research suggests that

peer effects exist when victimized students are present in a class. The focus of the current study is to estimate the effects of bullying victimization on only those students who reported victimization, and not on their classmates. Therefore, this study uses the average treatment effect on the treated (ATT), which only considers the effect of a treatment on those receiving the treatment (Guo & Fraser, 2015; Imbens, 2004; Imbens & Rubin, 2015; Khandker, Koolwal, & Samad, 2010; Stuart, 2010).

Treatment Variables

The ELS study asked the following question: "In the first semester or term of this school year, how many times did any of the following happen… Someone bullied me or picked on me?" Responses were "never," "once or twice," and "more than twice." I created two treatment variables from this question. The first treatment variable identified students who stated they had been bullied at least once during the fall semester of 2001.

Table 2 displays the number and percent of male and female students in the analytic sample who reported bullying victimization during the fall of 2001. Approximately 20 percent of males and females reported at least one instance of bullying. These estimates are in line with other studies on bullying victimization. For example, the Youth Risk Behavior Surveillance System (YRBSS) found that 19.6 percent of students reported bullying victimization (Kann et al., 2014). The 2015 School Crime Supplement (SCS) to the National Crime Victimization Survey found that 21 percent of students reported bullying victimization (Musu-Gillette et al., 2016). Ledwell and King (2013) estimated higher rates of bullying victimization at 26 percent of students. They also found that the rated of bullying was higher for female students than male students at 26 percent and 23 percent, respectively. Pontes, et

al., (2018) found that approximately 25 percent of females and 16 percent of males reported bullying victimization.

Table 2

Students in Analytic Sample Reporting Bullying Victimization by Sex

	Males		Females	
	Number	**Percent**	**Number**	**Percent**
Total	4,500	100.0	4,700	100.0
Never	3,600	79.9	3,700	79.0
Once or twice	640	14.3	720	15.2
More than twice	260	5.8	280	5.8

Note. Totals may not sum to 100 due to rounding.

Bullied at least once. The first treatment variable identified students in the treatment group as those who reported any bullying victimization, and students in the comparison group as those who reported no bullying victimization.

Bullied more than twice. The second treatment variable identified students in the treatment group as those who reported more than two instances of bullying victimization, and students in the comparison group as those who reported no bullying victimization. I excluded from the analyses students reporting one or two instances of bullying victimization for the second treatment variable.

Covariates Used to Estimate Propensity Scores

Propensity score analyses must meet the conditional independence assumption. The conditional independence assumption states that the potential outcomes of a treatment are independent of treatment assignment, given the covariates used to estimate the propensity scores (Caliendo & Kopeinig, 2005; Guo & Fraser, 2015; J. J. Heckman, Stixrud, & Urzua, 2006; Imbens & Rubin, 2015; Khandker et al., 2010; Ponzo, 2013). By accounting for all

relevant treatment predictors, the distribution of potential outcomes will be the same for both groups. Thus, any significant differences between the outcomes of the treatment and comparison groups can be attributed to the treatment. Propensity score models that do not include all treatment predictors may still reduce the selection bias stemming from a non-random treatment assignment (D'Agostino, 1998). Limiting covariates to those that are (1) constant over time, such as sex and race, or (2) collected prior to treatment assignment ensures that outcomes do not affect the covariates because they are exogenous to the treatment (Imbens, 2004). Acceptable covariates in this study are those that do not change depending on whether the student has been a victim of bullying. An example of an acceptable exogenous covariate used in the current study is the sex, because a student remains a male or female regardless of whether that student has been bullied. However, sex may affect whether a student is bullied, as well as his or her academic achievement.

It is not always clear if a covariate is truly exogenous. The treatment in the current study (i.e., bullying victimization) may affect several covariates have been theorized in the literature as predicting victimization. I estimate two models for each analytic sample (i.e., males and females). I first ran each model using only exogenous covariates to predict bullying victimization. To explore the effects of including possibly endogenous covariates to predict the likelihood of being a victim of bullying behaviors, I ran each model again, including a set of endogenous covariates. These endogenous covariates are unlikely to be independent of the treatment assignment, because either the data were collected at approximately the same time as the treatment assignment, or the direction of a theoretical causal link between the treatment and covariate is unknown. For example, students may have

few friends due to previous bullying victimization; however, it is also possible that a lack of friends may have increased the likelihood that the student was victim of bullying.

Table 3 lists the constructs identified in the literature as those that may predict bullying victimization, the ELS variable names, the recoded variables I used in the propensity score models, endogeneity, and the minimum and maximum values of the recoded variables.

Table 3

List of Model Constructs, ELS Variables, Analysis Variables and Labels, and Endogeneity

Construct	ELS Variable	Analysis Variable	Label	Endogenous Covariate
Race and Ethnicity	BYRACE	White	White	No
		Asian	Asian	No
		Black	Black or African American	No
		Hispanic	Hispanic or Latino	No
		Other	Another race or more than one race	No
English Language Learners	BYSTLANG BYS33G	NonNativeEng	Non-native English speaker	No
Special Education	BYS33I	SpecEd	In a special education program	No
Early Childhood Education	BYP44A	Daycare	Attended daycare	No
	BYP44B	Preschool	Attended preschool	No
	BYP44C	Headstart	Attended Head Staart	No
	BYP44D	Kinder	Attended Kindergarten	No
Academic Achievement	F1RGP9	GPA9	Grade point average in grade 9	No
	BYS33A/B	APIBProg	Enrolled in Advanced Placement coursework or International Baccelaureate program	Yes

Table 3 (continued)

Construct	ELS Variable	Analysis Variable	Label	Endogenous Covariate
Academic	BYS41D	HonorSoc	In an academic honor society	Yes
Achievement	BYP46	Retained	Student repeated one or more grades	Yes
Family	BYFCOMP	ParNumInHH	Single parent household	No
Composition	BYSIBHOM	Siblings	Number of siblings	No
	BYINCOME	FamIncome20-	Family income less than $20,000	No
		FamIncome50	Family income $20,001 - $50,000	No
		FamIncome75	Family income $50,001 - $75,000	No
		FamIncome75+	Family income more than $75,000	No
Socioeconomic Status	BYMOTHED	MomEdNoHS	Mother did not receive a HS diploma	No
		MomEdHSdip	Mother received a HS diploma	No
		MomEdAA	Mother received an associate's degree	No
		MomEdBA	Mother received a bachelor's degree	No
		MomEdGradDeg	Mother received a graduate degree	No
	BYFATHED	DadEdNoHS	Father did not receive a HS diploma	No
		DadEdHSdip	Father received a HS diploma	No
		DadEdAA	Father received an associate's degree	No
		DadEdBA	Father received a bachelor's degree	No
		DadEdGradDeg	Father received a graduate degree	No

Table 3 (continued)

Construct	ELS Variable	Analysis Variable	Label	Endogenous Covariate
Socioeconomic Status	BYOCCUM	MomOccOthers	Mother in another occupation	No
		MomOccClerical	Mother in a clerical occupation	No
		MomOccManager	Mother in a managerial occupation	No
		MomOccProfessional	Mother in a professional occupation	No
		MomOccTeacher	Mother is a teacher	No
		MomOccService	Mother in a service occupation	No
	BYOCCUF	DadOccOther	Father in another occupation	No
		DadOccCraftsperson	Father is a craftsperson	No
		DadOccLaborer	Father is a laborer	No
		DadOccManager	Father in a managerial occupation	No
		DadOccOperative	Father in a operations occupation	No
		DadOccProfessional	Father in a professional occupation	No
Extracurricular Activities	BYS41A	Band	In school band or orchestra	Yes
	BYS41B	Drama	In school drama program	Yes
	BYS41C	StuGovt	In student government	Yes
	BYBASEBL	Baseball	Interscolastic sports: Baseball	Yes
	BYBSKTBL	Basketball	Interscolastic sports: Basketball	Yes
	BYCHRDRL	Cheer	Interscolastic sports: Cheerleading	Yes
	BYFOOTBL	Football	Interscolastic sports: Football	Yes

Table 3 (continued)

Construct	ELS Variable	Analysis Variable	Label	Endogenous Covariate
Extracurricular Activities	BYSOCCER	Soccer	Interscolastic sports: Soccer	Yes
	BYSOFTBL	Softball	Interscolastic sports: Softball	Yes
	BYTEAMSP	OtherTeam	Interscolastic sports: Other team sport	Yes
	BYSOLOSP	IndivSport	Interscolastic sports: Individual sport	Yes
Interpersonal Relationships	BYSF1-BYSF3	StuFriends	Student has few friends	Yes
	BYP59AC/BC/CC	ParFriends	Parent knows student's friends	Yes
	BYP56	ParAdvice	Parent provided advice to student	Yes
	BYP57	ParInvolve	Parental involvement with student	Yes
	BYP55/BYP69	FamRules	Family rules	Yes

Race and ethnicity. The ELS data file provided a variable describing the race and ethnicity of each student, as indicated on student enrollment lists. I recoded this race variable to the four races and ethnicities commonly discussed in the literature: White, Black, Hispanic, and Asian. I recoded the remaining students who identified as American Indian or Alaska Native, two or more races, or another race not included in the ELS data file into a fifth category, "other."

English language learner status. The ELS data file included two variables used in the current study to identify (1) students whose native language was a language other than English and (2) students who had previously enrolled in an English language learner or English as a Second Language program. I created a single dummy variable with a one to identify students who indicated that either their native language was not English, or they had participated in an English language learner program, or both. I coded the remaining students with a zero.

Students in special education. I included a variable from the ELS student questionnaire to identify students who were in special education, which asked if the student was ever in a special education program. This item was a dummy variable in the ELS data file.

Early childhood education. Four variables in the ELS parent questionnaire described participation of each student in early childhood education, including whether the student attended day care program, a nursery or preschool, a Head Start program, or Kindergarten. Each early childhood education variable was recoded into dummy a variable to identify students who participated in each of the program. I coded missing responses only when all four of the early education questions were missing. For example, if a parent

indicated that the student went to Kindergarten and did not provided responses for daycare, Head Start, and preschool, I coded the Kindergarten dummy variable with a one to signify an affirmative response, and each of the remaining three with zeros to signify negative responses.

Academic achievement. To examine the impact of prior academic achievement on bullying victimization, I utilized five variables from the ELS data file: GPA in grade 9, enrollment in Advanced Placement (AP), enrollment in International Baccalaureate (IB) courses, membership in an honor society, and whether or not the student has been held back.

I used the student's ninth grade GPA as a measure of prior academic achievement. The GPA variable in the ELS data file was measured on a scale from 0 to 4 covering all courses taken in grade 9 for all students (Ingels et al., 2004). This ensures that all students in the ELS study had a similar measure of grade 9 GPA, regardless of how their high school might calculate GPA. I also included a quadratic term for grade point average in ninth grade, and interacted grade point average separately with family income and race.

Three variables in the ELS data file could measure academic achievement in terms of advanced students: (1) enrollment in Advanced Placement courses, (1) enrollment in an International Baccalaureate program, and (3) membership in an academic honor society. These variables are possibly endogenous to the treatment assignment, because ELS did not collect data on AP and IB coursework and honor society membership prior to the treatment variable. I constructed a single dummy variable to identify students enrolled in Advanced Placement courses or in an International Baccalaureate program. I included in the models a separate dummy variable to identify students who were members of an academic honor society.

Lastly, I included a covariate to identify students who had been held back, or retained, at least one grade prior to and including grade 10. For the purposes of the present study, I also consider grade retention to be endogenous to the treatment assignment, because the question wording covered the same the point in time when the treatment was assigned.

Family composition. The ELS data file includes two variables that describe each student's family composition. The first variable indicates that the student lives with one or two parents or guardians. I created a dummy variable to identify students from single-parent households and students who split their time between two divorced parents. The second variable indicates the number of siblings living in the student's household.

Socioeconomic status. I included five variables to measure the socioeconomic status of each student's family, as provided by parents via the ELS parent questionnaire. These included:

- level of education of the student's mother or female guardian;
- level of education of the student's father or male guardian;
- family income;
- occupation of the student's mother or female guardian.
- occupation of the student's father or male guardian; and

I recoded the parental education and family income variables to address small cell sizes, as described below.

Parent education. I recoded the parental education variables from eight categories into five dummy variables: (1) did not graduate from high school; (2) graduated from high school; (3) received an associate's degree, and (5) received a bachelor's degree, and (5) received a graduate degree.

Family income. I recoded the original 13 family income categories into four dummy variables: (1) less than $20,000, (2) 20,001 to $50,000, (3) $50,001 to $75,000, and (4) more than $75,000.

Parent occupation. Each of the parental occupation variables included a total of 16 occupation categories. I recoded variables for the occupation of the mother and father to six dummy variables each for the five largest occupations and a sixth dummy variable that included all other occupations. The recoded variable for mother's occupation variables included (1) clerical workers, (2) managers, (3) professionals, (4) school teachers, (5) service professionals, and (6) all other professions. The recoded father's occupation variables included (1) craft workers, (2) laborers, (3) managers, (4) operatives, (5) professionals, and (6) all other professions.

Extracurricular activities. Three items from the ELS questionnaire indicated whether the student participated in a school band or orchestra, a drama production, and student government. I also included eight items to indicate whether or not students participated in baseball, basketball, cheerleading, football, soccer, softball, another team sport, or a solo sport. These are all coded as dummy variables indicating participation.

Interpersonal Relationships. I included several covariates to address the construct of interpersonal relationships that accounted for student friends and parent knowledge of their student’s friends. The covariates accounting for student friends and parent knowledge of the student's friends are possibly endogenous due to the unknown direction of a causal relationship between bullying victimization and the student's friends. I also conducted three factor analyses to identify the latent constructs from four series of questions asked of parents during the base year data collection in 2001. The three factors, including parent advice,

parental involvement, and family rules are also possibly endogenous because the timeframe that these questionnaire items overlap with instances of bullying victimization.

Student friends. The ELS questionnaire included variables for student participants to identify the race of up to three of their friends. Although these variables specifically requested the race of each friend, the races of the student's friends were not relevant to this study. Rather, I used these variables to identify students who listed zero, one, two, or three friends. It is possible that students who listed three friends have more than three friends, whereas students who listed only zero, one, or two friends may have the same number of friends. This covariate is endogenous due to the unknown direction of a causal relationship between bullying victimization and the number of friends.

Parent knowledge of student's friends. The parent questionnaire included three items that asked if the parent knew each of the three friends identified by the student. Although prior research has not investigated the relationship between parental familiarity with friendships and bullying victimization, I included it as a measure of parental involvement. Therefore, as the purpose of its inclusion was not to measure the actual number of each student's friends that the parent knew, I recoded this variable with a one to indicate the parent knew at least one of the student's friends and a zero to indicate the parent did not know any of the friends. This covariate is endogenous due to the unknown direction of a causal relationship between bullying victimization and the student's friends.

Parent advice. To further examine interpersonal relationships between students and their parents, I utilized six items that measured the amount of the parent's advice given to the student. These items included advice about selecting courses or programs; plans for college entrance exams; applying to college or another school after high school; jobs to apply for

after high school; community, national, and world events; and things troubling student. Response categories for these items included never, sometimes, and often. I conducted separate factor analyses for male and female students to estimate a single continuous variable to describe the amount of parental advice given to students. Table 4 presents the results of the factor analyses of parent advice. A post-hoc analysis of the individual questionnaire items determined moderately strong relationships among the parental advice items for both male students ($\alpha = .76$) and female students ($\alpha = .78$).

Table 4

Results of Factor Analysis for Parent Advice

	Analytic Sample	
Item	**Males**	**Females**
Advice about selecting courses or programs	0.57	0.47
Advice about plans for college entrance exams	0.67	0.67
Advice about applying to college after high school	0.67	0.67
Advice about jobs to apply for after high school	0.58	0.46
Information about community, national, or world events	0.53	0.32
Advice about things troubling 10th-grader	0.48	0.25
Eigenvalues	2.05	2.05

Parental involvement. Using a series of 12 items drawn from the parent questionnaire, I also conducted separate factor analyses for male and female students to estimate an overall level of involvement parents have with their children. These items asked how often the parent participated in attended school activities with the student; worked on homework or school projects with the student; attended concerts, plays, or movies with the student; attended sports events outside school with the student; attended religious services with the student; attended family social functions with the student; took day trips or vacations with the student; worked on hobby or played sports with the student; went shopping with the

student, went to restaurants with the student, spent time talking with the student, and did something else fun with the student. Both factor analyses used Varimax rotation to estimate a continuous variable that describes the level of parental involvement with the student. Table 5 presents the results of the factor analyses of parental involvement. A post-hoc analysis of the individual questionnaire items determined moderately strong relationships among the questionnaire items for both male students ($\alpha = .80$) and female students ($\alpha = .83$).

Table 5

Results of Factor Analysis of Parent Involvement

Item	**Males**	**Females**
Attended school activities	0.47	0.60
Worked on homework/school projects	0.47	0.41
Attended concerts/plays/movies	0.53	0.51
Attended sports events outside school	0.58	0.65
Attended religious services	0.37	0.25
Attended family social functions	0.49	0.24
Took day trips/vacations	0.56	0.36
Worked on hobby/played sports	0.61	0.61
Went shopping	0.43	0.11
Went to restaurants	0.51	0.18
Spent time talking	0.51	0.15
Did something else fun	0.66	0.26
Eigenvalues	3.24	3.71

Family rules. The ELS questionnaire included two series of items that measured the rules and structure provided for the student. The first series asked how often the parent checked the student's homework, discussed the student's report card, knew the student's whereabouts, and made or enforced rules a nighttime curfew. The ELS questionnaire also included four items about family rules regarding (1) maintaining a grade average, (2) doing

homework, (3) doing household chores, and (4) watching TV. I conducted separate factor analyses for male and female students using these eight questionnaire items. The factor analyses used Varimax rotation to estimate a continuous variable that describes the level of parental involvement with their student. Table 6 presents the results of the factor analyses of family rules. A post-hoc analysis of the individual questionnaire items determined moderately weak relationships among the questionnaire items for both male students ($\alpha = .64$) and female students ($\alpha = .65$).

Table 6

Results of Factor Analysis of Family Rules

	Analytic Sample	
Item	**Males**	**Females**
How often check that homework completed	0.39	0.43
How often discuss report card	0.37	0.43
How often know whereabouts	0.29	0.28
How often make/enforce school night curfews	0.36	0.40
Rules about maintaining grade average	0.50	0.49
Rules about doing homework	0.55	0.58
Rules about doing household chores	0.44	0.41
Rules about watching TV	0.44	0.43
Eigenvalues	1.44	1.54

High school effects. Each student in the ELS sample attended one of the 751 high schools that agreed to participate in the study. As such, students in the sample are clustered by high school. To address clustering, I first created a dummy variable for each high school and assigned students who attended the high school a one and students who did not attend the high school a zero. The dummy variables act as cluster fixed effects.

The fixed effect approach serves two purposes in the propensity score models. First, the dummy variables ensure that the students included in this analysis attended schools that

had both students who did and did not report bullying victimization. For example, if all students in this study attended one of only two high schools, it's possible that students in the treatment group primarily attended one, while students in the comparison group primarily attended the other.

Second, although school-level characteristics likely affect bullying victimization, using high school fixed effects is preferable to using individual school-level covariates because the high school dummy variables absorb the variation of unobservable school-level characteristics, in addition to the observable characteristics. Thus, while models using school-level covariates may control for observable school-level characteristics, by using a cluster fixed effects approach, the models in this study control for all school-level characteristics, not only observable characteristics.

Student analytic weights. The ELS study employed a complex sampling design to select the student sample. The first step sampled schools in the 50 states and Washington, DC. NCES collected enrollment information for all students in grade 10 from the schools agreeing to participate in the study. Students were then sampled from the enrollment lists. In addition, Asian and Hispanic students were oversampled to ensure that these groups were sufficiently large enough to facilitate analyses of these subpopulations (Ingels et al., 2004).

The ELS data file includes several statistical weights to correct study design effects when calculating standard errors. These weights include primary sampling units, strata, and balanced repeated replication weights. The data file also includes student-level analytic weights to correct for nonresponse bias (Ingels et al., 2004). As suggested by DuGoff et al. (2014), I also included the ELS survey weight as a covariate in propensity score models.

Missing Data

Missing data in this study result from both unit- and item-level nonresponse. Unit-level nonresponse occurs when a subject who was sampled for a study does not complete the study questionnaire. The current study includes approximately 9,300 ELS cases that had completed student and parent questionnaires and attended a public school from the16,200 ELS students. The unit-level missing data therefore comprises the remaining students not included in the current study.

Item-level nonresponse occurs when a subject completed a questionnaire, but did not respond to all questionnaire items. The rate of item-level missing data therefore varies across variables. Table 7 describes the percent of missing data among students included in the analytic sample. The percent of missing data due to item-level nonresponse ranges from zero to ten percent for grade 9 GPA.

Table 7

Percent of Cases with Missing Values by Propensity Score Model Covariate

	Males		Females	
Covariate	**Bullied at least once**	**Bullied more than twice**	**Bullied at least once**	**Bullied more than twice**
Race/Ethnicity	0.00	0.00	0.00	0.00
Early childhood education	0.06	0.06	0.06	0.06
Grade 9 GPA	0.10	0.10	0.09	0.09
Non-native English	0.00	0.00	0.00	0.00
Special education	0.03	0.03	0.01	0.01
Single parent households	0.00	0.00	0.00	0.00
Number of siblings	0.03	0.03	0.02	0.02
Family income	0.00	0.00	0.00	0.00
Mother's education	0.00	0.00	0.00	0.00
Father's education	0.00	0.00	0.00	0.00
Mother's occupation	0.00	0.00	0.00	0.00
Father's occupation	0.00	0.00	0.00	0.00
Academically advanced students	0.02	0.02	0.01	0.01
Band or orchestra	0.02	0.02	0.02	0.02
Drama	0.02	0.02	0.02	0.02
Student government	0.03	0.03	0.02	0.02
Honor society	0.02	0.02	0.02	0.02
Retained	0.01	0.01	0.01	0.01
Baseball	0.02	0.02	0.02	0.02
Softball	0.02	0.02	0.02	0.02
Basketball	0.02	0.02	0.02	0.02
Football	0.02	0.02	0.02	0.02
Soccer	0.02	0.02	0.02	0.02
Other team sport	0.02	0.03	0.02	0.02
Individual sport	0.03	0.03	0.02	0.02
Cheerleading	0.02	0.02	0.02	0.02
Friends	0.00	0.00	0.00	0.00
Parent knows friend	0.00	0.00	0.00	0.00
Parental advice	0.05	0.05	0.05	0.05
Parent involvement	0.06	0.06	0.05	0.05
Family rules	0.05	0.05	0.05	0.05

Item-level missing data may also indirectly affect the final number of students included in the analytic sample due to the inclusion of fixed effects terms to identify school clusters in the propensity score models. When a fixed effects term perfectly predicts the

success or failure of the dependent variable, the cases included in that fixed effect term are dropped from the model. This means that students attending the same school who have no item-level missing data may be dropped from a model when all of the students have the same value for the dependent variable.

The current study included 9,300 students. The two analytic samples (i.e., males and females), two sets of covariates (i.e., exogenous and endogenous covariates), and two treatment variables (i.e., bullied at least once and bullied more than twice) resulted in the eight models described in Table 8. The difference between the total number of male and female students (i.e., approximately 4,500 and 4,700, respectively) and the number of students in each of the models described in Table 8 is due to item-level nonresponse, either directly or indirectly.

Table 8

Numbers of Students in Analytic Samples by Treatment Variable, Type of Model Covariates, and Sex

		Analytic sample	
Treatment variable	**Covariates included**	**Males**	**Females**
Bullied at least once	Exogenous only	2,800	3,200
	Exogenous and possibly endogenous	2,300	2,600
Bullied more than twice	Exogenous only	1,200	1,300
	Exogenous and possibly endogenous	1,200	900

Outcome Variables

I used a total of six academic outcomes, including self-perceived mathematics ability, scores on the ELS mathematics assessment, GPA in grades 11 and 12, high school graduation, and enrollment in postsecondary education.

Mathematics self-efficacy. I also conducted separate factor analyses for male and female students to estimate an overall level of self-efficacy in mathematics. These items from the ELS first follow-up data collection in 2004 asked students how often they can (1) do an excellent job on mathematics tests, (2) understand difficult mathematics texts; (3) understand difficult mathematics classes, (4) do an excellent job on mathematics assignments, and (5) master mathematics skills in class. Both factor analyses used Varimax rotation to estimate a continuous variable that describes student self-perception of mathematics ability. Table 9 presents the results of the factor analyses of mathematics ability. A post-hoc analysis of the individual questionnaire items determined strong relationships among the questionnaire items for both male and female students ($\alpha = .91$).

Table 9

Results of Factor Analysis for Mathematics Self-Efficacy

Item	**Males**	**Females**
Can do an excellent job on mathematics tests	0.81	0.81
Can understand difficult mathematics texts	0.84	0.82
Can understand difficult mathematics classes	0.83	0.81
Can do an excellent job on mathematics assignments	0.80	0.79
Can master mathematics skills in class	0.82	0.81
Eigenvalues	3.35	3.26

Mathematics assessment. The second outcome measure provides the result of the ELS mathematics assessment, which was administered during the first follow-up data collection in 2004. The mathematics assessment scores are norm-referenced to a mean of 50 and a standard deviation of 10.

GPA in grades 11 and 12. The third and fourth outcome measures indicate the students' grade point average at the end of grades 11 and 12, respectively. Each GPA ranges from 0.0 to 4.0.

High school graduation. The fifth outcome measure indicates whether or not a student received a high school diploma by the end of academic year 2004–05 after most students would have completed grade 12.

Immediate enrollment in postsecondary education. The sixth outcome measure identifies students who enrolled in postsecondary education immediately after high school. Students considered immediately enrolling were those who enrolled in postsecondary education during the first semester after high school. For example, students who graduated by July 2004 were immediately enrolled in postsecondary education if their enrollment began before October 2004 (Ingels et al., 2014). Similarly, students who graduated after July 2004 were immediately enrolled in postsecondary education if their enrollment began before February 2005.

Propensity Score Estimation

The first step to calculate inverse probability weights is to estimate propensity scores (i.e., the probability of receiving a treatment). I ran eight separate logistic regression models to estimate the propensity scores, because I have two analytic samples based on gender, two versions of the treatment variable, and two sets of covariates. Appendix A includes the logistic regression results for each of the eight propensity score models.

The equations that describe the logistic regression models followed two general forms. For males and females separately, I regressed each treatment variable on exogenous covariates only, using the following equation:

$$Y_i = \beta_0 + \beta_1(Exo_i) + \beta_2(GPA9_i * GPA9_i) + \beta_3(GPA9_i * FamIncome_i) + \beta_4(GPA9_i * RaceEthn_i) + \omega_i + \alpha_i + \epsilon$$

where Y_i represents the treatment variable. Exo_i represents the set of exogenous covariates used to predict bullying victimization. $GPA9_i * GPA9_i$ is a quadratic expression of GPA in grade 9. $GPA9_i * FamIncome_i$ is an interaction term that allows GPA in grade 9 vary by level of family income. $GPA9 * RaceEthn_i$ is an interaction term that allows GPA in grade 9 vary by race and ethnicity dummy variables. ω_i is the ELS student-level analytic weight (i.e., included as a covariate). α_i is a dummy variable that represents the high school each student attended. ϵ represents the error term, or all unobserved student characteristics affecting the probability of bullying victimization not included in the model.

The models that included both sets of exogenous and possibly endogenous covariates to estimate propensity scores used the following equation:

$$Y_i = \beta_0 + \beta_1(Exo_i) + \beta_2(Endo_i) + \beta_3(GPA9_i * GPA9_i) + \beta_4(GPA9_i * FamIncome_i) + \beta_5(GPA9_i * RaceEthn_i) + \beta_6(Sport_i * RaceEthn_i) + \omega_i + \alpha_i + \epsilon$$

where Y_i represents the treatment variable. Exo_i represents the set of exogenous covariates used to predict bullying victimization. $Endo_i$ represents the set of endogenous covariates used to predict bullying victimization. $GPA9_i * GPA9_i$ is a quadratic expression of GPA in grade 9. $GPA9_i * FamIncome_i$ is an interaction term that allows GPA in grade 9 vary by level of family income. $GPA9_i * RaceEthn_i$ is an interaction term that allows GPA in grade

9 vary by race and ethnicity. $Sport_i * RaceEthn_i$ interacts a dummy variable identifying participation in each sport with each race and ethnicity. ω_i is the ELS student-level analytic weight (i.e., included as a covariate). α_i is a dummy variable that represents the high school each student attended. ϵ represents the error term, or all unobserved student characteristics affecting the probability of bullying victimization not included in the model.

Areas of Common Support

Propensity score analyses require removing, or trimming, the cases that fall outside of the area of common support (Guo & Fraser, 2015; Khandker et al., 2010). Trimming ensures that sufficient overlap of propensity scores exists between the treatment and comparison groups (Ho, Imai, King, & Stuart, 2007). Trimming also eliminates outliers, which may result in extreme large or small inverse probability weights that may skew outcomes. It is also important to consider that trimming cases that fall outside of the area of common support limits the results of outcome analyses, because such results will apply to only those members of the population who theoretically fall under the defined area of common support. I analyzed the area of common support for each of the eight sets of propensity scores and removed observations with propensity scores that fell outside of the area of common support for each model. This trimming accounted for the removal of approximately 10 to 100 students in each of the eight propensity score models.

The area of common support is defined as the range of propensity scores is common to both treatment and comparison groups and is formed by identifying those cases that fall between (1) the higher of the minimum treatment and control propensity scores and (2) the lower of the maximum treatment and control propensity scores. For example, if the range of propensity scores is 0.45 to 0.90 among students in the treatment group, and 0.35 to 0.85

among students in the comparison group, then the area of common support includes cases with propensity scores between 0.45 and 0.85. In this example, students would be removed from the analysis if their propensity scores are lower than 0.45 or higher than 0.85.

Another diagnostic measure to evaluate the propensity scores is to create a graph the shows the distribution of propensity scores by treatment assignment. Figures 1 through 4 display the post-trimming distributions of the propensity for the models that estimated the propensity for students to report at least one instance of bullying victimization, and figures 5 through 8 show the distributions of propensity scores for the models that estimated the propensity for students to report more than two instances of bullying victimization.

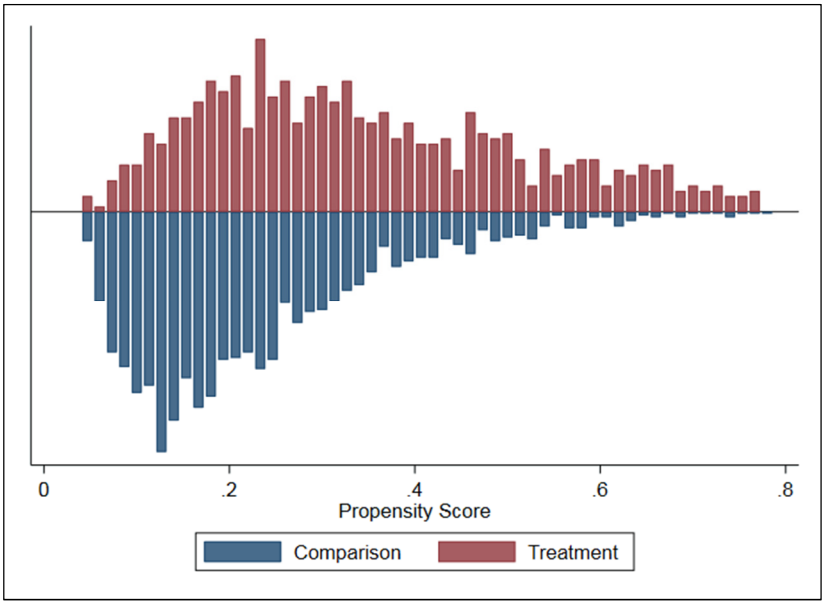

Figure 1. Post-Trimming Propensity Scores, Male Students Bullied at Least Once, Exogenous Covariates Only

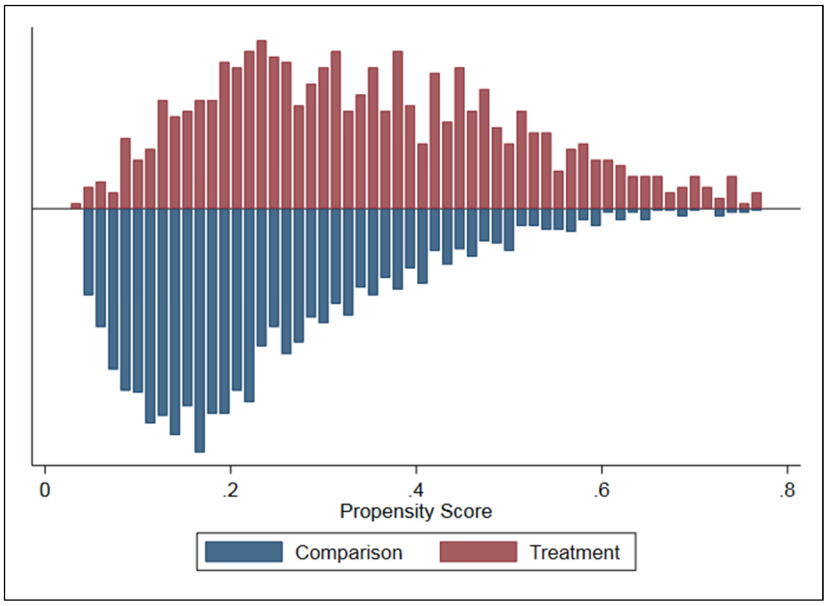

Figure 2. Post-Trimming Propensity Scores, Female Students Bullied at Least Once, Exogenous Covariates Only

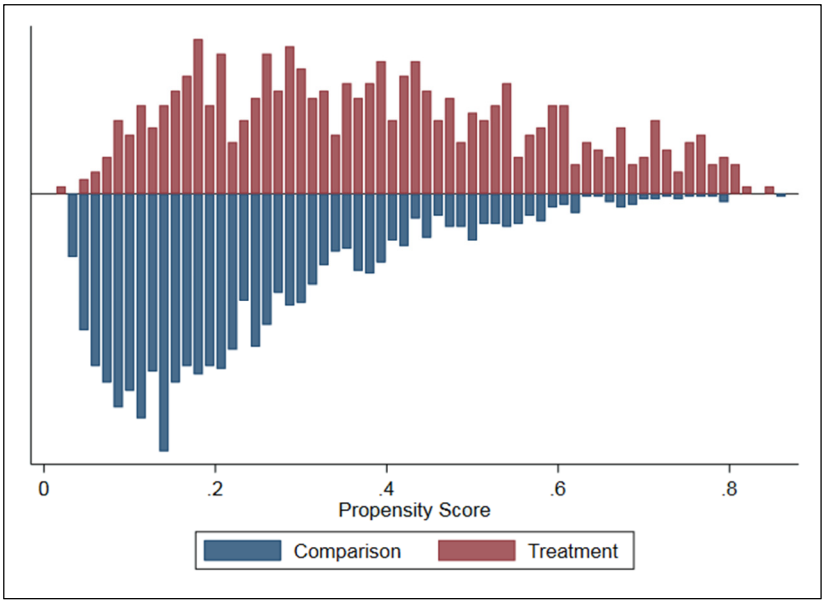

Figure 3. Post-Trimming Propensity Scores, Male Students Bullied at Least Once, Exogenous Covariates and Endogenous Covariates

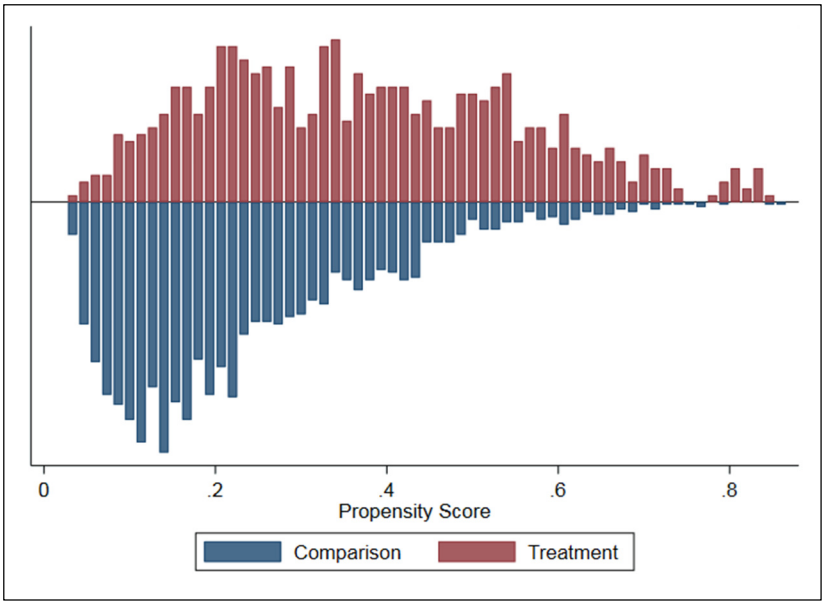

Figure 4. Post-Trimming Propensity Scores, Female Students Bullied at Least Once, Exogenous Covariates and Endogenous Covariates

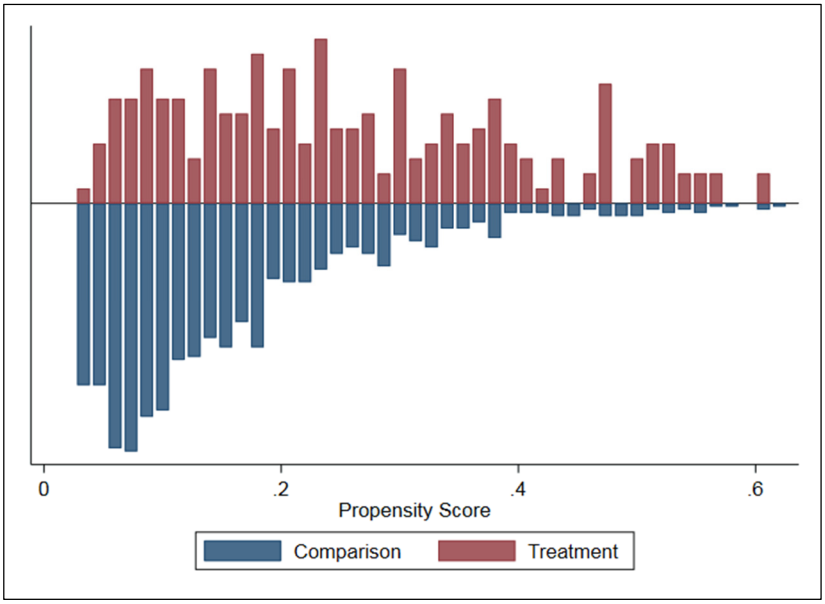

Figure 5. Post-Trimming Propensity Scores, Male Students Bullied More than Twice, Exogenous Covariates Only

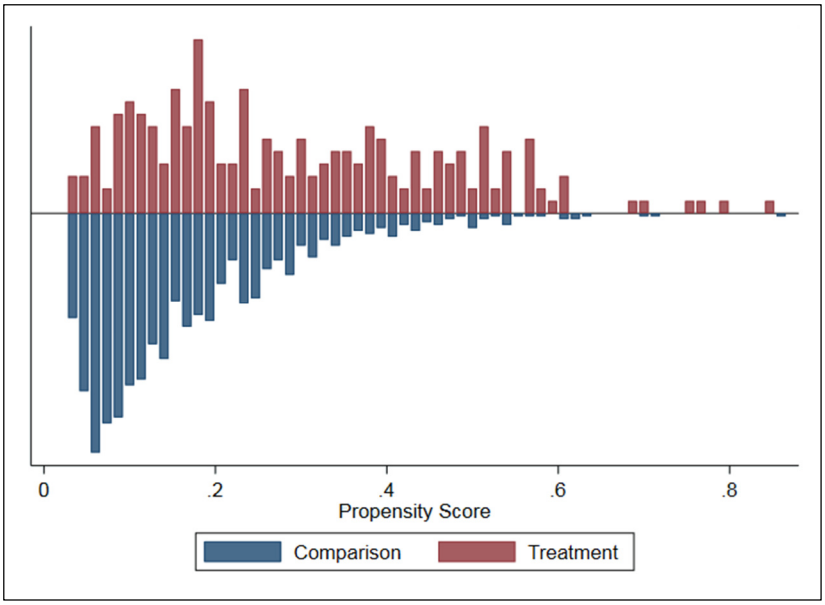

Figure 6. Post-Trimming Propensity Scores, Female Students Bullied More than Twice, Exogenous Covariates Only

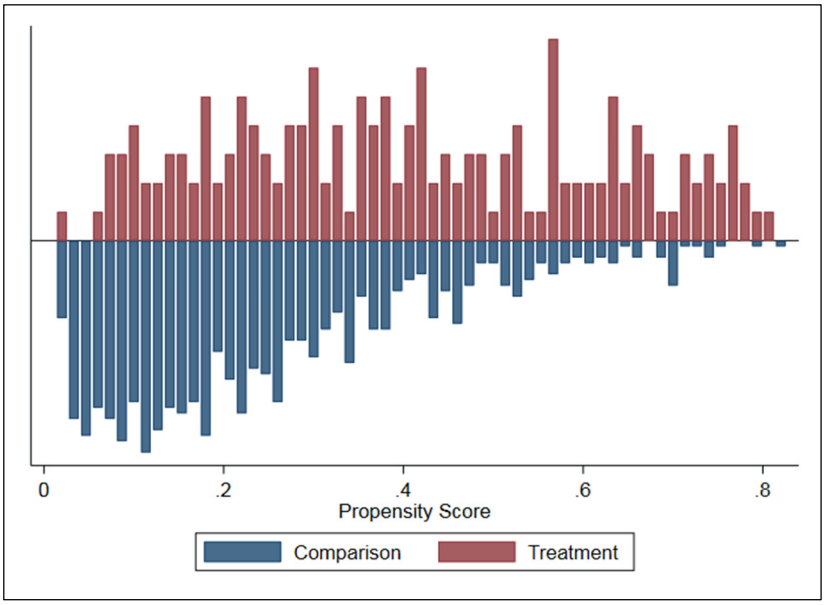

Figure 7. Post-Trimming Propensity Scores, Male Students Bullied More than Twice, Exogenous and Endogenous Covariates

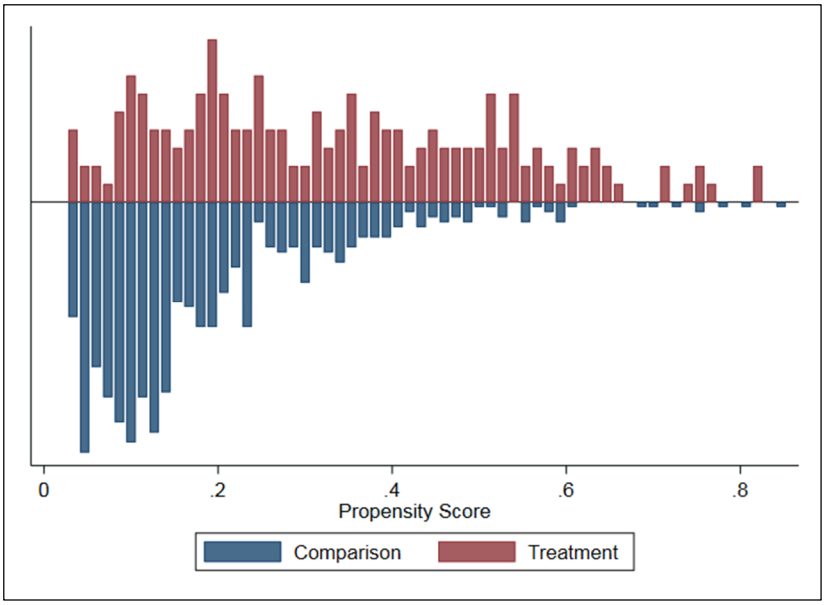

Figure 8. Post-Trimming Propensity Scores, Female Students Bullied More than Twice, Exogenous and Endogenous Covariates

Inverse Probability Weights

I used the following equation to calculate the inverse probability weights for each of the eight sets of propensity scores:

$$\omega(W|X) = W + (1 - W)\frac{p}{1 - p}$$

where $\omega(W, X)$ represents the inverse probability weight for a treatment assignment (W) given a set of covariates (X), and p represents the propensity score. When the treatment assignment has a value of one, signifying inclusion in the treatment group, the weight also equals one. When the treatment assignment is zero, signifying inclusion in the comparison group, the equation is reduced to

$$\omega(W|X) = \frac{p}{1-p}$$

which assigns each comparison group student a weight between zero and one that is equal to the probability of treatment divided by one minus the probability of being in the control condition.

DuGoff, Schuler, and Stuart (2014) state that analyses using IPWs to analyze data with a complex sampling design should multiply the student-level analytic weights by the IPWs. These new weights are then used in place of the analytic weights to examine treatment assignment bias and outcome measures. The ELS study collected the covariates I used in the propensity score models during the base-year data collection in 2002. The outcome variables, however, were collected during the first and third follow-up data collection in 2004 and 2012, respectively. This means that outcome models need different sets of analytic and design weights based on the source of the variables. I therefore created three versions of the new IPWs by multiplying the IPWs by the student-level analytic weights corresponding with the base-year, first follow-up, and third follow-up data collections. I used the IPWs multiplied by the base-year analytic weights to conduct the analysis of covariate bias described in the next section. All outcome models used the IPWs multiplied by the first follow-up analytic weights, except for high school graduation, which used the IPWs multiplied by the first follow-up analytic weights.

Analysis of Propensity Score Covariate Bias

To sufficiently estimate treatment effects, treatment and comparison groups must be balanced. Balanced covariates demonstrate that the observed characteristics of the treatment group are the same as the observed characteristics of the comparison group (Guo & Fraser,

2015). The difference between treatment and comparison group characteristics is described as the covariate bias, a standardized estimate of the difference between the means of the treatment and comparison group for each covariate.

For each of the eight models, I analyzed the extent to which the inverse probability weights reduced the bias between the treatment and comparison groups for each matching covariate. I first estimated the unweighted bias of the covariates using the following equation:

$$bias = \frac{\bar{x}_t - \bar{x}_c}{\sqrt{\left(\frac{s_t^2 + s_c^2}{2}\right)}}$$

where bias is equal to the mean of the comparison group ($\bar{x}_c$) subtracted from the mean of the treatment group ($\bar{x}_t$) divided by the pooled standard deviation. The pooled standard deviation is the square root of the average of the treatment group variance (s_t^2) and the comparison group variance (s_c^2). Next, I applied the IPWs to the model covariates in each of the eight models and estimated the covariate bias again.

Tables 10 and 11 provide the average absolute covariate bias before and after applying the IPWs for male and female students, respectively. Although the average absolute bias was not large prior to applying the IPWs, results of the bias analyses suggest that the IPWs reduced covariate bias in each of the eight propensity score models.

Table 10

Unweighted and Weighted Average Absolute Covariate Bias for Male Students by Treatment Variable and Covariates Included in Propensity Score Models

		Males in Grade 10	
Treatment Variable	**Covariates included**	**Unweighted**	**Weighted**
Bullied at least once	Exogenous only	0.04	0.01
	Exogenous and possibly endogenous	0.05	0.02
Bullied more than twice	Exogenous only	0.06	0.01
	Exogenous and possibly endogenous	0.09	0.05

Table 11

Unweighted and Weighted Average Absolute Covariate Bias for Female Students by Treatment Variable and Covariates Included in Propensity Score Models

		Females in Grade 10	
Treatment Variable	**Covariates included**	**Unweighted**	**Weighted**
Bullied at least once	Exogenous only	0.05	0.01
	Exogenous and possibly endogenous	0.04	0.01
Bullied more than twice	Exogenous only	0.06	0.03
	Exogenous and possibly endogenous	0.05	0.04

Tables 12 through 19 display the full results from the bias analysis of the eight propensity score models by analytic sample (i.e., male or female students), treatment variable (i.e., bullied at least once or more than twice), and covariate type (i.e., exogenous only or exogenous and possibly endogenous covariates). In each table, the first four columns display the unweighted covariate means for treatment and comparison groups, the absolute difference between the unweighted means, and the unweighted bias. The last four columns include the

weighted covariate means for treatment and comparison groups, the difference between weighted means, and the weighted bias.

A covariate is generally considered balanced if the weighted bias is no larger than .10 standard deviations (Austin, 2011). Table 12 demonstrates that the inverse probability weights estimated using exogenous covariates sufficiently balanced the treatment and comparison groups for each covariate. For example, the unweighted percentage of special education students was approximately 12 percent of students in the treatment group and 8 percent of students in the comparison group. The unweighted bias for special education students was .12 standard deviations. Applying the inverse probability weights reduced the bias associated with this covariate to .02 standard deviations.

The unweighted covariates in the bias analysis tables also describe the characteristics of the analytic sample by treatment assignment. The characteristics of bullied male and female students were generally within two or three percentage points of their non-bullied counterparts. For example, among male students who reported at least one instance of bullying victimization on Table 12, approximately 66 percent were White, six percent were Black, 13 percent were Hispanic, nine percent were Asian, and seven percent were another race. Among male students who reported no bullying victimization, 61 percent were White, nine percent were Black, 15 percent were Hispanic, nine percent were Asian, and six percent were another race. More than half of both bullied and non-bullied males attended preschool and more than 90 percent attended Kindergarten. The grade 9 GPA among bullied and non-bullied students was 2.66 and 2.64, respectively. Approximately 12 percent of bullied male students and eight percent of non-bullied students were enrolled in a special education program.

As shown on Table 13, female students followed a pattern similar to their male counterparts. Among bullied female students, 66 percent were White, eight percent were Black, 13 percent were Hispanic, seven percent were Asian, and seven percent were another race, as shown in Table 13. Among female students who reported no bullying victimization, 61 percent were White, ten percent were Black, 14 percent were Hispanic, nine percent were Asian, and five percent were another race. More than 50 percent of bullied and non-bullied female students attended preschool, and more than 90 percent attended Kindergarten. The average GPA in grade 9 was 2.83 among female students who reported at least one instance of bullying victimization, and 2.93 among the non-bullied counterparts. Approximately ten percent of bullied female students and five percent of non-bullied students were enrolled in a special education program.

Table 12

Bias Analysis for Male Students, Bullied at Least Once, Exogenous Covariates Only

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
White	0.66	0.61	0.04	0.09	0.66	0.67	-0.01	-0.02
Black	0.06	0.09	-0.03	-0.13	0.06	0.06	0.00	0.00
Hispanic	0.13	0.15	-0.02	-0.07	0.13	0.13	0.00	0.00
Asian	0.09	0.09	0.00	0.00	0.09	0.08	0.01	0.03
Other	0.07	0.06	0.01	0.05	0.07	0.07	0.00	0.01
Daycare	0.31	0.32	-0.01	-0.02	0.31	0.32	0.00	-0.01
Preschool	0.53	0.53	0.00	0.00	0.53	0.53	-0.01	-0.01
Head Start	0.14	0.13	0.00	0.01	0.14	0.13	0.01	0.02
Kindergarten	0.90	0.92	-0.02	-0.08	0.90	0.89	0.00	0.01
Grade 9 GPA	2.66	2.65	0.01	0.01	2.66	2.67	-0.01	-0.01
Non-native English	0.89	0.87	0.02	0.06	0.89	0.89	0.00	-0.01
Special education	0.12	0.08	0.04	0.12	0.12	0.13	-0.01	-0.02
Family characteritics								
Single Parent Household	0.21	0.21	0.00	0.00	0.21	0.22	-0.01	-0.03
No siblings	0.22	0.20	0.01	0.03	0.22	0.22	0.00	0.00
1 Sibling	0.39	0.40	-0.01	-0.02	0.39	0.40	-0.01	-0.01
2 Siblings	0.26	0.25	0.02	0.04	0.26	0.26	0.00	0.01

Table 12 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
3 Siblings	0.07	0.10	-0.02	-0.09	0.07	0.07	0.00	0.00
4 Siblings	0.03	0.03	0.01	0.03	0.03	0.03	0.00	0.01
5 or more siblings	0.02	0.02	0.00	-0.01	0.02	0.02	0.00	0.00
Income								
$20,000 or less	0.14	0.14	0.00	0.00	0.14	0.14	0.00	0.00
$20,001 to $50,000	0.37	0.39	-0.02	-0.04	0.37	0.38	0.00	-0.01
$50,001 to $75,000	0.23	0.23	0.00	0.00	0.23	0.22	0.00	0.00
More than $75,000	0.26	0.24	0.02	0.05	0.26	0.26	0.00	0.00
Mother's Education								
No HS graduation	0.12	0.13	-0.01	-0.03	0.12	0.12	0.00	0.00
High school diploma	0.50	0.52	-0.01	-0.02	0.50	0.51	0.00	0.00
Associate's degree	0.11	0.12	-0.01	-0.02	0.11	0.11	0.00	-0.01
Bachelor's degree	0.18	0.17	0.02	0.04	0.18	0.18	0.00	0.01
Graduate degree	0.09	0.07	0.01	0.04	0.09	0.09	0.00	0.00
Father's Education								
No HS graduation	0.13	0.13	0.00	0.00	0.13	0.12	0.00	0.01

Table 12 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
High school diploma	0.49	0.51	-0.02	-0.03	0.49	0.50	0.00	-0.01
Associate's degree	0.10	0.09	0.00	0.01	0.10	0.09	0.00	0.01
Bachelor's degree	0.17	0.16	0.01	0.02	0.17	0.17	0.00	0.01
Graduate degree	0.12	0.11	0.01	0.03	0.12	0.12	0.00	-0.01
Mother's Occupation								
All other jobs	0.37	0.35	0.02	0.05	0.37	0.37	0.00	0.00
Clerical	0.17	0.18	-0.01	-0.03	0.17	0.18	-0.01	-0.02
Manager	0.11	0.11	0.01	0.03	0.11	0.11	0.01	0.03
Professional	0.14	0.15	-0.02	-0.05	0.14	0.14	-0.01	-0.02
School teacher	0.06	0.07	-0.01	-0.03	0.06	0.06	0.00	-0.01
Service	0.15	0.14	0.00	0.01	0.15	0.14	0.01	0.02
Father's Occupation								
All other jobs	0.39	0.36	0.02	0.04	0.39	0.38	0.00	0.01
Craftsperson	0.11	0.15	-0.04	-0.12	0.11	0.11	0.00	0.01
Laborer	0.12	0.12	0.00	0.01	0.12	0.13	-0.01	-0.02
Manager	0.15	0.15	-0.01	-0.02	0.15	0.15	0.00	0.00
Operative	0.13	0.12	0.02	0.05	0.13	0.13	0.00	0.00

Table 12 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Professional	0.10	0.09	0.01	0.03	0.10	0.10	0.00	0.00
Average absolute bias				0.04				0.01

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 13

Bias Analysis for Female Students, Bullied at Least Once, Exogenous Covariates Only

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
White	0.66	0.61	0.04	0.09	0.66	0.67	-0.01	-0.02
Black	0.08	0.10	-0.02	-0.08	0.08	0.08	0.00	-0.01
Hispanic	0.13	0.14	-0.02	-0.05	0.13	0.12	0.00	0.01
Asian	0.07	0.09	-0.02	-0.08	0.07	0.07	0.00	0.01
Other	0.07	0.05	0.02	0.08	0.07	0.06	0.01	0.02
Daycare	0.31	0.29	0.02	0.04	0.31	0.31	0.00	0.00
Preschool	0.52	0.51	0.01	0.01	0.52	0.52	0.00	0.00
Head Start	0.12	0.13	0.00	-0.01	0.12	0.12	0.00	0.00
Kindergarten	0.93	0.92	0.01	0.04	0.93	0.93	0.00	0.01
Grade 9 GPA	2.82	2.93	-0.11	-0.14	2.82	2.81	0.02	0.02
Non-native English	0.90	0.87	0.03	0.08	0.90	0.90	0.00	-0.02
Special education	0.10	0.05	0.05	0.19	0.10	0.11	-0.01	-0.04
Family characteritics								
Single Parent Household	0.23	0.22	0.02	0.04	0.23	0.23	0.01	0.01
No siblings	0.22	0.19	0.03	0.06	0.22	0.22	0.00	-0.01
1 Sibling	0.40	0.38	0.02	0.04	0.40	0.40	0.00	0.01
2 Siblings	0.24	0.26	-0.02	-0.04	0.24	0.23	0.01	0.02

Table 13 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
3 Siblings	0.09	0.11	-0.02	-0.07	0.09	0.10	-0.01	-0.02
4 Siblings	0.03	0.03	0.00	-0.02	0.03	0.03	0.00	0.00
5 or more siblings	0.02	0.03	0.00	-0.03	0.02	0.02	0.00	-0.01
Income								
$20,000 or less	0.15	0.15	0.01	0.02	0.15	0.15	0.00	0.01
$20,001 to $50,000	0.39	0.38	0.01	0.03	0.39	0.39	0.00	0.01
$50,001 to $75,000	0.22	0.23	-0.01	-0.02	0.22	0.22	0.00	0.00
More than $75,000	0.23	0.24	-0.01	-0.03	0.23	0.24	-0.01	-0.01
Mother's Education								
No HS graduation	0.11	0.13	-0.01	-0.04	0.11	0.12	0.00	-0.01
High school diploma	0.55	0.52	0.03	0.05	0.55	0.55	0.00	0.00
Associate's degree	0.12	0.11	0.01	0.04	0.12	0.13	0.00	0.00
Bachelor's degree	0.14	0.17	-0.03	-0.10	0.14	0.13	0.00	0.01
Graduate degree	0.08	0.07	0.01	0.03	0.08	0.08	0.00	0.00
Father's Education								
No HS graduation	0.13	0.13	0.00	0.00	0.13	0.13	0.00	-0.01

Table 13 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
High school diploma	0.53	0.50	0.04	0.08	0.53	0.54	0.00	0.00
Associate's degree	0.08	0.08	0.00	0.00	0.08	0.08	0.00	0.01
Bachelor's degree	0.14	0.18	-0.03	-0.09	0.14	0.14	0.00	0.00
Graduate degree	0.11	0.12	-0.01	-0.02	0.11	0.11	0.00	0.00
Mother's Occupation								
All other jobs	0.36	0.36	0.00	0.01	0.36	0.36	0.00	0.00
Clerical	0.16	0.16	0.00	0.00	0.16	0.16	0.00	0.00
Manager	0.12	0.12	0.00	-0.01	0.12	0.12	0.00	-0.01
Professional	0.14	0.14	0.00	-0.01	0.14	0.14	0.00	-0.01
School teacher	0.06	0.07	-0.01	-0.06	0.06	0.06	0.00	0.01
Service	0.16	0.15	0.01	0.04	0.16	0.16	0.00	0.01
Father's Occupation								
All other jobs	0.36	0.38	-0.02	-0.05	0.36	0.36	0.00	-0.01
Craftsperson	0.14	0.14	0.00	0.00	0.14	0.13	0.00	0.01
Laborer	0.13	0.12	0.01	0.02	0.13	0.12	0.00	0.01
Manager	0.15	0.13	0.02	0.04	0.15	0.15	0.00	0.00
Operative	0.13	0.13	-0.01	-0.02	0.13	0.13	0.00	0.00

Table 13 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Professional	0.10	0.10	0.01	0.03	0.10	0.10	0.00	0.00
Average absolute bias				0.05				0.01

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 14

Bias Analysis for Male Students, Bullied at Least Once, Exogenous and Endogenous Covariates

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Exogenous covariates								
White	0.68	0.65	0.03	0.06	0.68	0.69	-0.01	-0.03
Black	0.06	0.07	-0.01	-0.04	0.06	0.06	0.00	-0.01
Hispanic	0.12	0.14	-0.02	-0.06	0.12	0.11	0.01	0.02
Asian	0.07	0.08	-0.01	-0.02	0.07	0.06	0.01	0.03
Other	0.07	0.06	0.01	0.04	0.07	0.07	0.00	-0.01
Daycare	0.33	0.33	0.00	0.00	0.33	0.34	-0.01	-0.02
Preschool	0.54	0.54	0.00	0.00	0.54	0.54	0.00	0.00
Head Start	0.12	0.13	-0.01	-0.02	0.12	0.11	0.01	0.03
Kindergarten	0.91	0.93	-0.01	-0.05	0.91	0.92	0.00	-0.01
Grade 9 GPA	2.68	2.66	0.02	0.03	2.68	2.68	0.01	0.01
Non-native English	0.90	0.88	0.02	0.07	0.90	0.91	-0.01	-0.03
Special education	0.11	0.08	0.03	0.09	0.11	0.12	-0.01	-0.05
Family characteritics								
Single Parent Household	0.21	0.20	0.01	0.02	0.21	0.20	0.01	0.02
No siblings	0.20	0.20	0.00	-0.01	0.20	0.20	0.00	0.00
1 Sibling	0.41	0.40	0.01	0.02	0.41	0.40	0.00	0.01
2 Siblings	0.28	0.25	0.02	0.06	0.28	0.27	0.00	0.00

Table 14 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
3 Siblings	0.07	0.10	-0.03	-0.12	0.07	0.07	0.00	0.00
4 Siblings	0.03	0.03	0.00	0.01	0.03	0.04	0.00	-0.03
5 or more siblings	0.02	0.02	0.00	-0.01	0.02	0.02	0.00	0.01
Income								
$20,000 or less	0.13	0.12	0.00	0.01	0.13	0.12	0.01	0.02
$20,001 to $50,000	0.37	0.39	-0.02	-0.04	0.37	0.37	0.01	0.01
$50,001 to $75,000	0.23	0.23	0.00	0.01	0.23	0.24	0.00	-0.01
More than $75,000	0.27	0.25	0.01	0.03	0.27	0.28	-0.01	-0.02
Mother's Education								
No HS graduation	0.10	0.12	-0.02	-0.05	0.10	0.11	-0.01	-0.04
High school diploma	0.51	0.52	-0.01	-0.01	0.51	0.50	0.01	0.02
Associate's degree	0.12	0.12	0.00	-0.01	0.12	0.12	0.00	-0.01
Bachelor's degree	0.18	0.17	0.01	0.03	0.18	0.17	0.00	0.01
Graduate degree	0.09	0.08	0.01	0.05	0.09	0.09	0.00	0.00
Father's Education								
No HS graduation	0.10	0.12	-0.01	-0.05	0.10	0.10	0.00	-0.01

Table 14 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
High school diploma	0.51	0.52	0.00	0.00	0.51	0.52	-0.01	-0.01
Associate's degree	0.09	0.10	-0.01	-0.02	0.09	0.10	0.00	-0.01
Bachelor's degree	0.17	0.16	0.01	0.04	0.17	0.16	0.01	0.03
Graduate degree	0.12	0.11	0.01	0.02	0.12	0.12	0.00	0.00
Mother's Occupation								
All other jobs	0.36	0.34	0.02	0.04	0.36	0.36	0.00	0.01
Clerical	0.17	0.19	-0.01	-0.04	0.17	0.18	0.00	-0.01
Manager	0.12	0.11	0.01	0.04	0.12	0.12	0.00	-0.01
Professional	0.14	0.16	-0.02	-0.06	0.14	0.15	-0.01	-0.03
School teacher	0.06	0.07	-0.01	-0.03	0.06	0.06	0.00	0.00
Service	0.15	0.14	0.01	0.03	0.15	0.13	0.01	0.03
Father's Occupation								
All other jobs	0.40	0.37	0.04	0.08	0.40	0.39	0.01	0.02
Craftsperson	0.10	0.15	-0.05	-0.15	0.10	0.10	0.00	0.02
Laborer	0.11	0.11	0.00	0.01	0.11	0.12	0.00	-0.01
Manager	0.14	0.16	-0.02	-0.05	0.14	0.14	0.00	0.00
Operative	0.13	0.11	0.02	0.06	0.13	0.15	-0.02	-0.04
Professional	0.11	0.10	0.01	0.02	0.11	0.10	0.00	0.01

Table 14 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Endogenous covariates								
Band or orchestra	0.22	0.16	0.06	0.15	0.22	0.21	0.01	0.03
Drama	0.11	0.09	0.02	0.08	0.11	0.10	0.01	0.04
Student government	0.04	0.05	-0.01	-0.05	0.04	0.04	0.00	-0.01
Honor society	0.07	0.07	0.00	-0.01	0.07	0.06	0.00	0.01
Advanced student	0.20	0.20	0.00	0.00	0.20	0.21	-0.01	-0.03
Retained	0.13	0.13	-0.01	-0.02	0.13	0.14	-0.01	-0.04
Sports participation								
Baseball	0.09	0.14	-0.05	-0.15	0.09	0.10	0.00	-0.01
Softball	0.07	0.06	0.01	0.03	0.07	0.08	-0.01	-0.03
Basketball	0.11	0.14	-0.03	-0.09	0.11	0.10	0.01	0.04
Football	0.20	0.29	-0.09	-0.21	0.20	0.20	-0.01	-0.01
Soccer	0.09	0.09	0.00	0.00	0.09	0.09	0.00	0.01
Other team sport	0.21	0.20	0.00	0.00	0.21	0.22	-0.01	-0.03
Individual sport	0.18	0.18	0.00	-0.01	0.18	0.18	-0.01	-0.02
Cheerleading	0.08	0.07	0.01	0.04	0.08	0.08	0.00	0.01

Table 14 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Interpersonal Relationships								
Friends	0.12	0.08	0.04	0.12	0.12	0.12	0.00	-0.01
Parent knows friend	0.95	0.93	0.01	0.06	0.95	0.94	0.01	0.03
Parental advice	-0.02	0.03	-0.05	-0.06	-0.02	-0.01	-0.01	-0.01
Parent involvement	-0.03	0.05	-0.07	-0.08	-0.03	-0.05	0.02	0.03
Family rules	-0.04	-0.01	-0.03	-0.04	-0.04	-0.06	0.02	0.03
Average absolute bias				0.05				0.02

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 15

Bias Analysis for Female Students, Bullied at Least Once, Exogenous and Endogenous Covariates

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Exogenous covariates								
White	0.67	0.64	0.03	0.05	0.67	0.68	-0.02	-0.03
Black	0.07	0.09	-0.02	-0.08	0.07	0.07	0.00	0.01
Hispanic	0.13	0.14	-0.01	-0.03	0.13	0.13	0.00	0.00
Asian	0.07	0.07	0.00	-0.01	0.07	0.06	0.01	0.03
Other	0.06	0.05	0.01	0.05	0.06	0.06	0.01	0.02
Daycare	0.33	0.30	0.03	0.06	0.33	0.32	0.01	0.01
Preschool	0.53	0.52	0.01	0.02	0.53	0.53	0.00	0.00
Head Start	0.12	0.12	0.00	-0.01	0.12	0.12	0.00	0.00
Kindergarten	0.94	0.92	0.01	0.05	0.94	0.93	0.00	0.01
Grade 9 GPA	2.83	2.93	-0.10	-0.12	2.83	2.81	0.03	0.03
Non-native English	0.90	0.88	0.02	0.06	0.90	0.91	-0.01	-0.04
Special education	0.10	0.04	0.05	0.20	0.10	0.10	-0.01	-0.03
Family characteritics								
Single Parent Household	0.23	0.22	0.01	0.03	0.23	0.22	0.01	0.01
No siblings	0.22	0.19	0.03	0.08	0.22	0.23	-0.01	-0.03

Table 15 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
1 Sibling	0.40	0.38	0.02	0.04	0.40	0.39	0.01	0.02
2 Siblings	0.24	0.26	-0.02	-0.05	0.24	0.23	0.01	0.02
3 Siblings	0.09	0.11	-0.02	-0.08	0.09	0.10	-0.01	-0.02
4 Siblings	0.03	0.03	0.00	-0.02	0.03	0.03	0.00	-0.01
5 or more siblings	0.02	0.02	0.00	-0.02	0.02	0.02	0.00	0.01
Income								
$20,000 or less	0.14	0.14	0.00	0.00	0.14	0.14	0.00	0.01
$20,001 to $50,000	0.38	0.38	0.00	0.00	0.38	0.38	0.00	0.00
$50,001 to $75,000	0.23	0.23	0.00	-0.01	0.23	0.23	-0.01	-0.01
More than $75,000	0.24	0.24	0.01	0.01	0.24	0.24	0.00	0.00
Mother's Education								
No HS graduation	0.12	0.12	-0.01	-0.02	0.12	0.11	0.00	0.00
High school diploma	0.53	0.53	0.01	0.01	0.53	0.54	-0.01	-0.01
Associate's degree	0.14	0.11	0.02	0.06	0.14	0.13	0.01	0.02
Bachelor's degree	0.13	0.17	-0.04	-0.10	0.13	0.13	0.01	0.02
Graduate degree	0.08	0.07	0.02	0.06	0.08	0.09	-0.01	-0.03

Table 15 (continued)

Covariates	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
	Bullied at Least Once	Not Bullied	Diff.	Bias	Bullied at Least Once	Not Bullied	Diff.	Bias
Father's Education								
No HS diploma	0.12	0.13	0.00	-0.01	0.12	0.13	-0.01	-0.02
High school diploma	0.53	0.51	0.02	0.05	0.53	0.52	0.01	0.02
Associate's degree	0.09	0.08	0.00	0.01	0.09	0.08	0.00	0.01
Bachelor's degree	0.15	0.17	-0.02	-0.05	0.15	0.14	0.01	0.02
Graduate degree	0.11	0.12	-0.01	-0.02	0.11	0.12	-0.01	-0.03
Mother's Occupation								
All other jobs	0.36	0.35	0.01	0.01	0.36	0.36	0.00	0.00
Clerical	0.16	0.16	0.00	0.01	0.16	0.16	0.00	0.00
Manager	0.12	0.12	0.00	0.00	0.12	0.12	0.00	0.00
Professional	0.15	0.15	0.00	0.00	0.15	0.15	-0.01	-0.01
School teacher	0.06	0.07	-0.01	-0.06	0.06	0.06	0.00	0.00
Service	0.15	0.15	0.00	0.01	0.15	0.14	0.01	0.02
Father's Occupation								
All other jobs	0.35	0.37	-0.02	-0.05	0.35	0.36	-0.01	-0.01

Table 15 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Craftsperson	0.14	0.14	0.00	0.00	0.14	0.13	0.01	0.02
Laborer	0.13	0.13	0.00	0.00	0.13	0.12	0.00	0.01
Manager	0.15	0.13	0.02	0.06	0.15	0.15	0.01	0.01
Operative	0.12	0.13	-0.01	-0.04	0.12	0.13	-0.01	-0.03
Professional	0.11	0.09	0.02	0.05	0.11	0.11	0.00	0.01
Endogenous covariates								
Band or orchestra	0.32	0.30	0.03	0.05	0.32	0.32	0.00	0.00
Drama	0.16	0.14	0.03	0.07	0.16	0.15	0.01	0.03
Student government	0.09	0.09	0.01	0.02	0.09	0.09	0.00	0.01
Honor society	0.11	0.11	0.00	0.01	0.11	0.11	0.00	0.01
Advanced student	0.22	0.21	0.01	0.03	0.22	0.23	-0.01	-0.03
Retained	0.09	0.09	0.00	0.00	0.09	0.08	0.01	0.02
Sports participation								
Baseball	0.01	0.01	0.00	-0.01	0.01	0.01	0.00	0.00
Softball	0.13	0.14	-0.01	-0.04	0.13	0.14	-0.01	-0.02
Basketball	0.09	0.11	-0.02	-0.07	0.09	0.09	0.00	0.00

Table 15 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**	**Bullied at Least Once**	**Not Bullied**	**Diff.**	**Bias**
Football	0.05	0.05	0.00	0.00	0.05	0.05	0.00	0.00
Soccer	0.07	0.08	-0.01	-0.04	0.07	0.06	0.00	0.02
Other team sport	0.24	0.25	-0.02	-0.04	0.24	0.24	0.00	0.00
Individual sport	0.10	0.11	-0.02	-0.05	0.10	0.09	0.00	0.00
Cheerleading	0.21	0.17	0.04	0.10	0.21	0.21	0.00	0.00
Interpersonal Relationships								
Friends	0.08	0.07	0.00	0.02	0.08	0.08	-0.01	-0.02
Parent knows friend	0.95	0.96	0.00	-0.01	0.95	0.96	0.00	-0.01
Parental advice	-0.04	0.00	-0.04	-0.05	-0.04	-0.05	0.01	0.01
Parent involvement	-0.03	0.05	-0.08	-0.10	-0.03	-0.04	0.01	0.01
Family rules	0.01	-0.01	0.02	0.02	0.01	0.00	0.01	0.01
Average absolute bias				0.04				0.01

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 16

Bias Analysis Results for Male Students, Bullied More than Twice, Exogenous Covariates Only

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
White	0.68	0.67	0.01	0.02	0.68	0.68	-0.01	-0.02
Black	0.05	0.07	-0.02	-0.07	0.05	0.05	0.00	0.00
Hispanic	0.13	0.12	0.02	0.05	0.13	0.14	0.00	-0.01
Asian	0.07	0.08	-0.01	-0.03	0.07	0.06	0.01	0.02
Other	0.06	0.06	0.00	0.01	0.06	0.06	0.00	0.01
Daycare	0.30	0.31	-0.01	-0.02	0.30	0.31	0.00	0.00
Preschool	0.46	0.52	-0.06	-0.12	0.46	0.47	0.00	-0.01
Head Start	0.15	0.14	0.02	0.05	0.15	0.15	0.00	0.01
Kindergarten	0.90	0.92	-0.02	-0.08	0.90	0.89	0.01	0.04
Grade 9 GPA	2.62	2.68	-0.06	-0.07	2.62	2.61	0.01	0.01
Non-native English	0.93	0.90	0.03	0.11	0.93	0.93	0.00	0.00
Special education	0.12	0.08	0.04	0.14	0.12	0.14	-0.02	-0.05
Family characteritics								
Single Parent Household	0.23	0.22	0.02	0.04	0.23	0.24	-0.01	-0.02
No siblings	0.19	0.19	0.00	0.01	0.19	0.19	0.01	0.02
1 Sibling	0.41	0.44	-0.03	-0.05	0.41	0.42	0.00	-0.01
2 Siblings	0.27	0.24	0.03	0.06	0.27	0.27	0.00	0.00

Table 16 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
3 Siblings	0.08	0.09	-0.01	-0.02	0.08	0.08	0.00	0.00
4 Siblings	0.03	0.02	0.01	0.07	0.03	0.04	0.00	-0.01
5 or more siblings	0.00	0.01	-0.01	-0.09	0.00	0.00	0.00	0.00
Income								
$20,000 or less	0.18	0.13	0.05	0.14	0.18	0.18	0.00	0.00
$20,001 to $50,000	0.33	0.41	-0.08	-0.16	0.33	0.32	0.01	0.02
$50,001 to $75,000	0.26	0.24	0.02	0.04	0.26	0.26	0.00	0.00
More than $75,000	0.23	0.22	0.01	0.03	0.23	0.24	-0.01	-0.03
Mother's Education								
No HS graduation	0.12	0.11	0.01	0.02	0.12	0.11	0.00	0.02
High school diploma	0.53	0.53	0.00	-0.01	0.53	0.54	-0.01	-0.02
Associate's degree	0.15	0.13	0.02	0.07	0.15	0.15	0.00	0.00
Bachelor's degree	0.15	0.16	0.00	-0.01	0.15	0.15	0.00	0.01
Graduate degree	0.05	0.07	-0.02	-0.09	0.05	0.05	0.00	0.00

Table 16 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Father's Education								
No HS graduation	0.12	0.10	0.02	0.06	0.12	0.12	0.01	0.02
High school diploma	0.54	0.54	0.01	0.01	0.54	0.54	0.00	0.01
Associate's degree	0.09	0.09	0.00	0.00	0.09	0.10	-0.01	-0.02
Bachelor's degree	0.15	0.16	-0.01	-0.03	0.15	0.15	0.00	-0.01
Graduate degree	0.09	0.10	-0.02	-0.05	0.09	0.09	0.00	-0.01
Mother's Occupation								
All other jobs	0.37	0.33	0.04	0.09	0.37	0.40	-0.02	-0.05
Clerical	0.16	0.19	-0.03	-0.08	0.16	0.16	0.00	0.01
Manager	0.13	0.11	0.02	0.05	0.13	0.12	0.01	0.02
Professional	0.14	0.15	-0.01	-0.03	0.14	0.14	0.00	0.00
School teacher	0.05	0.07	-0.02	-0.09	0.05	0.05	0.00	0.01
Service	0.15	0.15	0.00	0.01	0.15	0.14	0.01	0.03
Father's Occupation								
All other jobs	0.41	0.35	0.06	0.12	0.41	0.41	0.00	-0.01
Craftsperson	0.11	0.15	-0.04	-0.12	0.11	0.10	0.01	0.04

Table 16 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Laborer	0.14	0.13	0.01	0.03	0.14	0.14	0.00	0.00
Manager	0.11	0.15	-0.04	-0.11	0.11	0.11	0.00	-0.01
Operative	0.15	0.12	0.03	0.10	0.15	0.16	0.00	0.00
Professional	0.07	0.10	-0.03	-0.10	0.07	0.07	0.00	-0.02
Average absolute bias				0.06				0.01

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 17

Bias Analysis Results for Female Students, Bullied More than Twice, Exogenous Covariates Only

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
White	0.67	0.67	0.00	0.01	0.67	0.71	-0.03	-0.07
Black	0.05	0.08	-0.03	-0.12	0.05	0.05	0.00	0.01
Hispanic	0.14	0.14	0.00	0.00	0.14	0.12	0.02	0.05
Asian	0.04	0.07	-0.02	-0.10	0.04	0.04	0.00	0.01
Other	0.09	0.04	0.05	0.20	0.09	0.08	0.01	0.04
Daycare	0.31	0.27	0.04	0.08	0.31	0.33	-0.02	-0.04
Preschool	0.50	0.51	0.00	-0.01	0.50	0.51	-0.01	-0.01
Head Start	0.13	0.13	0.00	0.01	0.13	0.11	0.01	0.05
Kindergarten	0.93	0.93	0.01	0.02	0.93	0.93	0.00	-0.01
Grade 9 GPA	2.75	2.89	-0.14	-0.19	2.75	2.74	0.01	0.01
Non-native English	0.93	0.90	0.04	0.13	0.93	0.94	-0.01	-0.03
Special education	0.14	0.06	0.08	0.27	0.14	0.15	-0.01	-0.03
Family characteritics								
Single Parent Household	0.24	0.20	0.05	0.11	0.24	0.25	-0.01	-0.02
No siblings	0.25	0.19	0.06	0.14	0.25	0.27	-0.02	-0.05
1 Sibling	0.37	0.39	-0.02	-0.05	0.37	0.37	0.00	0.00
2 Siblings	0.24	0.26	-0.02	-0.04	0.24	0.23	0.02	0.04

Table 17 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
3 Siblings	0.10	0.10	-0.01	-0.02	0.10	0.09	0.01	0.02
4 Siblings	0.03	0.03	0.00	-0.02	0.03	0.03	0.00	0.00
5 or more siblings	0.01	0.02	-0.01	-0.05	0.01	0.01	0.00	0.00
Income								
$20,000 or less	0.15	0.14	0.01	0.04	0.15	0.14	0.02	0.05
$20,001 to $50,000	0.43	0.39	0.04	0.08	0.43	0.44	-0.01	-0.02
$50,001 to $75,000	0.19	0.23	-0.04	-0.11	0.19	0.19	0.00	-0.01
More than $75,000	0.23	0.24	-0.01	-0.03	0.23	0.23	0.00	-0.01
Mother's Education								
No HS graduation	0.12	0.11	0.01	0.03	0.12	0.11	0.01	0.03
High school diploma	0.57	0.55	0.02	0.03	0.57	0.58	-0.02	-0.04
Associate's degree	0.13	0.13	0.01	0.02	0.13	0.13	0.01	0.02
Bachelor's degree	0.10	0.14	-0.03	-0.10	0.10	0.10	0.01	0.02
Graduate degree	0.08	0.08	0.00	0.00	0.08	0.08	-0.01	-0.02

Table 17 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Father's Education								
No HS graduation	0.15	0.12	0.03	0.08	0.15	0.16	-0.01	-0.04
High school diploma	0.52	0.52	0.00	0.00	0.52	0.50	0.01	0.03
Associate's degree	0.08	0.09	-0.01	-0.02	0.08	0.08	0.01	0.02
Bachelor's degree	0.15	0.18	-0.03	-0.09	0.15	0.15	-0.01	-0.02
Graduate degree	0.10	0.09	0.01	0.03	0.10	0.10	0.00	0.00
Mother's Occupation								
All other jobs	0.34	0.36	-0.02	-0.03	0.34	0.34	0.00	0.00
Clerical	0.19	0.17	0.02	0.04	0.19	0.21	-0.01	-0.04
Manager	0.11	0.12	-0.02	-0.05	0.11	0.11	0.00	-0.01
Professional	0.12	0.13	-0.02	-0.05	0.12	0.10	0.01	0.04
School teacher	0.06	0.07	-0.01	-0.05	0.06	0.07	-0.01	-0.05
Service	0.19	0.14	0.04	0.12	0.19	0.17	0.02	0.04
Father's Occupation								
All other jobs	0.34	0.38	-0.03	-0.07	0.34	0.34	0.00	0.00
Craftsperson	0.15	0.15	0.00	0.00	0.15	0.14	0.01	0.02

Table 17 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Laborer	0.14	0.13	0.02	0.05	0.14	0.13	0.01	0.03
Manager	0.13	0.13	0.01	0.02	0.13	0.14	-0.01	-0.02
Operative	0.15	0.14	0.01	0.02	0.15	0.16	-0.01	-0.04
Professional	0.08	0.08	0.00	0.00	0.08	0.08	0.01	0.02
Average absolute bias				0.06				0.03

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 18

Bias Analysis Results for Male Students, Bullied More than Twice, Exogenous and Endogenous Covariates

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Exogenous covariates								
White	0.72	0.69	0.03	0.06	0.72	0.72	0.00	0.00
Black	0.05	0.06	-0.01	-0.03	0.05	0.05	0.00	0.00
Hispanic	0.12	0.12	0.01	0.02	0.12	0.10	0.02	0.06
Asian	0.05	0.07	-0.01	-0.06	0.05	0.05	0.00	0.01
Other	0.05	0.06	-0.01	-0.05	0.05	0.07	-0.02	-0.08
Daycare	0.33	0.33	0.00	0.01	0.33	0.35	-0.01	-0.03
Preschool	0.48	0.54	-0.06	-0.12	0.48	0.52	-0.04	-0.07
Head Start	0.15	0.13	0.02	0.06	0.15	0.13	0.02	0.06
Kindergarten	0.91	0.93	-0.03	-0.09	0.91	0.92	-0.01	-0.04
Grade 9 GPA	2.60	2.69	-0.10	-0.12	2.60	2.66	-0.07	-0.09
Non-native English	0.94	0.90	0.03	0.12	0.94	0.94	0.00	-0.01
Special education	0.13	0.07	0.06	0.19	0.13	0.11	0.02	0.05
Family characteritics								
Single Parent Household	0.23	0.19	0.04	0.09	0.23	0.22	0.01	0.02
No siblings	0.15	0.19	-0.05	-0.12	0.15	0.19	-0.04	-0.12

Table 18 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
1 Sibling	0.43	0.43	0.00	0.00	0.43	0.39	0.04	0.08
2 Siblings	0.29	0.24	0.05	0.12	0.29	0.29	0.00	0.00
3 Siblings	0.08	0.10	-0.02	-0.06	0.08	0.08	0.00	0.01
4 Siblings	0.04	0.02	0.02	0.12	0.04	0.04	0.00	0.02
5 or more siblings	0.01	0.02	-0.01	-0.10	0.01	0.01	0.00	-0.03
Family Income								
$20,000 or less	0.18	0.11	0.07	0.19	0.18	0.13	0.05	0.14
$20,001 to $50,000	0.32	0.43	-0.11	-0.22	0.32	0.36	-0.04	-0.08
$50,001 to $75,000	0.26	0.24	0.02	0.05	0.26	0.27	-0.01	-0.02
More than $75,000	0.25	0.23	0.02	0.04	0.25	0.25	0.00	0.00
Mother's Education								
No HS graduation	0.09	0.11	-0.02	-0.06	0.09	0.09	0.01	0.02
High school diploma	0.52	0.53	-0.01	-0.02	0.52	0.53	-0.01	-0.01
Associate's degree	0.16	0.13	0.03	0.09	0.16	0.15	0.01	0.04
Bachelor's degree	0.17	0.15	0.02	0.05	0.17	0.15	0.02	0.05
Graduate degree	0.05	0.08	-0.02	-0.10	0.05	0.08	-0.03	-0.13

Table 18 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Father's Education								
No HS graduation	0.11	0.11	0.00	0.01	0.11	0.09	0.02	0.07
High school diploma	0.56	0.54	0.02	0.05	0.56	0.58	-0.02	-0.04
Associate's degree	0.09	0.09	0.00	0.00	0.09	0.08	0.02	0.06
Bachelor's degree	0.15	0.15	0.00	-0.01	0.15	0.15	-0.01	-0.02
Graduate degree	0.09	0.11	-0.02	-0.07	0.09	0.10	-0.01	-0.03
Mother's Occupation								
All other jobs	0.37	0.33	0.04	0.08	0.37	0.33	0.04	0.08
Clerical	0.17	0.20	-0.03	-0.07	0.17	0.18	-0.01	-0.02
Manager	0.12	0.11	0.01	0.02	0.12	0.11	0.01	0.02
Professional	0.16	0.16	0.01	0.02	0.16	0.16	0.00	0.00
School teacher	0.04	0.08	-0.03	-0.15	0.04	0.07	-0.03	-0.12
Service	0.14	0.13	0.01	0.02	0.14	0.15	-0.01	-0.03
Father's Occupation								
All other jobs	0.40	0.34	0.06	0.12	0.40	0.42	-0.02	-0.04
Craftsperson	0.11	0.16	-0.06	-0.17	0.11	0.10	0.01	0.02

Table 18 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Laborer	0.14	0.12	0.02	0.05	0.14	0.13	0.01	0.04
Manager	0.12	0.16	-0.04	-0.11	0.12	0.14	-0.02	-0.05
Operative	0.16	0.12	0.05	0.14	0.16	0.13	0.04	0.11
Professional	0.08	0.10	-0.03	-0.09	0.08	0.09	-0.02	-0.06
Endogenous covariates								
Band or orchestra	0.23	0.16	0.06	0.16	0.23	0.22	0.01	0.02
Drama	0.09	0.08	0.01	0.04	0.09	0.09	0.00	0.00
Student government	0.06	0.06	0.01	0.03	0.06	0.06	0.01	0.03
Honor society	0.07	0.08	0.00	-0.02	0.07	0.07	0.00	0.02
Advanced student	0.14	0.17	-0.03	-0.08	0.14	0.18	-0.04	-0.10
Retained	0.16	0.13	0.03	0.08	0.16	0.16	0.00	-0.01
Sports participation								
Baseball	0.09	0.14	-0.05	-0.16	0.09	0.10	-0.01	-0.03
Softball	0.10	0.06	0.04	0.16	0.10	0.06	0.04	0.15
Basketball	0.06	0.14	-0.08	-0.25	0.06	0.11	-0.05	-0.16
Football	0.16	0.29	-0.14	-0.33	0.16	0.21	-0.05	-0.13

Table 18 (continued)

	Males in Grade 10 (unweighted)				Males in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Soccer	0.08	0.08	0.00	0.00	0.08	0.08	-0.01	-0.03
Other team sport	0.20	0.19	0.01	0.02	0.20	0.21	-0.01	-0.02
Individual sport	0.20	0.15	0.06	0.15	0.20	0.20	0.00	0.01
Cheerleading	0.09	0.06	0.03	0.12	0.09	0.08	0.01	0.04
Interpersonal Relationships								
Friends	0.12	0.10	0.02	0.06	0.12	0.12	0.00	-0.01
Parent knows friend	0.96	0.94	0.02	0.09	0.96	0.95	0.01	0.06
Parental advice	0.00	0.04	-0.04	-0.05	0.00	0.03	-0.03	-0.04
Parent involvement	-0.11	0.06	-0.17	-0.19	-0.11	-0.01	-0.10	-0.12
Family rules	-0.07	-0.02	-0.05	-0.06	-0.07	-0.05	-0.02	-0.02
Average absolute bias				0.09				0.50

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Table 19

Bias Analysis Results for Female Students, Bullied More than Twice, Exogenous and Endogenous Covariates

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Exogenous covariates								
White	0.69	0.71	-0.02	-0.04	0.69	0.76	-0.06	-0.14
Black	0.05	0.06	-0.01	-0.02	0.05	0.04	0.01	0.04
Hispanic	0.14	0.14	-0.01	-0.02	0.14	0.10	0.03	0.10
Asian	0.05	0.05	0.00	-0.01	0.05	0.04	0.01	0.03
Other	0.07	0.04	0.03	0.14	0.07	0.06	0.01	0.06
Daycare	0.31	0.27	0.04	0.08	0.31	0.30	0.01	0.02
Preschool	0.53	0.52	0.01	0.02	0.53	0.53	0.00	-0.01
Head Start	0.12	0.12	0.00	-0.01	0.12	0.10	0.02	0.06
Kindergarten	0.94	0.94	0.01	0.03	0.94	0.95	-0.01	-0.04
Grade 9 GPA	2.77	2.89	-0.12	-0.16	2.77	2.74	0.03	0.03
Non-native English	0.93	0.89	0.04	0.14	0.93	0.94	-0.01	-0.04
Special education	0.12	0.05	0.07	0.26	0.12	0.13	-0.01	-0.03
Family characteritics								
Single Parent Household	0.25	0.19	0.06	0.15	0.25	0.24	0.02	0.04
No siblings	0.24	0.19	0.05	0.13	0.24	0.24	0.00	0.01

Table 19 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
1 Sibling	0.37	0.39	-0.01	-0.03	0.37	0.40	-0.03	-0.05
2 Siblings	0.27	0.26	0.00	0.01	0.27	0.23	0.04	0.09
3 Siblings	0.09	0.12	-0.03	-0.08	0.09	0.12	-0.03	-0.09
4 Siblings	0.02	0.03	-0.01	-0.07	0.02	0.01	0.00	0.02
5 or more siblings	0.01	0.02	-0.01	-0.07	0.01	0.01	0.01	0.06
Income								
$20,000 or less	0.15	0.15	0.00	0.00	0.15	0.11	0.04	0.11
$20,001 to $50,000	0.42	0.39	0.02	0.05	0.42	0.42	0.00	-0.01
$50,001 to $75,000	0.18	0.22	-0.04	-0.10	0.18	0.20	-0.02	-0.05
More than $75,000	0.25	0.24	0.01	0.03	0.25	0.27	-0.01	-0.03
Mother's Education								
No HS graduation	0.12	0.12	0.00	0.01	0.12	0.11	0.01	0.04
High school diploma	0.55	0.53	0.01	0.03	0.55	0.56	-0.01	-0.02
Associate's degree	0.15	0.12	0.02	0.07	0.15	0.14	0.00	0.01
Bachelor's degree	0.10	0.15	-0.06	-0.17	0.10	0.09	0.00	0.01
Graduate degree	0.09	0.07	0.02	0.06	0.09	0.10	-0.01	-0.04

Table 19 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Father's Education								
No HS graduation	0.12	0.12	0.00	0.01	0.12	0.12	0.01	0.03
High school diploma	0.51	0.52	-0.01	-0.01	0.51	0.51	0.01	0.01
Associate's degree	0.10	0.10	0.00	0.00	0.10	0.09	0.00	0.01
Bachelor's degree	0.16	0.17	-0.01	-0.02	0.16	0.15	0.01	0.02
Graduate degree	0.10	0.09	0.01	0.03	0.10	0.13	-0.03	-0.08
Mother's Occupation								
All other jobs	0.34	0.34	0.00	0.00	0.34	0.35	-0.01	-0.02
Clerical	0.18	0.17	0.01	0.03	0.18	0.17	0.01	0.02
Manager	0.12	0.13	-0.01	-0.03	0.12	0.11	0.01	0.02
Professional	0.11	0.14	-0.03	-0.08	0.11	0.10	0.01	0.04
School teacher	0.06	0.07	-0.01	-0.05	0.06	0.09	-0.02	-0.09
Service	0.18	0.14	0.04	0.10	0.18	0.18	0.01	0.01
Father's Occupation								
All other jobs	0.34	0.37	-0.02	-0.04	0.34	0.33	0.02	0.04
Craftsperson	0.14	0.15	-0.01	-0.03	0.14	0.14	0.00	0.01
Laborer	0.13	0.13	0.00	-0.01	0.13	0.13	0.00	-0.01

Table 19 (continued)

Covariates	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
	Bullied More than Twice	Not Bullied	Diff.	Bias	Bullied More than Twice	Not Bullied	Diff.	Bias
Manager	0.15	0.13	0.02	0.05	0.15	0.16	-0.02	-0.04
Operative	0.14	0.14	0.00	-0.01	0.14	0.14	0.00	-0.01
Professional	0.10	0.08	0.02	0.07	0.10	0.10	0.00	0.01
Endogenous covariates								
Band or orchestra	0.33	0.31	0.02	0.05	0.33	0.37	-0.05	-0.10
Drama	0.19	0.16	0.03	0.08	0.19	0.18	0.00	0.01
Student government	0.08	0.09	-0.01	-0.02	0.08	0.07	0.01	0.03
Honor society	0.07	0.10	-0.02	-0.08	0.07	0.07	0.00	0.00
Advanced student	0.17	0.18	-0.01	-0.04	0.17	0.16	0.01	0.03
Retained	0.11	0.09	0.02	0.06	0.11	0.11	0.00	-0.01
Sports participation								
Baseball	0.01	0.01	0.00	0.05	0.01	0.01	0.00	0.03
Softball	0.12	0.16	-0.04	-0.11	0.12	0.12	0.00	0.01
Basketball	0.07	0.09	-0.03	-0.09	0.07	0.07	-0.01	-0.03
Football	0.06	0.05	0.01	0.04	0.06	0.05	0.01	0.04
Soccer	0.06	0.06	0.00	-0.02	0.06	0.04	0.02	0.08

Table 19 (continued)

	Females in Grade 10 (unweighted)				Females in Grade 10 (weighted)			
Covariates	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**	**Bullied More than Twice**	**Not Bullied**	**Diff.**	**Bias**
Other team sport	0.25	0.25	0.00	0.00	0.25	0.27	-0.02	-0.04
Individual sport	0.08	0.10	-0.02	-0.07	0.08	0.07	0.00	0.02
Cheerleading	0.24	0.19	0.05	0.13	0.24	0.27	-0.02	-0.05
Interpersonal Relationships								
Friends	0.05	0.05	0.00	0.00	0.05	0.04	0.01	0.03
Parent knows friend	0.96	0.95	0.01	0.03	0.96	0.97	-0.01	-0.03
Parental advice	-0.07	-0.07	0.00	0.00	-0.07	-0.09	0.02	0.02
Parent involvement	-0.04	0.02	-0.06	-0.08	-0.04	-0.02	-0.01	-0.01
Family rules	0.02	0.02	0.00	0.00	0.02	0.07	-0.05	-0.07
Average absolute bias				0.05				0.04

Note: "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teachers.

Benjamini-Hochberg False Discovery Adjustments

Using a significance level of $\alpha = .05$ suggests that about five out of 100 tests conducted will be false positives, or Type I errors, where results show statistical significance when in fact the null hypothesis cannot be rejected. Because I ran a total of 72 models using a significance level of $\alpha = .05$, it is possible that some of the results suffer from Type I error. I employed the Benjamini-Hochberg method for multiple comparisons to adjust the critical p values.

The first step in the Benjamini-Hochberg method is to rank order the outcomes by p values from highest to lowest (Benjamini & Hochberg, 2000). Then the equation to determine the adjusted critical p value for each outcome is:

$$Adjusted\ critical\ p = \alpha(r/m)$$

where α is the original critical p level, r is the rank number of the outcome, and m is the total number of tests conducted.

I conducted a total of 18 tests among males who reported at least one instance of bullying victimization. This means that after applying the Benjamini-Hochberg method, the outcome with the highest p value would be significant if the p value associated with that test is less than a critical p of .003 (i.e., .05 * (1/18)=.003). The outcome with the lowest p value would then be significant if the p value associated with that test is less than a critical p of .05 (i.e., .05 * (18/18)=.05). I used the Benjamini-Hochberg method to adjust the critical p values for four separate sets of outcomes including (1) males bullied at least once, (2) females

bullied at least once, (3) males bullied more than twice, and (4) females bullied more than twice.

Summary

To examine the relationship between bullying victimization and academic outcomes in high school, I conducted a quasi-experimental study that used inverse probability weights to reduce the selection bias associated with a non-random treatment assignment. Results of the bias analysis demonstrate that the IPWs reduced the average absolute bias in each of the eight propensity score models. In the next chapter, I will provide a description of the study results. In chapter 5, I provide summaries of the methods and the findings, as well as discussions about research implications, the limitations of the current study, and directions for future research.

CHAPTER 4

RESULTS

The purpose of this study was to examine the relationship between bullying victimization and academic outcomes in high school. In this chapter, I provide the results of bivariate outcome models by analytic sample (i.e., male and female students) and treatment variable (i.e., bullied at least once and bullied more than twice). For each outcome measure, I ran a series of three bivariate models that regressed the outcome on the treatment and weighted the models using the ELS balanced repeated replication (BRR) weights to address the complex sampling design:

1. Without IPWs.
2. With the IPWs that I estimated using only exogenous covariates multiplied by the student analytic weight.
3. With the IPWs that I estimated using both exogenous and possibly endogenous covariates multiplied by the student analytic weight.

Next, I present results of the Benjamini-Hochberg method to adjust the critical p values for each set of outcome models by analytic sample (i.e., males and females) and treatment variable (i.e., bullied at least once and bullied more than twice). I then present the outcomes in terms of their effect size (d). The effect size for OLS regression models is equal to the coefficient of the treatment variable. For logistic regression models, the effect size is the difference between the treatment and comparison group response proportions.

Males Bullied at Least Once

Table 20 displays the critical p-values I adjusted using the Benjamini-Hochberg procedure for multiple comparisons among male students. Table 21 presents the results of

outcome models for male students and Table 22 presents the effect sizes. The first treatment variable compared students who reported at least one instance of bullying victimization during the fall semester of 2001. Results of the bivariate models without IPWs suggest that no significant differences exist between treatment and comparison group students. Applying the IPWs estimated using only exogenous covariates yielded no significant results. Applying the IPWs estimated using exogenous and possibly endogenous covariates also yielded no significant results.

Males Bullied More than Twice

The second treatment variable examined the outcomes of male students who reported more than two instances of bullying victimization during the fall semester of 2001. These results mirrored the results of the first treatment variable. Results of the bivariate models without IPWs suggest that no significant differences exist between treatment and comparison group students. Applying the IPWs estimated using only exogenous covariates yielded no significant results. Applying the IPWs estimated using exogenous and possibly endogenous covariates also yielded no significant results.

Table 20

Benjamini-Hochberg False Discovery Adjustments for Outcomes among Male Students

		Bullied at least once			Bullied more than twice		
Outcome	**Model**	***p***	**Rank**	**Adjusted critical *p***	***p***	**Rank**	**Adjusted critical *p***
Math Self-Efficacy	No IPWs	.732	13	.036	.926	18	.050
	IPW exogenous	.389	10	.028	.912	17	.047
	IPW exogenous plus	.254	6	.017	.638	11	.031
Assessment Scores	No IPWs	.365	8	.022	.725	13	.036
	IPW exogenous	.860	15	.042	.162	3	.008
	IPW exogenous plus	.852	14	.039	.829	15	.042
Grade 11 GPA	No IPWs	.091	3	.008	.739	14	.039
	IPW exogenous	.133	5	.014	.067	1	.003
	IPW exogenous plus	.046	1	.003	.909	16	.044
Grade 12 GPA	No IPWs	.297	7	.019	.437	7	.019
	IPW exogenous	.969	18	.050	.512	9	.025
	IPW exogenous plus	.891	16	.044	.617	10	.028
High School Diploma	No IPWs	.512	11	.031	.709	12	.033
	IPW exogenous	.125	4	.011	.293	4	.011
	IPW exogenous plus	.087	2	.006	.073	2	.006
Immediate PSE Enrollment	No IPWs	.967	17	.047	.433	6	.017
	IPW exogenous	.379	9	.025	.507	8	.022
	IPW exogenous plus	.521	12	.033	.430	5	.014

Table 21

Outcome Results Using Bivariate Regression Models for Males

	Bullied at Least Once			Bullied More than Twice		
Outcome	**Naive**	**IPW exogenous**	**IPW exogenous plus**	**Naive**	**IPW exogenous**	**IPW exogenous plus**
Math Self-Efficacy	-0.015	-0.042	-0.060	-0.008	0.066	0.048
	(0.0444)	(0.0489)	(0.0525)	(0.0813)	(0.0893)	(0.1024)
Assessment Scores	0.473	0.106	-0.119	0.289	1.491	-0.240
	(0.5210)	(0.6000)	(0.6359)	(0.8208)	(1.0614)	(1.1063)
Grade 11 GPA	0.076	0.070	0.109	0.023	0.142	0.010
	(0.0444)	(0.0467)	(0.0542)	(0.0691)	(0.0774)	(0.0880)
Grade 12 GPA	0.045	0.002	0.007	0.057	0.055	-0.045
	(0.0433)	(0.0471)	(0.0504)	(0.0736)	(0.0833)	(0.0891)
High School Diploma	0.102	0.283	0.367	0.111	0.402	0.704
	(0.1560)	(0.1835)	(0.2137)	(0.2968)	(0.3812)	(0.3906)
Immediate PSE Enrollment	0.004	-0.100	-0.079	-0.127	0.136	0.169
	(0.0990)	(0.1140)	(0.1226)	(0.1614)	(0.2040)	(0.2136)

Note. Naive = No IPWs applied. IPW exogenous = IPWs estimated with exogenous covariates. IPW exogenous plus = IPWs estimated with exogenous and possibly endogenous covariates. PSE = Postsecondary Education. Standard errors in parentheses.
**Result is significant after adjusting critical p-values for multiple comparisons*

Table 22

Effect Sizes for Outcome Measures Using Bivariate Regression Models for Male Students

	Bullied at Least Once			Bullied More than Twice		
Outcome	**Naive**	**IPW exogenous**	**IPW exogenous plus**	**Naive**	**IPW exogenous**	**IPW exogenous plus**
Math Self-Efficacy	-0.015	-0.042	-0.060	-0.008	0.066	0.048
Assessment Scores	0.473	0.106	-0.119	0.289	1.491	-0.240
Grade 11 GPA	0.076	0.070	0.109	0.023	0.142	0.010
Grade 12 GPA	0.045	0.002	0.007	0.057	0.055	-0.045
High School Diploma	0.010	0.026	0.036	0.011	0.036	0.076
Immediate PSE Enrollment	0.001	-0.024	-0.019	-0.031	0.033	0.042

Note. Naive = No IPWs applied. IPW exogenous = IPWs estimated with exogenous covariates. IPW exogenous plus = IPWs estimated with exogenous and possibly endogenous covariates. PSE = Postsecondary Education.

Females Bullied at Least Once

Table 23 displays the critical p-values I adjusted using the Benjamini-Hochberg procedure for multiple comparisons among female students. Table 24 presents the results of outcome models for female students and Table 25 presents the effect sizes. The first treatment variable compared students who reported at least one instance of bullying victimization during the fall semester of 2001. The results of the bivariate models without IPWs suggest that significant differences exist between treatment and comparison group students. Female students who were bullied at least once demonstrated lower levels of self-efficacy in mathematics ($d = -0.135, p = .003$). Female students who were bullied at least once also demonstrated lower scores on the ELS mathematics assessment ($d = -1.479, p = .001$), as well as lower GPAs in grade 11 ($d = -0.106, p = .002$) and in grade 12 ($d = -0.110, p = .001$). Among female students, I found no significant differences between bullied and non-bullied students for high school graduation and immediate postsecondary enrollment.

No significant differences between treatment and comparison group students remained after applying the IPWs that I estimated using only exogenous covariates. No significant differences remained after applying the IPWs that I estimated using exogenous and endogenous covariates.

Females Bullied More than Twice

The second treatment variable examined the outcomes of female students who reported more than two instances of bullying victimization during the fall semester of 2001. Results of the bivariate models without IPWs indicate significant differences between students bullied more than twice and non-bullied students for all but one outcome measure.

Female students who were bullied more than twice indicated lower levels of mathematics self-efficacy ($d = -0.276, p = .000$). Bullied female students also had lower scores on the ELS mathematics assessment ($d = -3.376, p = .000$), grade 11 GPA ($d = -0.260, p = .000$), and grade 12 GPA ($d = -0.210, p = .001$). I found no significant differences between bullied and non-bullied students for high school graduation and immediate postsecondary enrollment.

I next applied the IPWs estimated using only exogenous covariates to the outcome models. Results of these models suggest no differences exist between female students who reported bullying victimization more than twice and those who reported no bullying victimization. I then applied the IPWs that I estimated using exogenous and possibly endogenous covariates. The results of these models suggest that lower levels of mathematics self-efficacy among bullied female students ($d = -0.254, p = .014$).

Table 23

Benjamini-Hochberg False Discovery Adjustments for Outcomes among Female Students

		Bullied at least once			Bullied more than twice		
Outcome	**Model**	***p***	**Rank**	**Adjusted critical *p***	***p***	**Rank**	**Adjusted critical *p***
Math Self-Efficacy	No IPWs	.003	4	.011	.000	1	.003
	IPW exogenous	.028	5	.014	.017	6	.017
	IPW exogenous plus	.085	7	.019	.014	5	.014
Assessment Scores	No IPWs	.001	1	.003	.000	2	.006
	IPW exogenous	.138	9	.025	.178	9	.025
	IPW exogenous plus	.121	8	.022	.416	14	.039
Grade 11 GPA	No IPWs	.002	3	.008	.000	3	.008
	IPW exogenous	.852	15	.042	.202	10	.028
	IPW exogenous plus	.749	14	.039	.204	11	.031
Grade 12 GPA	No IPWs	.001	2	.006	.001	4	.011
	IPW exogenous	.210	10	.028	.147	8	.022
	IPW exogenous plus	.732	13	.036	.361	13	.036
High School Diploma	No IPWs	.524	12	.033	.614	17	.047
	IPW exogenous	.304	11	.031	.444	15	.042
	IPW exogenous plus	.929	18	.050	.266	12	.033
Immediate PSE Enrollment	No IPWs	.063	6	.017	.068	7	.019
	IPW exogenous	.861	16	.044	.459	16	.044
	IPW exogenous plus	.912	17	.047	.776	18	.050

Table 24

Outcome Results Using Bivariate Regression Models for Females

	Bullied at Least Once			Bullied More than Twice		
Outcome	**Naive**	**IPW exogenous**	**IPW exogenous plus**	**Naive**	**IPW exogenous**	**IPW exogenous plus**
Math Self-Efficacy	-0.135*	-0.108	-0.093	-0.276*	-0.215	-0.254
	(0.0449)	(0.0489)	(0.0538)	(0.0777)	(0.0897)	(0.1022)
Assessment Scores	-1.479*	-0.708	-0.817	-3.376*	-1.162	-0.744
	(0.4425)	(0.4755)	(0.5238)	(0.7840)	(0.8603)	(0.9129)
Grade 11 GPA	-0.106*	-0.007	0.013	-0.260*	-0.092	-0.115
	(0.0343)	(0.0356)	(0.0417)	(0.0681)	(0.0719)	(0.0901)
Grade 12 GPA	-0.110*	-0.041	-0.013	-0.210*	-0.092	-0.063
	(0.0320)	(0.0327)	(0.0375)	(0.0625)	(0.0635)	(0.0689)
High School Diploma	-0.105	0.222	0.021	-0.151	-0.299	-0.513
	(0.1644)	(0.2154)	(0.2361)	(0.2990)	(0.3901)	(0.4598)
Immediate PSE Enrollment	-0.187	-0.020	0.014	-0.358	-0.177	0.075
	(0.1000)	(0.1159)	(0.1280)	(0.1950)	(0.2392)	(0.2624)

Note. Naive = ELS analytic and design weights. IPW exogenous = IPWs estimated with exogenous covariates. IPW exogenous plus = IPWs estimated with exogenous and possibly endogenous covariates. PSE = Postsecondary Education. Standard errors in parentheses.

**Result is significant after adjusting critical p-values for multiple comparisons*

Table 25

Effect Sizes for Outcome Measures Using Bivariate Regression Models for Female Students

	Bullied at Least Once			Bullied More than Twice		
Outcome	**Naive**	**IPW exogenous**	**IPW exogenous plus**	**Naive**	**IPW exogenous**	**IPW exogenous plus**
Math Self-Efficacy	-0.135	-0.108	-0.093	-0.276	-0.215	-0.254
Assessment Scores	-1.479	-0.708	-0.817	-3.376	-1.162	-0.744
Grade 11 GPA	-0.106	-0.007	0.013	-0.260	-0.092	-0.115
Grade 12 GPA	-0.110	-0.041	-0.013	-0.210	-0.092	-0.063
High School Diploma	-0.008	0.016	0.001	-0.011	-0.019	-0.029
Immediate PSE Enrollment	-0.043	-0.005	0.003	-0.084	-0.041	0.017

Note. Naive = ELS analytic and design weights. IPW exogenous = IPWs estimated with exogenous covariates. IPW exogenous plus = IPWs estimated with exogenous and possibly endogenous covariates. PSE = Postsecondary Education.

Summary

This study used IPWs to address the selection bias associated with a non-random treatment assignment. The results presented in this chapter indicate the most academic outcomes for both male and female students were not related to bullying victimization after applying IPWs to address selection bias. The next chapter provides summaries of the methods and results. It also includes a discussion of the limitations of this study, and directions for future research.

CHAPTER 5

DISCUSSION

I begin chapter 5 with a summary of the methods and results of the research described in the preceding chapters. I then discuss the implications of the research, the limitations of the study, and the directions for future research.

Summary of the Methods

This current study used data from the Education Longitudinal Study of 2002 to examine the relationship between bullying victimization and academic outcomes among students in public high schools in the U.S. The ELS data file included a wealth of data for approximately 16,000 participating students, including demographic data about the students and their families, and academic outcome data. The ELS student questionnaire included one item that I used to identify bullied students. I used this questionnaire item to identify two treatment groups: (1) students reporting at least one instance of bullying victimization, and (2) students reporting more than two instances of bullying victimization. Students who reported no bullying victimization served as the comparison group for each treatment group. The analytic sample in this study included approximately 9,300 male and female students.

In studies using observational data, such as the current study, treatments are not randomly assigned. Without random treatment assignment, statistical models will produce biased estimates of the treatment effect, unless the researcher corrects for differences between the treatment and comparison groups (Angrist & Pischke, 2009; Imbens & Rubin, 2015; Khandker et al., 2010; Murnane & Willett, 2011). Bullying victimization is clearly not random, because bullies target specific students.

I conducted a propensity score analysis to correct the bias that results from the non-random treatment assignment in the current study. First, I estimated propensity scores by regressing the treatment on the covariates identified in the literature as predicting bullying victimization. I then used the propensity scores to calculate statistical weights based on the inverse probability of receiving the treatment (IPWs) that I used to address the selection bias. In each of the eight propensity score models, the IPWs reduced the average absolute covariate bias.

Summary and Discussion of the Findings

This study was designed to answer the following research question: What are the longitudinal impacts of bullying victimization on academic outcomes after applying inverse probability weights to account for differences between bullied and non-bullied students? To test the research question, I used outcomes that measured academic achievement through the end of high school and beyond. The first outcome measure examined the effects of bullying victimization on mathematics self-efficacy. Although not a direct measure of academic achievement itself, self-efficacy is an important predictor of academic success (Caprara et al., 2011). I then tested the effect of bullying victimization on measures of achievement, including scores on the ELS mathematics assessment, GPA in grades 11 and 12, high school graduation, and immediate enrollment in postsecondary education.

Among the 72 outcome models in this study, a total of eight had significant results and were limited to the models without IPWs for female students:

- Lower levels of self-efficacy in mathematics among female students who reported being bullied at least once ($d = -0.135$), and among those who reported being bullied more than twice ($d = -0.276$).

- Lower scores on the mathematics assessment among female students who reported being bullied at least once ($d = -1.479$), and among those who reported being bullied more than twice ($d = -3.376$).
- Lower GPAs in grade 11 among female students who reported being bullied at least once ($d = -0.106$), and among those who reported being bullied more than twice ($d = -0.260$).
- Lower GPAs in grade 12 ($d = -0.110$), and among those who reported being bullied more than twice ($d = -0.210$).

Because I found significant results for self-efficacy among female students using the models without the IPWs, these results of the unweighted models for female students are aligned conceptually with some research in the literature. That is, some studies suggest that female students may be more likely to be victims of relational bullying (Carbone-Lopez et al., 2010) and relational bullying victimization is associated with lower levels of academic self-efficacy (Ma et al., 2009; Popp et al., 2014).

The significant results were limited to the outcome models without IPWs. After applying the IPWs, I observed no differences between the outcomes of female students who reported bullying victimization compared to female students reporting no bullying victimization. Taken alone, these results suggest that bullied students do not have lower self-efficacy in mathematics after applying the IPWs to address the baseline differences between bullied and non-bullied students.

Because the mathematics self-efficacy outcomes were no longer significant after applying the IPWs, the true cause of the differences observed among the naive model outcomes is possibly (1) one or more of the observed covariates in the propensity score

model, or (2) some other unobserved characteristic that is correlated with one more of the covariates in the propensity score models.

Defining Bullied Students in Observational Data

The lack of results among the outcome models with the IPWs begs the question why I found no significant results where other studies did, including studies that used ELS data. The main reason may be due to how I defined bullied students compared to other studies, including those that also used ELS data.

The current study was fundamentally constrained by my use of observational data to examine bullying victimization, because observational data requires researchers to make decisions about how to best define analytic samples and treatment groups based on the variables included in the data file. The results of the current study may differ from others because of the decisions that I made, including how I defined the treatment variable.

The base-year ELS student questionnaire included a series of items that asked about the involvement of each student with peer victimization, including bullying victimization. These included:

- I had something stolen from me at school
- Someone offered to sell me drugs at school
- Someone threatened to hurt me at school
- I got into a physical fight at school
- Someone hit me
- Someone used strong-arm or forceful methods to get money or things from me
- Someone purposely damaged or destroyed my belongings
- Someone bullied me or picked on me

Studies using ELS data have utilized one or more of these items to define various types of victimization including, but not limited to, bullying victimization. That is, authors have used a variety of these items to define bullying, and have also used the same items to define non-bullying victimizations. For example, to examine the relationship between bullying victimization and participation in extracurricular activities, Peguero (2008) used six items, including (1) someone threatened to hurt me at school, (2) someone hit me, (3) someone used strong-arm or forceful methods to get money or things from me, (4) someone bullied me or picked on me, (5) I had something stolen from me at school, and (6) someone purposely damaged or destroyed my belongings. Coincidentally, in a study of non-bullying victimization in schools, Peguero (2009a) used the first four of these same six items to identify students who were "exposed to violent victimization," and the last two to identify students who were "exposed to property victimization."

Williams and Peguero (2013) and Popp, Peguero, Day, and Kahle (2014) used ELS data to examine the relationship between bullying and academic achievement. Williams and Peguero (2013) defined bullied students as those who reported (1) being bullied, (2) being hit, or (3) being threatened. In addition to these three variables, Popp, Peguero, Day, and Kahle (2014) also included in their definition of bullying those students who reported that another student had forcefully stolen something from them.

Whereas each of the individual victimization variables used by Peguero (2008, 2009a), Williams and Peguero (2013), and Popp, Peguero, Day, and Kahle (2014) could possibly indicate bullying victimization, they are not inherently indicative of bullying victimization because, excluding the question that explicitly asks about bullying, each could also describe non-bullying situations. Therefore, by using these uncertain items to define

bullying victimization, the researchers likely included students who were not actually bullying victims.

For the current study, I took a more conservative approach by only using the item "someone bullied me or picked on me" to identify students who were bullying victims. Whereas the approaches used by researchers such as Peguero (2008, 2009a) and others likely include students who were not actually victims of bullying, I employed an approach intended to minimize the number of students who were not victims of bullying in the analytic samples. As such, the conservative definition of bullied students may explain why the results of this study do not align with other studies that used ELS data.

Implications of the Research

This research presents implications for policy and research. First, states should make a concerted effort to ensure that state anti-bullying legislation clearly define bullying using specific behaviors, including relational bullying behaviors. Three examples of definitions included in state anti-bullying legislation show the variety of definitions employed at the state level. It is unclear in North Carolina, for example, that the definition of bullying behaviors covers relational bullying. North Carolina defines bullying behaviors as “any pattern of gestures or written, electronic, or verbal communications, or any physical act or any threatening communication" (29 § 115C-407.15). Nebraska provides a general definition with few details about bullying behaviors. Nebraska defines bullying as “any ongoing pattern of physical, verbal, or electronic abuse on school grounds" (79-2, 137). As with the definition provided by North Carolina, Nebraska also does not mention relational, or any specific type, of bullying. Oregon provides a clearer definition of bullying behaviors that includes language that may be interpreted as referring to relational bullying. Oregon defines bullying as

"physically harming a student or damaging a student's property; knowingly placing a student in reasonable fear of physical harm to the student or damage to the student's property; or creating a hostile educational environment, including interfering with the psychological well-being of a student." (ORS § 339.351). State legislators are in a position to spearhead the creation of a standardized bullying definition. In turn, researchers could adopt such a definition to guide the design and dissemination of future bullying victimization studies.

The second implication involves bullying victimization research. Although most prior research suggests that bullying victimization has a negative association with academic outcomes, the relatively few significant outcomes identified in this study is encouraging, because they suggest that the relationship between bullying victimization and academic outcomes may be minimal after controlling for differences between the observed characteristics of bullied and non-bullied students. Regardless of the results of the current study, some bullied students will exhibit negative academic outcomes due to bullying victimization. Continuing to develop a better understanding of how victimization affects achievement for these students should remain a priority among researchers.

Researchers should also focus efforts to better understand how changes in asymmetric power relationships and the number of instances of bullying may affect students and their academic outcomes. Ybarra, Espelage, & Mitchell (2014) suggest that these are key to understanding why bullying victimization affects some students to a greater or lesser degree than others. Specifically, they found that bullying victimization coupled with a wider asymmetric power relationship or more instances of bullying victimization are more devastating to the victim.

Researchers should focus efforts to determine if resilience theory explains why bullying victimization negatively affects some students but not others. Resiliency might explain why some students suffer fewer negative effects of an adverse event, such as bullying victimization, than others because resiliency is positively related to "warm relationships with the family" (Bowes, Maughan, Caspi, Moffitt, & Arseneault, 2010), and it is enhanced by strong friendship networks in the school (Kendrick et al., 2012). That is, victims of bullying tend to lack the appropriate skills to avoid the negative outcomes of bullying victimization (Hansen, Steenberg, Palic, & Elklit, 2012), unlike students who come from cohesive, connected families and have positive friendship networks.

Limitations

The findings described herein should be interpreted with caution due to several limitations of the study. First, propensity score models need to include all characteristics that predict treatment assignment (Austin, 2011; Guo & Fraser, 2015; Imbens & Rubin, 2015; Rosenbaum & Rubin, 1983). ELS did not collect all variables suggested in the literature of possibly predicting bullying victimization. For example, Bollmer, Milich, Harris, and Maras (2005) state that bullies target other students using less measurable characteristics:

> Children who are victimized tend to possess certain characteristics that signal vulnerability to a potential bully. These characteristics are often referred to as internalizing problems because these children appear anxious, depressed, and socially withdrawn, and they tend to blame themselves for the victimization (p. 702).

Because I could not account for these types of variables in the propensity score models, my models may suffer from omitted variable bias.

The second limitation of this study is related to the variable I used to identify the treatment and comparison groups. One of the strengths of ELS is the wealth of longitudinal data about student characteristics and academic outcomes that can be linked to bullying victimization. Despite this strength, the student questionnaire did not provide students with a definition of bullying victimization, which means that students used their own definitions when responding to the bullying question. Therefore, it is likely that students defined bullying in a variety of ways. By extension, this means that bullying was difficult to define in the current study.

Many definitions of bullying victimization state that bullying occurs when the victimization happens more than once over a period of time. It was not possible to identify students who indicated only one instance of bullying victimization using ELS data. The ELS student questionnaire did not provide response options that would allow researchers to identify groups of students who reported no instances, only one instance, and two or more instances of bullying victimization. Rather, response options included "never," "one or two times," and "more than twice." To address multiple victimizations, I created two treatment variables to investigate the differences between students who reported multiple instances of bullying victimization. Yet, I was unable to investigate students who reported a single instance of bullying victimization.

The third limitation to this study is that many of the variables may not be exogenous to the treatment assignment. To investigate the effect of these possibly endogenous covariates, I included them in separate propensity score models, in addition to the models with only exogenous covariates. Similarly, it is possible that students who reported bullying victimization in the ELS data file may have been bullied before the Fall of 2001. This would

suggest that one exogenous covariate, GPA in grade 9, would also be endogenous to the treatment. Given that the GPA interacts with other exogenous covariates, such as race and socioeconomic status, I included it with the set of exogenous covariates.

Directions for Future Research

The lessons learned completing this study suggest directions for future research. Bullying victimization research often identifies a negative relationship between victimization and academic outcomes without accounting for differences between students who are bullied and those who are not. Given that the amount of rigorous research on bullying victimization in the U.S. has increased since the Columbine High School shooting in 1999 (Wong & Schonlau, 2013), the use of quasi-experimental methods is not extensively utilized in the bullying victimization literature. As such, researchers are mostly unable to determine the direction of a causal relationship between victimization and the covariates used to predict bullying victimization. This study represents an initial step into the use of quasi-experimental methods to create treatment and comparison groups that are equivalent at baseline, but the results are not definitive. Scholars should continue to investigate using quasi-experimental methods to develop a deeper understanding about such causal links among bullying victimization, predictive covariates, and academic outcomes.

One of the most salient lessons from the current study is the need to continue examining the ways in which bullying victimization data are collected to develop methodological best practices. The ability of scholars to examine and disseminate findings on bullying victimization ultimately rests on how the data are initially collected. How studies collect bullying data will impact the ability of researchers to correctly identify bullied students and report findings. Although the term “bullying” describes a situation with which

most people are at least minimally familiar, the concept itself is nuanced. Bullying comprises a wide range of behaviors, and incidents of bullying are often subjective depending on the role of each individual as a bully, victim, or uninvolved bystander. Aspects of bullying victimization, such as asymmetric power relationships, may be understood by academics, but they should be clarified for students who provide valid data on their experiences with bullying. Future research and discourse on bullying should provide a cogent definition of bullying to include the following elements:

- Specific examples of aggressive behaviors.
- The existence of a power imbalance between bully and victim.
- The repeated nature of bullying behaviors.
- Other specific details, such as the type of victimization (i.e., direct or indirect), as required by the study.

Collecting data about specific bullying behaviors and frequencies, while providing students with a coherent definition of bullying, will allow researchers who use the data to conduct more flexible and fluid future analyses of bullying victimization.

Conclusions

The purpose of this study was to examine the effects of bullying victimization on academic outcomes. Although research has consistently suggested that bullying adversely affects academic outcomes, few studies to date have taken the appropriate statistical steps to ensure that treatment and comparison groups are equivalent at baseline. The current study uses inverse probability weights, a quasi-experimental method, to balance the observable characteristics between students who have been bullied and those who have not. An analysis

of the covariate bias suggests that the weights sufficiently reduced the average absolute bias in each of the eight propensity score models.

Results of the models indicate that, after balancing the treatment and comparison groups across, academic outcomes appear no different for bullied students than for non-bullied students in the weighted models. In other words, there are no differences between the outcomes of bullied students and non-bullied students after accounting for observable characteristics that predict bullying victimization.

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APPENDICES

Appendix A: Propensity Score Model Results

Table A1

Results of Logistic Regression Models Using Only Exogenous Covariates to Estimate Propensity Scores

	Bullied at least once		**Bullied more than twice**	
Exogenous covariates	**Males**	**Females**	**Males**	**Females**
Black	0.17	-0.99	-0.24	-3.43
	(0.696)	(0.634)	(1.300)	(1.551)
Hispanic	-0.20	0.14	0.32	1.78
	(0.531)	(0.533)	(0.961)	(1.053)
Asian	0.38	-0.01	-0.31	0.15
	(0.730)	(0.888)	(1.482)	(1.964)
Other	1.08	0.86	0.64	1.80
	(0.736)	(0.706)	(1.382)	(1.331)
Daycare	0.00	0.10	0.06	0.12
	(0.117)	(0.109)	(0.220)	(0.212)
Preschool	-0.01	0.02	-0.32	0.00
	(0.112)	(0.105)	(0.209)	(0.199)
Head Start	0.16	-0.16	0.14	-0.29
	(0.163)	(0.153)	(0.305)	(0.291)
Kindergarten	-0.34*	0.11	-0.39	0.16
	(0.174)	(0.179)	(0.321)	(0.355)
Grade 9 GPA	0.16	0.58	-0.12	2.41
	(0.405)	(0.406)	(0.730)	(0.856)
Non-native English	0.26	0.11	1.14**	0.80**
	(0.186)	(0.187)	(0.386)	(0.403)
Special education	0.58***	0.80***	0.80**	1.06**
	(0.164)	(0.178)	(0.301)	(0.302)
Single Parent Household	-0.04	0.05	0.04	0.33
	(0.135)	(0.126)	(0.250)	(0.244)
Number of siblings				
1 Sibling	-0.18	-0.07	-0.05	-0.17
	(0.137)	(0.127)	(0.257)	(0.244)
2 Sibling	-0.07	-0.11	0.14	-0.34
	(0.150)	(0.139)	(0.283)	(0.263)

Table A1 (continued)

	Bullied at least once		Bullied more than twice	
Exogenous covariates	**Males**	**Females**	**Males**	**Females**
3 Sibling	-0.43*	-0.35	-0.26	-0.36
	(0.206)	(0.186)	(0.377)	(0.351)
4 Sibling	0.29	-0.31	1.05	-0.09
	(0.302)	(0.301)	(0.561)	(0.608)
5 or more siblings	-0.18	-0.15	-1.32	-1.05
	(0.379)	0.000	(1.112)	(0.734)
Family income				
$20,001 to $50,000	-0.36	0.71	-0.88	1.00
	(0.512)	(0.501)	(0.920)	(1.007)
$50,001 to $75,000	0.61	0.85	0.49	0.88
	(0.570)	(0.598)	(0.969)	(1.205)
More than $75,000	0.40	0.78	0.56	1.00
	(0.629)	(0.638)	(1.152)	(1.216)
Mother's eduation				
HS diploma	0.02	0.06	0.33	-0.11
	(0.182)	(0.172)	(0.341)	(0.323)
AA degree	0.05	0.26	0.79	0.20
	(0.229)	(0.217)	(0.423)	(0.410)
BA/BS degree	0.22	0.03	0.44	-0.39
	(0.228)	(0.225)	(0.437)	(0.442)
Grad degree	0.29	0.48	-0.07	0.47
	(0.280)	(0.265)	(0.585)	(0.520)
Father's education				
HS diploma	-0.18	-0.07	-0.22	-0.26
	(0.177)	(0.162)	(0.329)	(0.301)
AA degree	0.03	-0.33	0.07	-0.39
	(0.233)	(0.226)	(0.436)	(0.424)
BA/BS degree	-0.16	-0.45	-0.15	-0.21
	(0.225)	(0.209)	(0.425)	(0.386)
Grad degree	-0.11	-0.20	-0.47	-0.03
	(0.248)	(0.227)	(0.481)	(0.426)

Table A1 (continued)

	Bullied at least once		Bullied more than twice	
Exogenous covariates	**Males**	**Females**	**Males**	**Females**
Mother's occupation				
Clerical	-0.18	0.04	-0.49	0.20
	(0.149)	(0.142)	(0.279)	(0.261)
Manager	-0.01	-0.11	0.05	-0.21
	(0.175)	(0.158)	(0.308)	(0.310)
Professional	-0.5	-0.04	-0.37	-0.35
	(0.168)	(0.158)	(0.308)	(0.322)
School teacher	-0.54*	-0.28	-0.78	-0.35
	(0.233)	(0.221)	(0.463)	(0.450)
Service	-0.07	0.09	-0.26	0.36
	(0.157)	(0.142)	(0.293)	(0.266)
Father's occupation				
Craftsperson	-0.43	-0.17	-0.64	0.03
	(0.172)	(0.150)	(0.309)	(0.280)
Laborer	0.03	-0.07	-0.06	0.17
	(0.174)	(0.160)	(0.302)	(0.304)
Manager	-0.20	0.11	-0.67	0.10
	(0.154)	(0.147)	(0.304)	(0.296)
Operative	0.12	-0.13	0.21	0.20
	(0.171)	(0.157)	(0.303)	(0.296)
Professional	0.06	0.28	-0.81	0.07
	(0.182)	(0.172)	(0.367)	(0.356)
Student analytic weight	0.00	0.00	0.00	0.00
	(0.001)	(0.001)	(0.001)	(0.001)
Interaction terms				
GPA X GPA	0.00	-0.10	0.05	-0.42
	(0.074)	(0.071)	(0.135)	(0.150)
GPA X Family income	0.07	-0.27	0.09	-0.38
($20,001 to $50,000)	(0.202)	(0.181)	(0.362)	(0.364)

Table A1 (continued)

	Bullied at least once		Bullied more than twice	
Exogenous covariates	**Males**	**Females**	**Males**	**Females**
GPA X Family income ($50,001 to $75,000)	-0.29	-0.37	-0.27	-0.46
	(0.217)	(0.207)	(0.368)	(0.422)
GPA X Family income (More than $75,000)	-0.16	-0.33	-0.21	-0.42
	(0.229)	(0.215)	(0.411)	(0.417)
GPA X Black	-0.41	0.16	-0.32	0.77
	(0.282)	(0.237)	(0.538)	(0.543)
GPA X Hispanic	0.03	-0.09	-0.07	-0.57
	(0.200)	(0.188)	(0.363)	(0.381)
GPA X Asian	-0.18	0.04	0.22	-0.03
	(0.234)	(0.265)	(0.487)	(0.615)
GPA X Other	-0.40	-0.13	-0.24	-0.29
	(0.272)	(0.249)	(0.495)	(0.485)
Constant	-1.54	-2.37	-2.76	-5.42
	(1.088)	(1.398)	(1.747)	(1.885)
N	2,800	3,200	1,200	1,300
Pseudo R-squared	0.107	0.107	0.129	0.142

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: Models include school fixed effects. “Professional” refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teacher (Ingels et al., 2004). Interaction terms with blank cells did not include any students.

Standard errors in parentheses.

Table A2

Results of Logistic Regression Models Using Exogenous and Endogenous Covariates to Estimate Propensity Scores

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Exogenous covariates				
Black	1.36	-1.45	1.41	-4.30
	(0.847)	(0.773)	(1.185)	(2.311)
Hispanic	-0.57	0.11	-0.85	0.45
	(0.656)	(0.632)	(0.932)	(1.369)
Asian	0.42	-1.38	-1.71	-0.69
	(0.938)	(1.157)	(1.641)	(2.587)
Other	1.16	0.49	0.47	2.47
	(0.886)	(0.846)	(1.280)	(1.764)
Daycare	0.03	0.14	0.23	0.18
	(0.137)	(0.126)	(0.190)	(0.266)
Preschool	-0.10	-0.01	-0.15	0.13
	(0.132)	(0.122)	(0.183)	(0.259)
Head Start	0.16	-0.14	0.42	-0.26
	(0.198)	(0.179)	(0.281)	(0.376)
Kindergarten	-0.16	0.17	-0.23	-0.33
	(0.221)	(0.221)	(0.305)	(0.501)
Grade 9 GPA	0.39	0.63	-0.49	1.57
	(0.497)	(0.484)	(0.646)	(1.018)
Non-native English	0.40	0.23	1.01	0.54
	(0.238)	(0.224)	(0.380)	(0.514)
Special education	0.42	0.95	0.59	1.58
	(0.199)	(0.219)	(0.296)	(0.424)
Single Parent Household	0.00	0.13	0.11	0.65
	(0.163)	(0.148)	(0.223)	(0.313)
Number of siblings				
1 Sibling	-0.10	-0.13	-0.22	0.03
	(0.165)	(0.146)	(0.231)	(0.316)
2 Sibling	0.09	-0.11	0.39	-0.26
	(0.178)	(0.162)	(0.250)	(0.339)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
3 Sibling	-0.50	-0.44	-0.46	-0.44
	(0.247)	(0.212)	(0.344)	(0.454)
4 Sibling	0.46	-0.32	1.02	-1.05
	(0.371)	(0.355)	(0.544)	(0.874)
5 or more siblings	0.01	-0.39	-1.07	-2.72
	(0.455)	(0.401)	(1.025)	(1.180)
Family income				
$20,001 to $50,000	0.08	1.18	-0.87	1.35
	(0.630)	(0.595)	(0.857)	(1.269)
$50,001 to $75,000	0.53	1.28	0.06	0.93
	(0.718)	(0.696)	(0.971)	(1.514)
More than $75,000	0.49	1.37	0.26	1.87
	(0.770)	(0.749)	(1.067)	(1.510)
Mother's eduation				
HS diploma	0.03	-0.07	0.42	-0.32
	(0.227)	(0.202)	(0.317)	(0.428)
AA degree	0.05	0.24	0.63	0.56
	(0.277)	(0.249)	(0.384)	(0.529)
BA/BS degree	0.17	-0.32	0.43	-0.84
	(0.277)	(0.263)	(0.398)	(0.560)
Grad degree	0.42	0.64	0.67	0.78
	(0.336)	(0.311)	(0.487)	(0.661)
Father's education				
HS diploma	-0.14	-0.02	-0.46	-0.07
	(0.223)	(0.189)	(0.316)	(0.390)
AA degree	-0.07	-0.09	-0.85	-0.10
	(0.285)	(0.260)	(0.419)	(0.539)
BA/BS degree	-0.08	-0.37	-0.56	-0.01
	(0.279)	(0.243)	(0.393)	(0.491)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Grad degree	-0.11	-0.12	-1.03	-0.08
	(0.300)	(0.267)	(0.437)	(0.559)
Mother's occupation				
Clerical	-0.21	0.07	-0.45	0.04
	(0.176)	(0.167)	(0.248)	(0.340)
Manager	0.03	-0.05	-0.07	-0.30
	(0.204)	(0.181)	(0.283)	(0.394)
Professional	-0.54	-0.02	-0.26	-0.46
	(0.192)	(0.180)	(0.266)	(0.403)
School teacher	-0.66	-0.25	-0.16	-0.31
	(0.279)	(0.256)	(0.375)	(0.574)
Service	-0.04	0.02	0.04	0.34
	(0.186)	(0.168)	(0.252)	(0.350)
Father's occupation				
Craftsperson	-0.63	-0.13	-0.92	0.08
	(0.203)	(0.174)	(0.283)	(0.367)
Laborer	0.07	-0.01	-0.13	0.36
	(0.209)	(0.184)	(0.282)	(0.389)
Manager	-0.28	0.22	-0.38	0.28
	(0.180)	(0.169)	(0.249)	(0.357)
Operative	0.06	-0.14	0.03	-0.01
	(0.207)	(0.183)	(0.285)	(0.377)
Professional	-0.10	0.34	-0.19	0.28
	(0.213)	(0.200)	(0.304)	(0.425)
Endogenous Covariates				
Student friends	0.43	0.30	0.12	-0.98
	(0.198)	(0.213)	(0.277)	(0.562)
Parent knows friends	0.34	-0.22	0.18	-0.56
	(0.258)	(0.265)	(0.379)	(0.572)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Retained a grade	-0.07	-0.20	-0.04	0.09
	(0.188)	(0.199)	(0.256)	(0.402)
Advanced student	0.21	0.31	0.25	0.18
	(0.164)	(0.146)	(0.246)	(0.337)
Band or orchestra	0.48	0.15	0.54	0.22
	(0.172)	(0.127)	(0.240)	(0.272)
Drama	-0.08	0.22	0.07	0.21
	(0.213)	(0.160)	(0.306)	(0.333)
Student government	-0.33	0.03	-0.20	0.03
	(0.296)	(0.199)	(0.392)	(0.445)
Honor society	-0.20	0.19	-0.40	-0.52
	(0.255)	(0.190)	(0.349)	(0.455)
Baseball	-0.36	-0.17	1.23	-50.20
	(0.994)	(1.995)	(1.157)	(7639.337)
Basketball	0.82	-0.09	0.37	33.79
	(0.693)	(0.772)	(0.994)	(5557.178)
Cheerleading	-0.11	0.93	0.93	2.47
	(0.940)	(0.645)	(1.409)	(1.384)
Football	-0.77	-0.07	-1.02	0.15
	(0.604)	(1.268)	(0.807)	(4.662)
Soccer	0.56	0.27	-0.34	30.27
	(0.914)	(1.065)	(1.605)	(6333.332)
Softball	2.28	0.41	1.44	3.79
	(1.873)	(0.815)	(2.716)	(2.110)
Other team sport	-0.01	0.68	-0.77	-3.20
	(0.618)	(0.613)	(0.938)	(2.080)
Individual sport	0.08	-0.47	0.29	-14.23
	(0.674)	(0.841)	(0.977)	(3554.410)
Parental advice	-0.08	-0.02	-0.06	-0.02
	(0.080)	(0.077)	(0.113)	(0.162)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Parent involvement	-0.11	-0.17	-0.14	-0.17
	(0.081)	(0.081)	(0.116)	(0.170)
Family rules	-0.05	0.04	0.04	0.18
	(0.081)	(0.073)	(0.110)	(0.165)
Student analytic weight	0.00	0.00	0.00	0.00
	(0.001)	(0.001)	(0.001)	(0.002)
Interaction terms				
GPA X GPA	-0.02	-0.10	0.08	-0.27
	(0.091)	(0.084)	(0.117)	(0.185)
GPA X Family income ($20,001 to $50,000)	-0.10	-0.44	0.18	-0.46
	(0.248)	(0.213)	(0.333)	(0.451)
GPA X Family income ($50,001 to $75,000)	-0.25	-0.47	-0.09	-0.43
	(0.272)	(0.240)	(0.363)	(0.528)
GPA X Family income (More than $75,000)	-0.21	-0.44	-0.20	-0.52
	(0.280)	(0.251)	(0.384)	(0.513)
GPA X Black	-0.60	0.25	-0.61	1.41
	(0.336)	(0.286)	(0.491)	(0.861)
GPA X Hispanic	0.04	-0.13	0.38	-0.19
	(0.248)	(0.221)	(0.362)	(0.482)
GPA X Asian	-0.35	0.46	0.51	0.36
	(0.306)	(0.348)	(0.504)	(0.803)
GPA X Other	-0.49	-0.18	-0.17	-0.83
	(0.323)	(0.298)	(0.438)	(0.696)
Baseball X White	-0.19	0.19	-1.98	52.04
	(1.023)	(2.106)	(1.207)	(7639.338)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Baseball X Black	1.60	0.40	-3.63	
	(1.406)	(2.538)	(6.629)	
Baseball X Hispanic	1.60	0.57	1.72	
	(1.148)	(2.448)	(1.619)	
Baseball X Asian	-0.53	1.70	-1.88	
	(1.564)	(3.295)	(1.826)	
Softball X White	-1.76	-0.66	-0.96	-4.54
	(1.900)	(0.837)	(2.751)	(2.159)
Softball X Black	-1.30	-0.63	0.93	
	(2.150)	(1.144)	(3.211)	
Softball X Hispanic	-1.48	0.69	2.56	-3.52
	(2.137)	(1.029)	(3.451)	(2.461)
Softball X Asian	-1.52	1.43	-0.68	
	(2.296)	(1.790)	(3.637)	
Basketball X White	-0.94	-0.09	0.04	-34.37
	(0.736)	(0.808)	(1.043)	(5557.178)
Basketball X Black	-1.75	-0.63	-0.47	
	(0.950)	(1.028)	(1.502)	
Basketball X Hispanic	-2.75	-0.25	-4.37	-29.78
	(1.045)	(1.075)	(1.792)	(5557.178)
Basketball X Asian	0.74	0.76	1.36	
	(1.005)	(1.291)	(1.392)	
Football X White	0.03	0.41	0.05	0.76
	(0.629)	(1.304)	(0.840)	(4.702)
Football X Black	-1.25	0.15	-1.50	19.68
	(0.870)	(1.622)	(1.243)	(1132.765)
Football X Hispanic	0.54	-0.64	0.02	-3.61
	(0.759)	(1.493)	(1.120)	(6.250)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Football X Asian	-0.56	-1.77	-0.69	
	(1.057)	(1.923)	(1.518)	
Soccer X White	-0.54	-0.71	0.88	-31.12
	(0.955)	(1.095)	(1.646)	(6333.332)
Soccer X Black	-1.83		-0.82	
	(1.856)		(6.672)	
Soccer X Hispanic	0.36	0.02	0.78	-27.71
	(1.020)	(1.197)	(1.788)	(6333.332)
Soccer X Asian	-0.85	-0.41	0.05	
	(1.302)	(1.427)	(2.075)	
Team sport X White	0.16	-0.89	0.9	3.53
	(0.649)	(0.634)	(0.977)	(2.113)
Team sport X Black	-0.30	-0.25	-0.28	-13.31
	(0.981)	(0.811)	(1.448)	(1132.755)
Team sport X Hispanic	-0.22	-0.58	-1.02	3.71
	(0.783)	(0.776)	(1.263)	(2.408)
Team sport X Asian	-0.25	-1.35	-1.08	
	(0.904)	(0.845)	(1.581)	
Solo sport X White	-0.25	0.14	-0.23	13.63
	(0.698)	(0.866)	(1.014)	(3554.410)
Solo sport X Black	2.30	0.00	2.87	
	(1.093)	(1.410)	(1.617)	
Solo sport X Hispanic	1.08	0.35	2.07	
	(0.861)	(1.113)	(1.344)	
Solo sport X Asian	-0.10	-0.69	0.72	14.39
	(0.880)	(1.062)	(1.327)	(3554.410)
Cheerleading X White	0.37	-0.55	-0.32	-1.66
	(0.992)	(0.671)	(1.461)	(1.421)

Table A2 (continued)

	Bullied at least once		Bullied more than twice	
Covariates	**Males**	**Females**	**Males**	**Females**
Cheerleading X Black	-0.09	-0.64	3.10	-1.01
	(1.664)	(0.794)	(2.923)	(1.920)
Cheerleading X Hispanic	0.25	-0.34	-0.58	-2.46
	(1.313)	(0.774)	(2.140)	(1.694)
Cheerleading X Asian	1.08	-2.06	1.60	
	(1.373)	(1.393)	(2.901)	
Constant	-1.54	-2.37	-2.76	-5.42
	(1.088)	(1.398)	(1.747)	(1.885)
N	2,300	2,600	1,200	900
Pseudo R-squared	0.157	0.135	0.198	0.214

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Models include school fixed effects. "Professional" refers to occupations such as accountant, artist, registered nurse, engineer, librarian, writer, social worker, actor, actress, athlete, politician, but not including school teacher (Ingels et al., 2004). Interaction terms with blank cells did not include any students.

Standard errors in parentheses.