ABSTRACT

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Delinquent and violent behaviors have become a major concern of parents, teachers, and school administrations across the country as media images of school violence permeate perceptions of school safety. Although national surveys show a slight decline in school delinquency, schools continue to search for ways to improve safety. This investigation seeks to understand the predictors of weapon-use in schools. Literature related to school shootings, disorder, and weapon-carrying as well as various theories, including control, social disorganization, and subculture, guide hypotheses that explore the school characteristics related to in-school weapon-carrying as well as the interaction effects between school and student characteristics. Using a large, national sample, this unprecedented investigation explores whether school characteristics predict weapon-carrying net of individuals' propensity to carry weapons. The study also investigates whether school characteristics condition the relationships between student characteristics and weapon-carrying. Findings indicate that school characteristics, specifically those related to school location and violent

environments, are important in explaining recent in-school weapon-carrying even when controlling for past weapon-carrying. Further, results suggest that school-level predictors are more important in explaining student weapon-carrying in urban schools than in non-urban schools. Implications and directions for future research will be discussed.

PREDICTORS OF IN-SCHOOL WEAPON-CARRYING

By

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Dedication

To my mother. Your actions have instilled in me the value of education, commitment

to success, and dedication to family. Everything I am and who I will become, I owe

in large part to you. Thank you and I love you.

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Chapter 1: Introduction

Since the 1970s there has been a heightened level of public concern regarding school violence (Anderson, 1998). Despite a general decline in violent crime during the latter portion of the 1990s (Blumstein and Wallman, 2006), middle and high schools around the country suffered from an upsurge in violent rampage-like shootings (National Research Council/National Institute of Medicine [NRC/NIM], 2003). While there were only two instances of rampage-like school shootings during the 1970s, and six during the 1980s, there were 32 such incidents during the 1990s (mostly occurring after 1994; NRC/NIM, 2003).

The increase in school shootings, especially the 1999 Columbine massacre, continues to be a topic of media attention and analysis. Recent findings from national self-report surveys also highlight the consequences of school violence. Findings from the National Youth Survey indicate that between 1993 and 2005, 7% to 9% percent of high school students reported being threatened or victimized with a weapon (e.g., a gun, knife, or club) on school property (Center for Disease Control and Prevention, 2005). In 2005, 7% of high school students reported carrying a weapon to school, a decline from 1993 (when 12% of students reported carrying a weapon to school; Dinkes, et al., 2006). The School Crime Supplement of the National Crime Victimization Survey also shows a decline in reports of in-school victimization between 1995 and 2005 (10% and 4% respectively; Dinkes et al., 2006). Similarly there was a reduction in fear of being attacked at school between 1995 and 2001. There has been no discernable change in fear of being attacked at school since 2001 (Dinkes et al., 2006). Although violence and fear appear to have stabilized or,

in some cases, declined over the past ten years (Dinkes et al, 2006; Coggeshall and Kingery, 2001), the continued occurrence of weapons and violence in schools remains a public safety concern.

The infrequency of school shootings makes them difficult to study quantitatively. The NRC/NIM (2003) found that between 1992 and 2001 only 35 of all 116,910 elementary and secondary schools in the United States experienced a multiple victim shooting. Furthermore, less than 1% of all homicides with school-aged victims took place at school (Department of Justice, 1998). Thus, despite the increase in such incidences during the 1990s, they were and continue to be a relatively infrequent event. Weapon-carrying occurs more frequently.

While the act of weapon-carrying is not inherently violent, it is a necessary precursor to weapon use and violence on school campuses. The presence of weapons on school property has been shown to increase chances of victimization and fear of victimization in schools (Blumstein, 1995; Cook and Laub, 1998; Resnick, Ireland, and Borowsky, 2004; Wilcox, May, and Roberts, 2006). Further, research indicates that the predictors of weapon-carrying may be inherently different from the predictors of other forms of delinquency (e.g., Durant et al., 1999; Gottfredson and Gottfredson, 1985; Resnick et al., 1997; Watkins, 2008; Wilcox and Clayton, 2001). For these reasons, weapon-carrying should not necessarily be groups with other forms of delinquent behavior and requires special attention.

In addition to documenting the consequences of in-school weapon-carrying, the weapon-carrying literature as well as other research related to school violence offers some indication of the important risk factors for in-school weapon-carrying.

Research examining the individual predictors of weapon-carrying suggests that adolescent males with low parental and school attachments are more at risk for carrying weapons to school. The school violence literature also indicates that characteristics of schools and the communities in which youth attend schools (most notably school climate and community cultural factors) also influence school violence. To date, little research has investigated the school-level predictors of weapon-carrying per se.

A recent qualitative study by the National Research Council and National Institute of Medicine (NRC/NIM, 2003) that examines school violence reinforces the necessity of examining school and community-level predictors of weapon-carrying. The findings indicate that school and community-level characteristics may differentially predict in-school weapon-carrying depending on the location of the school. More precisely, school violence in urban schools seems to be related to subcultural beliefs about violence while suburban and rural school violence is more accurately explained using individual characteristics such as parental attachment and social status. Quantitative analyses have yet to investigate how school and community contexts moderate the effect of individual risk factors on weapon-carrying.

Given this gap in the literature on in-school weapon-carrying, this investigation focuses on school-level structural and subcultural predictors of weapon-carrying. Research questions are based on several different sources of literature. The in-school weapon-carrying literature indicates that student-level risk factors are important for explaining this behavior. Recent research on in-school weapon-

carrying provides some guidance as to the specific school and community level characteristics that might be important predictors of weapon-carrying. Furthermore, the recent report by the NRC/NIM (2003) describes the individual, school, and community-level factors found to be related to several infamous school shootings during the 1990s. Their findings regarding the contextual factors related to the shooting events provide a foundation for the current research questions. Their findings regarding the individual level predictors of in-school weapon-carrying corroborate many of the findings specifically found in literature related to in-school weapon-carrying. While the NRC/NIM report focuses on extreme violence, the possibility exists that such factors relate to less extreme forms of school crime, such as weapon-carrying.

Given the findings of the NRC/NIM (2003) report and the in-school weapon-carrying literature, the research questions whether school characteristics influence in-school weapon-carrying. Additionally, it asks whether school context moderates the influence of individual-level risk factors on in-school weapon-carrying. In order to better isolate the causal influences of the school factors, this research focuses on the associations of interest after controlling for individuals' propensities to carrying weapons.

A review of the in-school weapon-carrying literature, the NRC/NIM (2003) report, and a theoretical basis for the model are provided in chapter 2. Chapter 3 describes the sample, variable selection, and analytic procedures. Chapters 4 and 5 describe the results and offer conclusions and directions for future study.

Chapter 2: Prior Research

Both the NRC/NIM (2003) report and the prior literature relating to in-school weapon-carrying are catalysts for this dissertation. The NRC/NIM (2003) report offers a concentrated analysis of six infamous school shootings during the 1990s. The report's qualitative investigation poses interesting questions for researchers regarding the individual and contextual level predictors of school shootings. The report is meticulous in its observations and broader analysis of the commonalities and differences between the shootings. The distinct differences found in the report between shootings, specifically related to the school and community environments, provide a foundation for the present analysis.

Also reinforcing the need for this analysis is the little existing literature on in-school weapon-carrying. The few available studies focus mainly on student-level predictors of in-school weapon-carrying. Until recently, examination of the school and community factors that may also influence in-school weapon-carrying have been largely neglected.

A description of the findings from the NRC/NIM (2003) report follows as well as a brief description of the existing literature related to in-school weapon-carrying. Finally, a theoretical foundation is presented to support the model selection.

The NRC/NIM Report

A committee from the National Research Council and the National Institute of Medicine (NRC/NIM; 2003) offers an unprecedented in-depth qualitative analysis of six infamous school shootings that occurred during the 1990s. Their case study

investigation, requested by Congress, provides insight into the risk factors linked to school violence. Additionally, the committee synthesizes information from all of the shootings to find commonalities among the six cases.

Generally, the report found that the shooters were dissatisfied with their social status. While only one of eight shooters could be considered a loner, all were marginal members of their social groups. This finding was especially prevalent in the rural and suburban areas where social status was more hierarchical in nature. Certain peer groups were identified as "popular" groups and others as more peripheral. In the case studies coming out of these non-urban areas, the shooters had no connection to the popular groups and only marginalized membership in the peripheral groups (NRC/NIM, 2003). Alternatively, in the more urban areas, peers groups appeared to co-exist on a more even playing field. While there were fewer distinctions between peer groups (i.e., researchers had a more difficult time identifying popular versus non-popular groups), the shooters continued to have a less central role within their social groups. Thus, researchers identify dissatisfaction with social status as a commonality across the eight shooters.

Another similarity among the six case studies concerns the relationship between adults and youth. While of the shooters' parents were not considered neglectful or abusive, nor were schools considered especially detrimental, there was a distinct disconnect between adults and youth within the community. This disconnect reduced communication between youth and parents, teachers and other school staff. For example, interview information indicates that other students had knowledge of offenders' possessions of guns and plans to use guns at school but never shared this

knowledge with adults. The report interprets this to mean that students did not feel comfortable enough with adults at school or home to discuss disturbing conversations that they took part in. Furthermore, schools did not do an adequate job of protecting youth from the malicious behavior of their peers that can be common during adolescence. An example came in the form of an unflattering school newspaper article published about a student. The article highlighted a breakdown in the school's ability to protect students from the mean-spiritedness of adolescent social interactions. The student depicted in the newspaper article eventually became one of the shooters. The NRC/NIM report (2003) concluded that a lack of communication between youth and parents, adults at school, and adults in the community at large contributed to each of these shooting incidences.

A final similarity common to a majority of the school shootings concerns the stability of the communities. Five of the six victimized communities had recently undergone rapid social change prior to the shooting events. While in some cases the social change improved the socioeconomic status of the community, the stability of the community was altered. The report suggested that community instability might have played a role in making those schools more susceptible to extreme forms of violence.

Despite the consistencies found across the shooters and the victimized communities, one notable difference was apparent to the committee. The precipitating factors leading up to the shootings varied between schools located in urban versus rural and suburban locales. The inner-city school shootings were characterized by concrete conflicts that were known to all involved parties. Such

situations typically arose out of unresolved disputes and ended in violence due to the norms and expectations regarding the use of violence in these communities. Both the offenders and victims were aware of the impending violent confrontation as were other youths in the vicinity. The violence that occurred in the urban school shootings was characteristic of the violent areas in which it occurred.

In contrast, the shootings in the rural and suburban communities were the result of more undefined and unexpressed conflicts. The rural and suburban school shooters did not seem to have explicit targets, appearing rather to focus on the broader school community. Prior to the shootings, members of the rural and suburban communities could not have predicted such violence occurring in their schools. Afterwards, they had difficulty determining how or why it happened. A detailed retrospective examination of each shooter took place in the victimized communities. Many were diagnosed with mental illness and deemed at risk for suicide. The committee concluded that in the rural and suburban communities, individual characteristics, such as mental health problems, were more influential in causing the school shootings than in the urban communities, where social pressures and expectations appeared to be the driving force.

Ultimately, the NRC/NIM committee (2003) suggested that dissatisfaction with social status and apparent social conflict were at the root of the shootings; however the offenders' interpretations of peer interactions varied depending on the community in which the shooter came from. While all of the shooters were removed from the center of any social circle, the suburban and rural ones appeared to exaggerate and hyperbolize conflict with peers in their minds. In contrast, the urban

shootings seemed to come from explicit conflicts, with predefined expectations concerning resolutions.

The NRC/NIM evaluation provides a preliminary look into the multiple contexts that likely influence school violence, including individual, school, and community-level factors. While qualitative research can not supply definitive conclusions regarding the causes of school violence, it offers directions for further empirical investigation. As recommended by the committee overseeing the case study analysis, the present study quantitatively assesses some of the findings of the NRC/NIM exploration using a large, nationally-representative sample of youths. This current investigation uses the committee's findings related to community, school, and individual level predictors of school violence in order to form hypotheses regarding the complex risk factors for in-school weapon-carrying. Although the dependent variable in the current investigation is different than that of the NRC/NIM (2003) report; the NRC/NIM report is one of the most thorough investigations into the individual and contextual characteristics that might promote school violence. Given that the report shows some consistencies with the in-school weapon-carrying literature (described below) regarding the student-level predictors of weapon-carrying, it seems reasonable to assume that similar consistencies may be found in predicting the contextual risk factors for school violence and weapon-carrying. Thus, the insightful findings from the NRC/NIM report are deemed important in guiding the present research.

Studies of Weapon-Carrying

The selection of in-school weapon-carrying as the dependent variable for this investigation may lead to questions of whether there are differences in the causal processes related to this behavior versus other types of problem behavior on and off school property. Juvenile delinquency risk factors (including violent juvenile delinquency) are well-established (e.g., Lipsey and Derzon, 1998; Fagan, Van Horn, Hawkins, and Authur, 2007; Office of the Surgeon General, 2001); thus do we really need to study the specific behavior of in-school weapon-carrying or can we make the assumption that similar risk factors exist for different kinds of delinquent and problematic behaviors? Resnick et al. (1997) found inconsistencies in the predictors of different risky behaviors. Although family attachment and school connectedness operated as protective factors for a variety of risky behaviors, different student-level characteristics were more predictive of certain behaviors than others. For example, adolescents who were employed and worked long hours outside of school were more at risk for emotional distress and early sexual experiences. The impact of working was not as important in explaining violent outcomes. DuRant, Krowchuk, Kreiter, Sinal, and Woods (1999) found predictors to vary depending on whether the outcome was gun-carrying or carrying a weapon other than a gun.

Notwithstanding studies that report consistencies in the risk factors for different risky behavioral outcomes (e.g., Dornbusch, Erickson, Laird, and Wong, 2001), there is evidence that risk factors may be differentially important depending on the behavioral outcome of interest. Furthermore, in-school weapon-carrying presents a very certain danger to schools. The consequences of weapon use in schools can be

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largely irreparable, therefore requiring specific attention to the behavior. If there are different predictors for in-school weapon-carrying than other forms of delinquent behavior, the policy implications for schools will be significant. A more specialized understanding of this behavior as well as other delinquent outcomes can lead to more focused preventative efforts.

While there has been some empirical attention to in-school weapon-carrying (see Appendix A for a complete review), most of this literature focuses on individual level models (e.g., DuRant, Kahn, Beckford, and Wood, 1997; DuRant, et al., 1999; Furlong, Bates and Smith, 2001; Malecki and Demaray, 2003; Simon, Crosby, and Dahlberg, 1999; Rountree, 2000; Wilcox, May, and Roberts, 2006). Generally, this literature finds a connection between in-school weapon-carrying and demographic characteristics, substance use on school grounds, previous delinquency, negative peer influence, bullying, and perceptions of weak social support (DeVoe, 2007; DuRant, Kahn, Beckford, and Wood, 1997; DuRant et al., 1997; DuRant, et al., 1999; Kudjo, Auinger, and Ryan, 2003; Malecki and Demaray, 2003; Rountree, 2000; Simon et al., 1999). Specifically relating to demographics, there is consistent support for the relationship between gender and in-school weapon-carrying--males are more likely than females to carry a weapon to school as are minorities and older youth (DuRant et al., 1997; DuRant et al., 1999; Furlong, Bates, and Smith, 2001; Kodjo, Auinger, and Ryan, 2003; Malecki and Demaray, 2003; Simon, Crosby, and Dahlberg, 1999; Wilcox and Clayton, 2001).

This literature tells us little about the contextual factors that may also play a role in predicting weapon-carrying behavior (e.g., DuRant et al., 1997; DuRant et al.,

1999; Furlong, Bates and Smith, 2001; Malecki and Demaray, 2003; Simon, Crosby, and Dahlberg, 1999). More recent research accounts for this weakness by creating multilevel models that examine the student-level predictors of in-school weapon-carrying as well predictors at the school and community levels. As reviewed below, the importance of student-level factors continues to be apparent, however their influence varies once variables at the school and/or community levels are accounted for. More recent research also improves upon earlier works through the use of longitudinal data and national samples.

Wilcox and colleagues advanced upon much of the in-school weapon-carrying literature through their investigations into the temporal order and contextual predictors of in-school weapon-carrying (Rountree, 2000; Wilcox and Clayton, 2001; Wilcox, May, and Roberts, 2006). They also highlighted the possibility of measuring the dependent variable of weapon-carrying in various ways. Wilcox and colleagues debated the necessity of examining overall weapon-carrying versus dissecting the variable into gun and non-gun weapon-carrying (Rountree, 2000; Wilcox and Clayton, 2001). Generally, their analyses used overall measures of weapon-carrying (not distinguishing between weapons) arguing that solely focusing on guns takes away from the understanding of non-gun weapon-carrying, a more common practice on school grounds.

In their most recent work, Wilcox et al. (2006) examined both the predictors and consequences of in-school weapon-carrying. Regarding the consequences, Wilcox et al. (2006) found that gun and non-gun carrying in the 8th grade predicted increased fear and perceived risk of school crime, as well as actual victimization in 9th

grade. However, inconsistencies became apparent when examining the predictors of gun and non-gun weapon-carrying; different predictors emerged depending of the weapon carried. Victimization was generally unrelated to weapon-carrying (although 7th grade victimization had a modest positive relationship with non-gun weapon-carrying in 8th grade). Risk perceptions (i.e., perceived risk of being victimized) in 7th grade had a negative relationship with gun and non-gun weapon-carrying in 8th grade. Thus it appeared as though victimization slightly increased only non-gun weapon-carrying while perceived risk of victimization actually decreased both types of weapon-carrying. DuRant et al. (1999) also found different predictors for gun and non-gun weapon-carrying in their study of middle school weapon-carrying.

Rountree (2000) contributed to the understanding of contextual effects on in-school weapon-carrying through her investigation of in-school weapon-carrying in three diverse communities. Using data from the Kentucky Youth Survey, she tested the possibility that community context will explain variability in in-school weapon-carrying. In order to capture community effects, she analyzed student surveys from three different locations (that varied in geographical location, economy, and culture) and compares the findings. Generally, Rountree found that community context was not as important in predicting weapon-carrying as student-level factors such as peer weapon-carrying and previous criminal behavior. Additionally, demographic characteristics were not significant predictors of weapon-carrying once more etiologically important variables were included in the model. Rountree (2000) concluded that community context was not a strong predictor of in-school weapon-carrying as the model produced similar findings across all three locations. Note that

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while Rountree (2000) did not find support for the importance of contextual factors in predicting weapon-carrying, she did not actually incorporate contextual characteristics into her model. Rather, she compared the findings of three demographically distinct counties. Her conclusions were based on a finding of no differences in the student-level predictors across those counties.

Wilcox and Clayton (2001) extended the work of Rountree (2000) by utilizing a multilevel analysis. This allowed them to simultaneously examine predictors at multiple levels. Although they used the same data as Rountree (2000) they focused only on the largest county in the state, and use school data from 21 schools in that county. Wilcox and Clayton (2001) included student-level factors such as fear of victimization and criminal lifestyle, as well as school-level factors, including school structure, school capital, and school deficits (see Appendix A for complete list of variables). School structure was defined using the following variables: proportion nonwhite, proportion male, proportion free lunch (a proxy for school socioeconomic status), and school-level (i.e., middle vs. high). School capital was composed of items measuring average school attachment, average church attendance, and average religious commitment. Finally, school deficits were captured with the following items: proportion afraid at school, proportion of property victims, proportion threatened, and aggregated measures of problem behavior, family dysfunction, gun ownership, parental gun ownership, and peers carrying weapons. Wilcox and Clayton's investigation offers an improvement over the previous literature due to its statistical methods and inclusion of school-level variables.

At the student-level Wilcox and Clayton's (2001) findings indicated that being male, older, of a lower socioeconomic status, and a minority were all positively associated with in-school weapon-carrying as were prior victimizations. Gun ownership and a pattern of problem behavior also increases students' weapon-carrying. At the school-level, mean school-associated fear was not a significant predictor of weapon-carrying while school structure only explains a small amount of variance in in-school weapon-carrying. Evidence indicated that school socioeconomic status had an effect, but the effect diminished when school capital and school deficits were included in the model. In other words, prior to school deficit and capital variables being included in the model, as the proportion of students receiving reduced lunch increased, so did the level of weapon-carrying. However, the effect of SES was reduced to insignificance with the inclusion of school deficits and school capital. Thus, the authors described the relationship between school structural and contextual variables (i.e., school capital and deficits) similarly to how collective efficacy might alter the effects of community structure on crime and delinquency [see Sampson Raudenbush, and Earls (1997) for explanation of collective efficacy]. Wilcox and Clayton (2001) found that school capital and deficits could moderate the effects of school structural characteristics.

Kodjo, Auinger, and Ryan (2003) used a cross-sectional multilevel analysis. Using Wave I of the National Longitudinal Study of Adolescent Health (Add Health), the researchers analyzed the multilevel predictors of in-school weapon-carrying for 6,504 students at 80 schools. The researchers examined neighborhood poverty and parental education at the community level as well as intrinsic (internal) and extrinsic

(external) characteristics at the individual level. They found that when incorporating more etiologically important predictors, such as school and interpersonal connectedness, demographic variables such as neighborhood poverty and parental education did not predict in-school weapon-carrying. Another important finding of this investigation relates to the predictors of weapon-carrying for males and females. Results indicated that the predictors of weapon-carrying for males were more related to physical influences, such as interpersonal violence, witnessing violence, and interpersonal and school connectedness. For females, predictors included substance use at school, school suspension, and interpersonal violence. The authors concluded that intrinsic precipitators were driving female weapon-carrying while extrinsic factors explained male weapon-carrying.

The most recent research examining in-school weapon-carrying also used Wave I of the Add Health data. Watkins (2008) used approximately 10,000 students in 55 high schools (limited to schools serving students in grades eight through twelve) to examine the school-level contextual predictors of in-school weapon-carrying while controlling for various student-level predictors including demographics, parental education and attachment, single-parent households, GPA, school suspensions, school attachment, school fear, weapon-victimization, and drug use. Watkins focused on the impact of school community social conditions (i.e., disadvantage and mobility), and other school characteristics (% Black, location, sector, size, mean student absenteeism, mean student disconnectedness, mean student fear, and mean student fights) on in-school weapon-carrying. Interestingly, none of the school-level

characteristics predicted in-school weapon-carrying when including the fixed-effects of the student-level control variables in the model.

This more recent research reinforces the importance of examining school-level factors when investigating in-school weapon-carrying and highlights the need for further exploration of this topic. Although Wilcox and Clayton (2001) discussed the importance of including school-level variables in any study examining in-school weapon-carrying, the limited generalizability of their investigation to one urban community in Kentucky reinforces the need to further examine the complex nature of this behavior. Additionally, Kodjo, et al.'s (2003) and Watkins' (2008) use of nationally representative samples is commendable, but both analyses are limited due to their cross-sectional methodologies. Finally, none of this recent work examining the multilevel predictors of in-school weapon-carrying investigates how school and community contexts may moderate the relationships between student-level characteristics and weapon-carrying.

The in-school weapon-carrying literature is inconclusive regarding the relevance of community- and school-level characteristics (Kodjo, et al., 2003; Rountree, 2000; Watkins, 2008). While the support for community- and school-level influences is relatively weak in the few studies that include such characteristics (e.g., Kodjo, et al., 2003; Rountree, 2000; Watkins, 2008), the broader literature examining school disorder offers conflicting findings (e.g., Gottfredson and Gottfredson, 1985; Welsh, Stokes, and Greene, 2000). For example, Welsh, Stokes, and Greene (2000) found evidence of contextual effects in their analysis of school disorder in Philadelphia. They nested schools within communities and examined both the

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communities that schools were located in as well as the communities students came from. Their findings indicated that community structural factors from both school location and student location influenced school disorder. Specifically, community poverty indirectly increased school disorder through its effect on school stability. Combined with literature specifically focused on in-school weapon-carrying, these studies show that school characteristics are important in predicting school disorder more generally.

The NRC/NIM report (2003), along with the empirical literature related to in-school weapon-carrying and school disorder, support the notion that both individual and contextual-level factors should be considered when predicting in-school weapon-carrying. At the student-level, school and parental attachment are consistently important in explaining delinquent behavior in school (Kodjo, et al., 2003; NRC/NIM, 2003; Rountree, 2000; Wilcox and Clayton, 2001). Social status also plays an important role in predicting violent youth outcomes (NRC/NIM, 2003). According to the NRC/NIM report (2003), youth who felt that their social status was in jeopardy appeared to be at a higher risk for violent outcomes. Suicidal thinking, delinquent behavior, and exposure to weapons and violence are additional student-level factors that are considered to be important when predicting in-school weapon-carrying and violent outcomes (NRC/NIM, 2003; Rountree, 2000; Wilcox and Clayton, 2001).

While the individual factors listed above prove important when predicting in-school weapon-carrying, community and school levels are also necessary (Welsh, et al., 2000; Wilcox and Clayton, 2001). Regarding community stability, the NRC/NIM

report corroborates the findings of Welsh, et al. (2000). The NRC/NIM report found that several of the communities victimized by school shootings were considered to be unstable. They also found evidence of violent subcultures that they believe influenced the urban shootings. In terms of school-level factors that are important for predicting in-school weapon-carrying, the NRC/NIM report (2001) as well as Wilcox and Clayton (2001) found school climate to be an important asset to schools. While the NRC/NIM report (2003) made clear that schools do not act as risk factors for violent behavior, by improving school climate, schools can act as protective factors against deviant behavior. Wilcox and Clayton (2001) reinforced this observation with their finding that school climate moderated the effects of harmful structural components.

Given the conclusions of the NRC/NIM report (2003) as well as the empirical findings related to in-school weapon-carrying, the present analysis will incorporate school and student-level predictors into its model. Ultimately the purpose is to investigate the contextual effects on both weapon-carrying and the student-level predictors of weapon-carrying. In doing so, this investigation also confirms earlier findings relating to the student-level predictors of in-school weapon-carrying.

Theoretical Foundation

In the past five to eight years researchers have begun to focus on the contextual predictors of in-school weapon-carrying. This scant research tends not to be informed by the larger body of criminological theory that offers a broader understanding of contextual effects on criminal behavior. Several different theories,

both at the school/community and individual levels are implicated in the NRC/NIM (2003) report and the in-school weapon-carrying literature. The theoretical traditions of social disorganization, subculture, school climate, and social control are reviewed next to provide a foundation for the present investigation as these theories are implicit to the explanations found in the NRC/NIM report (2003) and the in-school weapon-carrying literature.

The NRC/NIM report indicated that instability was common to nearly all of the victimized communities. Violent subculture themes were also present in the urban communities, offering a possible explanation for those shootings. The NRC/NIM report, along with the in-school weapon-carrying literature, also indicated that school climate acts as a protective factor against problem behavior in schools. Additionally, the prior literature found multiple individual factors, specifically those believed to be important by social control theorists, potentially play a role in school violence and weapon-carrying: school connectedness, relationships with parents and peers, suicidal thoughts and attempts, and delinquency are all believed to influence weapon-carrying behavior in schools.

Community Structure, Culture, and School Climate Predictors of Weapon-Carrying

School structural characteristics, violent subculture themes, and school climate are all school-level factors noted as potential predictors of in-school weapon-carrying. The previous literature offers a compelling argument for further investigating these three predictors of in-school weapon-carrying. Social disorganization and subculture theories provide helpful perspectives for understanding the structural and subcultural influences on in-school weapon-carrying

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while literature that focuses on school-level predictors of problem behavior offers support for the school climate influence.

Structural Characteristics. Changes in the structural characteristics of the community are observed in a majority of the cases studied in the NRC/NIM report (2003). The report concludes that community-level structural characteristics potentially played a role in several of the shooting incidents. Such findings are not entirely surprising given the long history surrounding this line of research dating back to the 1940s when Shaw and McKay (1942) examined why city centers were fraught with crime while the suburbs seemed relatively crime-free. A recent research direction in the arena of social disorganization theory focuses on the possible consequences of structural instability in gentrifying and non-urban areas and coincides with the findings of the NRC/NIM report (e.g., Cantillon, 2006; Haynie, Silver, and Teasdale, 2006; Osgood and Chambers, 2000; Taylor and Covington, 1988, 1993; Van Wilsem, Wittenbrood, and De Graaf, 2006).

Conventional social disorganization theory predicts that extreme crimes such as school shootings are more common to urban areas as those areas are more frequently fraught with the qualities that define socially disorganized communities, such as unsupervised children, limited levels of communication among neighbors, and high levels of poverty and mobility (Sampson and Groves, 1989; Sampson et al., 1997; Sampson and Wilson, 1995; Shaw and McKay, 1942). However, the NRC/NIM report (2003) contradicted these expectations. Report findings imply that structural conditions drive crime outside of the city as well. These more rural and suburban communities are not only victimized due to structural deterioration, but also

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as a result of gentrification. In other words, neighborhoods that are economically improving are not immune to violence and crime. Thus, as reflected in the NRC/NIM report (2003) and the empirical findings reviewed below, the structural characteristics of a community are likely relevant to understanding a community-level influence on school crime rather than a simple measure of urbanicity.

Taylor and Covington (1988, 1993) and Covington and Taylor (1989) studied the potentially harmful effects of gentrification in Baltimore, Maryland. Gentrifying communities were described as communities in which housing values and home ownership were increasing as was overall socioeconomic status of the communities. Their analyses indicated that, like neighborhoods that were becoming increasingly disadvantaged, those neighborhoods that were becoming increasingly advantaged also experienced higher crime rates (Taylor and Covington, 1988). Neighborhoods that increased in value more quickly experienced an increase in crime while those that had less steep increases had a decline in crime, specifically, larceny (Covington and Taylor, 1989). Finally, Taylor and Covington (1993) found that changes in neighborhood (for better or for worse) were related not only to crime levels but also to fear of crime. Those living in gentrifying neighborhoods as well as those living in neighborhoods declining in status generally had an increase in fear. This increase in fear was related to changes in proportion of youth and elderly living in the communities as well as racial composition. More specifically, changing communities were associated with higher levels of youth populations, lower levels of elderly populations, and more diversity overall (Taylor and Covington, 1993).

Recent findings regarding the consequences of changing populations within communities support the work of Taylor and Covington (1988, 1993) and reinforce the importance of community stability when attempting to prevent crime. Drawing on a Dutch national sample, Van Wilsem, Wittebrood, and De Graaf (2006) found increased levels of victimization in gentrifying neighborhoods. This effect was attributed to the change in population that occurred as communities improved their socioeconomic status. The new population had to coexist with the current population, leading to potential conflict. When examining the possible benefits of community stability, Cantillon (2006) found that limited changes to the population directly reduced delinquency and indirectly improved social organization and informal social control. In summary, this prior research indicates that one possible cause of increased crime in gentrifying neighborhoods is the change in neighborhood population—a consequence of gentrification.

In addition to examining the effects of social disorganization on gentrifying communities, researchers have also investigated the consequences of social disorganization in non-urban areas. Osgood and Chambers (2000) noted the possibility that ethnic heterogeneity, poverty, and residential instability have similar effects in non-urban areas as in urban areas. Interestingly they found that residential stability, family disruption, and ethnic heterogeneity increased juvenile violent arrest rates; however poverty was unrelated. In fact, contrary to Shaw and McKay's (1942) findings that low SES drives rates of residential instability and heterogeneity, Osgood and Chambers (2000) found that poverty had a positive relationship with stability. The more impoverished a non-urban community was, the more stable it appeared to

be. Osgood and Chambers (2000) were in agreement with Shaw and McKay (1942) regarding the relationship between stability and crime—more stabile communities had less crime—however they differed on the relationship between poverty and stability. Osgood and Chambers (2000) conclude that while earlier empirical evidence indicated that poverty drove instability in urban areas, it limited people's ability to move in non-urban areas. In either situation, stability reduced levels of crime.

Bouffard and Mufic (2003) also found support for the harmful effects of social disorganization in non-urban areas with their examination of non-metropolitan areas in the Midwest. Their findings indicated that violent crime was positively related to residential mobility and family disruption. Like Osgood and Chambers (2000), they found a surprising poverty-crime relationship—poverty was negatively related to crime rates. In other words, as poverty levels rose, crime declined. Bouffard and Mufic (2003) attributed this relationship to the sampled communities' increased poverty rates which created a more stable and homogenous environment

In a more recent multilevel study examining the impact of neighborhood characteristics on adolescent violence, Haynie, Silver, and Teasdale (2006) found that although exposure to violent peers moderates the relationship, structural characteristics (specifically, neighborhood disadvantage and residential stability) were important predictors of adolescent violence in urban, suburban, and rural locales. Haynie et al.'s study is notable as it supports the notion that structural characteristics are valuable in explaining criminal behavior. Collectively the

reviewed literature indicates that structural characteristics are related to crime at both the community and student-levels.

The NRC/NIM report (2003) suggests that community instability is a possible predictor of school shootings. While the victimized urban communities showcased characteristics of disorganization such as concentrated poverty, the victimized non-urban communities presented the opposite structural characteristics. These communities were flourishing and improving their financial status. Despite these extreme differences in quality of neighborhoods, all were experiencing changes in the structure of their communities, thus creating unstable environments. The NRC/NIM report (2003) noted a recent change in economy and/or population in each of the reviewed communities. Given these observations, reinforced with findings from quantitative studies, the present investigation examines the effects of community structure in a selection of demographically diverse communities[1]. More specifically, this investigation examines the effects of low community socioeconomic status and neighborhood heterogeneity on students' likelihood of carrying weapons into schools net of several indicators of individual propensities to carry weapons[2]. While Welsh et al. (1999) recommends measuring both the community characteristics of where schools are located as well as where students' reside, limitations in the current data

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[1]The indicators of social disorganization included in the study are limited. They do not capture many important aspects of social disorganization (see Sampson and Groves, 1989; Sampson et al., 1997). This investigation therefore does not provide a test of social disorganization theory.

[2] Although the literature regarding gentrifying neighborhoods speaks to specific changes in the structure of neighborhoods, the measures of community available in the data used in this investigation are static. Only information regarding the structural characteristics at the time of data collection was available. The literature on gentrifying communities remains important to the research questions as it explains how neighborhoods that are not considered impoverished at the time of data collection might contain other structural characteristics of social disorganization and heightened levels of crime.

make this impossible. Thus, community-level data is examined only for where students reside.

Violent Subculture Characteristics. While instability may not be exclusive to urban areas, the authors of the NRC/NIM report (2003) found distinct differences between school shootings that occurred in urban schools versus those located in suburban and rural areas. Generally, victims in the urban schools appeared to be targeted. Shootings were related to pre-existing conflicts known to the victim, offender, and other members of the community. Furthermore, the shooters seemed to be acting in accordance with prescribed social norms for dealing with conflict.

In contrast, the school shootings that took place in the suburban and rural areas appeared to emerge from different circumstances. The conflicts that brought about these violent incidents were unknown to the victims and the communities at large. There were no specific targets and the precipitating causes of the incidents cited by the shooters' appeared imagined or hyperbolized in their minds.   In other words, the rural and suburban shooters' reasons for shooting their victims were generally based on inaccurate perceptions of the situation. Finally, in the rural and urban communities, such violence was infrequent and considered unacceptable. The distinct differences in how the offenders choose their victims and how the violence was perceived by the community led the NRC/NIM committee to conclude that there were inherent differences in what triggered the violent acts by location (NRC/NIM, 2003).

The NRC/NIM report (2003) suggests that while individual characteristics more strongly predicted rural and suburban shootings, violent subcultural overtones

predicted the urban school shootings. Those shootings appeared to be extensions of the general level of violence that occurred within the schools and close proximities to the schools. School shootings in those areas reflected conflicts or "beefs" that were understood by both parties as well as others not involved. Social status and reputation were often at stake in these confrontations and displays of "toughness" necessary in order to avoid the tarnishing of one's reputation.

Descriptions of the urban incidents in the NRC/NIM report are characteristic of the violence found in high crime communities where crime and violence appear to be embedded in the culture. A subculture of violence permits, perhaps even encourages, violence as a means to resolving conflicts. The use of violence in these cultures is intended to inflate one's reputation and command respect and fear (Anderson, 1999; Fagan and Wilkinson, 1998; Wolfgang and Feracutti, 1967).

Anderson (1999) specified how a subculture of violence comes to exist in his theory-- the "code of the street". The "code of the street" is a set of informal rules that dictate what is considered appropriate behavior in certain areas (Anderson, 1999). The rules routinely require the use of violence in order to gain and maintain respect. Respect is valued more than other qualities which are be considered valuable in mainstream culture such as education, employment, etc. In order to obtain retribution and command respect, violence is an acceptable response to perceived disrespect. While there is a general consensus in the literature that adopting the "code of the street" increases aggressive behavior and victimization, there is some disagreement regarding whether this "code" is unique to impoverished inner cities or can be found in wealthier or non-urban communities (Baumer, Horney, Felson, and

Lauritsen, 2003; Stewart, Simons, and Conger, 2002; Stewart, Schreck, and Simons, 2006).

Baumer et al. (2003) tested Anderson's predictions regarding the unique qualities of crime in disadvantaged neighborhoods. Anderson (1999) specified that violence in disadvantaged neighborhoods should be different from that in more affluent neighborhoods. More specifically, the "code" that existed in disadvantaged neighborhoods stated that individuals should resist assaults as a way to show toughness and gain/maintain respect. This resistance should lead to more injuries than an assault that might occur in a more affluent neighborhood. In the affluent neighborhood, the same rules regarding displays of toughness and respect do not apply, thus resistance is less likely. Additionally, Baumer et al. (2003) examined victim reaction to robberies. "Code" scripts instruct the victim of a robbery to act in a compliant manner, showing the robber respect in order to escape the robbery alive. Baumer et al. (2003) also predicted that in disadvantaged neighborhoods, violent crimes more often include the use of a weapon, per Anderson's (1999) hypotheses. Finally, Baumer et al. (2003) tested Anderson's prediction that the "code of the street" is unique to disadvantaged inner city neighborhoods.

Baumer et al. (2003) found partial support for Anderson's (1999) hypotheses. Violence in disadvantaged neighborhoods was qualitatively different from violence found in more affluent neighborhoods. More specifically, guns were more often used in robberies and assaults in disadvantaged neighborhoods. Furthermore, robberies and assaults followed the rules of the "code of the street" in those neighborhoods. Resistance was used during assaults but not during robberies. No evidence supported

Anderson's (1999) assertion that the "code" is unique to inner city areas (Baumer et al., 2003). While Baumer et al. (2003) concluded that a different set of rules applies to violent behavior in disadvantaged neighborhoods, those rules were not unique to urban areas.

Stewart et al. (2002) also found partial support for the "code of the street" hypothesis-- those youths who adopted the code of the street were more likely to behave aggressively. This investigation took place in suburban and rural communities, once again supporting the notion that the "code" was not unique to urban areas. Stewart et al's. (2002) findings indicated that while there was a correlation between neighborhood and individual levels of violence, this relationship was not significant in a multivariate analysis. In other words, an individual living in a violent neighborhood was not significantly more violent than an individual living in a non-violent neighborhood. The researchers reasoned that perhaps youth in violent neighborhoods become desensitized to violence. They also acknowledged that their sample was possibly too young to find an effect on individual levels of violence. Had the sample consisted of adolescents, perhaps a more substantial effect could have been detected.

In addition to subculture characteristics influencing crime at the community-level, subcultural themes of violence also appear to impact behavior within schools as well. Felson, Liska, South, and McNulty (1994) examined the effects of the subculture of violence within a school-setting. They found that regardless of youths' individual commitments to violent values, the presence of a violent subculture at the school-level increased both school- and student-level violent and delinquent

outcomes. Felson et al. (1994) concluded that schools with subcultures of violence were at higher risk for both violent and other forms of delinquent behavior, thus implicating the importance of social control at the school-level. This finding is consistent with the school climate literature which links values and norms held at the school level to student behavior within schools (Cook, Gottfredson, and Na (in press).

Given this previous research, there appears to be support for the notion that disadvantaged neighborhoods contain scripts or codes that dictate behavior differently from that of more affluent neighborhoods. The NRC/NIM report (2003) found elements of theses codes to be isolated in urban schools and their surrounding neighborhoods. The urban schools were not strangers to violence. Such behavior was a relatively common occurrence within these schools and surrounding neighborhoods. Thus, the report proposed that an underlying subculture, specific to urban areas, was the precipitating cause of school shootings in urban neighborhoods. The report suggests that there is a social pressure to respond violently to conflict in these areas. The quantitative research literature confirms this possibility. Whether these codes might explain school violence outside of urban areas must be investigated further, as such findings were not reflected in the NRC/NIM report (2003).

Nevertheless, the NRC/NIM report (2003) found distinct differences in what appears to trigger urban shootings versus those that occur in rural and suburban communities. More attention must be paid to what is driving urban, suburban and rural shootings. Given the disparate findings by location, the report concluded:

> It is the committee's strong view that additional research is necessary to investigate the question of whether there are two different strands of lethal school violence and, if so, whether they are correlated with urban on one hand and suburban and rural on the other. If these two

different patterns of lethal school violence exist, and if they are in fact correlated with the characteristics of the communities in which the violence occurred, then these trends should be revealed in the aggregate statistics on lethal violence in schools. (NRC/NIM, 2003, pgs. 337-338)

The present analysis addresses this gap by testing the extent to which the influence of certain elements of a violent school subculture, specifically a high level of violence among student bodies as well as access to weapons and lethal expectations, predict weapon-carrying and the extent to which the influence of subculture values differ by school location. Additional elements of violent subcultures, such as violent values, are not included in the current investigation; thus the analysis can not offer a full test of violent subculture theories.

School Connectedness. There is general agreement regarding the importance of community-level characteristics in predicting school-level crime [see Laub and Lauritson (1998) for review]. However, the characteristics of schools that are important to study when predicting school crime are less agreed upon. In spite of huge variations in the definition of school climate, the present investigation borrows Tagiuri's definition of school climate (as cited by Cook et al., in press) to define school climate as it pertains to the current analysis. Tagiuri identifies four different components of school climate.

School ecology denotes the structural environment of the school (e.g., finances, building structures, and student/teacher ratios). The second component of school climate, milieu, characterizes the background of the students attending schools. The third component of school climate, social systems, refers to patterns of personal relationships, rules of operation, and communication within schools. This

category can be broken down further to school organizational management and school administration and management. Finally, culture relates to values and attitudes of students and staff within schools. This aspect of school climate focuses on the quality of relationships and communal organization [Tagiuri (1968), as cited by Cook et al., in press)].

Research on school climate has measured all four of these categories of school climate. In their reanalysis of the Safe School Study data, Gottfredson and Gottfredson (1985) found that community factors such as poverty and community disorganization accounted for 54% of the variance in teacher victimization. In other words, the locations surrounding the schools were key predictors of teacher victimization rates. While findings such as Gottfredson and Gottfredson's (1985) highlight the importance of incorporating community characteristics into any model attempting to predict school crime and disorder, Gottfredson and Gottfredson also found evidence that the four dimensions of school climate described by Tagiuri (1968; as cited by Cook et al., in press) were also important in predicting school crime and disorder. Since Gottfredson and Gottfredson's (1985) early research, the importance of school climate and community characteristics has consistently been found in the empirical literature (e.g., Eitle and Eitle, 2004; Gottfredson, Gottfredson, Payne, and Gottfredson, 2005; Reiss, Trockel, and Mulhall, 2007; Welsh, 2001).

Hoffmann and Dufur (2008) studied the effects of individual and school-level factors on delinquency. They found that schools with effective social systems and a positive culture (e.g., fair, high functioning, trusting environment) acted as protective

factors against the harmful effects of low parental attachment and low academic achievement.

Gottfredson et al. (2005), using data from the National Study of Delinquency Prevention in Schools, examined the effects of school climate and school structure on school disorder. School disorder was measured using student offending and student and teacher victimization. Structural characteristics included measures of the surrounding communities as well as school demographics. Finally, school climate was measured using the following scales: students' perceived fairness and clarity of the rules, teacher morale, and teacher perceptions of administrative leadership. Findings indicated that schools with higher scores on the measures of favorable school climate had lower rates of student delinquency than schools with lowers scores on measures of favorable school climate. Reiss et al. (2007) came to the same conclusion given their findings that middle-school aggression declined when school climate improved. In Reiss et al.'s (2007) investigation, school climate was based on measures of whether students felt included in policy-making, schools had cultural sensitivity training, and teaching emphasized understanding over memorizing. Finally, Eitle and Eitle (2004) also found an inverse relationship between school climate and school deviance. More specifically, higher levels of school climate were related to reduced levels of drug, alcohol, and tobacco offenses on school campuses.

Welsh (2001) examined the influence of school climate on school disorder, using a collection of scales including: respect for students, perception of the schools ability to plan and implement school improvements, fairness and clarity of rules, and student influence. Generally, these scales were better able to predict student

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misconduct than more serious student offending. Welsh, Greene, and Jenkins (1999) found that school climate reduced school misconduct although the relationship did not reach significance. Individual level factors were most influential in explaining the variance in school disorder (Welsh et al., 1999).

Based on this review of school climate literature, supportive and trusting relationships in schools as well as schools' abilities to communicate and fairly regulate behavior are linked to reduced school disorder (Gottfredson, 2001; Gottfredson et al., 2005; Khoury-Kassabri, et al., 2004; Payne, Gottfredson and Gottfredson, 2003; Welsh, 2001; Wilcox and Clayton, 2001).

With the proper protective factors, including the elements of school climate described above, delinquent behaviors in school can be reduced (Gottfredson et al., 2005; Hoffmann and Dufur, 2008; Payne et al., 2003; Wilcox and Clayton, 2001). Many of the school-level factors described above were absent in the NRC/NIM report (2003) schools. There appeared to be a lack of attachments between adults and students within the schools (NRC/NIM, 2003). The adults in the schools failed to instill values of respect among students. In one especially unfortunate incident, a school newspaper printed an article about a student that was especially embarrassing. This student eventually became one of the shooters.   While the NRC/NIM report (2003) authors do not conclude that any of the schools are criminogenic, they suggest that the schools failed to provide a protective environment. Regarding the influence of the schools in these events, the authors explain,

> While the evidence is scarce that the schools somehow generated the
> violence as a consequence of the way they were structured and
> administered, the sense of community between youth and adults in

these schools, which research has shown is protective against crime, was lacking (NRC/NIM, 2003, p. 256).

Given the findings and conclusions of the NRC/NIM report (2003) and the consistent findings of the empirical literature, the present investigation includes a measure of school climate. It seems likely that a youth's intention to bring a weapon onto school property will be influenced by overarching perceptions regarding school policy and the positive or negative relationships that exist within the school. While school climate encompasses a broad range of school characteristics (see Cook, et al., in press; Gottfredson et al., 2005), this investigation only captures one component of school climate—school connectedness, an element of the culture dimension. While this measure is limited in its ability to capture the broader concept of culture, as described by Cook et al. (in press), it does examine the quality of relationships between students and their schools.

The prior research relating to criminological theory, in-school weapon-carrying, and school crime suggests that structural and violent subculture characteristics, as well as mean school connectedness are all potentially important contributors to weapon-carrying on school property. Moreover, little research exists that directly examines the influence of these characteristics on weapon-carrying behavior or the ability of school characteristics to moderate the effects of student-level predictors on in-school weapon-carrying. The present analysis explores the direct and interactional effects of school characteristics on in-school weapon-carrying, while controlling on individuals' propensities to carry weapons.

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In order to fully understand the influence schools have on weapon-carrying, individual characteristics must be included in the model. As reviewed below, the effects of student-level characteristics, including parental and school attachments as well as peer relationships, have been well-established in their relationship with in-school weapon-carrying and in-school deviance. Thus the present model includes these characteristics so as to confirm earlier findings, control for these characteristics when examining the influence of school factors, and explore the effects of school characteristics on the relationship between student-level factors and in-school weapon-carrying. A review of the literature relating to the student-level characteristics included in the model follows.

Student-Level Predictors of Weapon-Carrying

Student-level predictors continue to be important, even when incorporating community and school-level characteristics into an explanation of in-school weapon-carrying. In fact, in their multilevel analysis, Wilcox and Clayton (2001) found that student-level characteristics explained more variance in weapon-carrying than did school-level characteristics; although school-level characteristics were still deemed important. Generally, the empirical literature finds that students' previous behaviors, including previous fighting, delinquent and weapon-carrying behaviors, are related to in-school weapon-carrying (DuRant et al., 1999; Furlong et al, 2001; Kudjo, Auinger, and Ryan, 2003; Rountree, 2000; Simon et al., 1999; Wilcox and Clayton, 2001; Wilcox et al., 2006).

Previous in-school weapon-carrying research also found demographic characteristics to be predictors of weapon-carrying. Simon et al. (1999) found that boys were more likely than girls to carry weapons both on and off of school grounds. Unexpectedly, when limiting their analysis to only weapon carriers, females were more likely than males to carry a weapon on school grounds. Despite the findings of Simon et al. (1999), there is a general consensus in the literature that males are more likely to bring weapons on to school grounds than females although the strength of this relationship has not always been strong (DuRant et al., 1999; Kudjo, Auinger, and Ryan, 2003; Malecki and Demaray, 2003; Wilcox and Clayton, 2001). For example, Rountree (2000) examined weapon-carrying in three different locations and found that being male predicted in-school weapon-carrying in only one location after controlling for additional predictors.

In addition to gender, Furlong et al. (2001) found that ethnicity and grade level were also weak predictors of in-school weapon-carrying—older and minority youths were more likely to carry weapons. Wilcox and Clayton (2001) found that older and minority youths were more likely to carry weapons to school, as were youth who were of lower socioeconomic statuses. Kudjo, et al. (2003) also found ethnicity to be an important predictor of weapon-carrying. Additional factors that are deemed important student-level predictors of in-school weapon-carrying include pro-weapon socialization, peer weapon-carrying, school and parental attachments, victimization, mental health, and substance abuse (DuRant et al., 1997; DuRant et al., 1999; Kudjo, Auinger, and Ryan, 2003; Rountree, 2000; Wilcox and Clayton, 2001).

The NRC/NIM (2003) found that the eight shooters it studied had many of the qualities described in the above literature. These youth were known to be trouble-makers, although only two had records with the police. Most had experience using guns. The shooters coming from urban communities were African American and came from middle or working class backgrounds. The remaining youths were white and from middle and affluent backgrounds. These youth ran the gamut on demographic characteristics. The NRC/NIM report (2003) found that social status, low levels of attachment to adults and school, and mental health were also particularly important student-level factors in predicting the shootings.

Specifically in the rural and suburban communities, the NRC/NIM report (2003) found that social hierarchies within schools left shooters feeling displaced. While the report indicated that cliques were somewhat fluid, the shooters were never able to gain acceptance and often times experienced negative interactions with the more popular social groups in school. Isolation, paired with negative peer interactions, appeared to be a precipitator of the shooting incidents in these rural and suburban communities. The case studies implied that peer relationships in the urban communities did not reflect the same social hierarchies. That being said, conflict was prevalent in these communities, leading to social relationships being formed as a means of protection and for appearances' sake. Social relationships reflected gang membership in urban areas, according to the NRC/NIM report (2003).

While peer relationships may have been a unique problem to rural and suburban schools, the NRC/NIM report (2003) noted a lack of attachments to school and adults across locations. The report highlights several instances where shooters

lacked attachment to school and their families. This disconnect resulted in youth who were not properly exposed to adult values such as self-reliability, independence, responsibility, and morality. Given their lack of attachments to their schools and families, the shooters were unable to develop adult values and morals.

As a means of curbing school violence, the report suggests that schools find a way to make students feel valued. One way of doing so is to ensure that each student feels connected and attached to their school. Improved communication with parents was an additional suggestion of the NRC/NIM report (2003).

The NRC/NIM report (2003) found that mental illness was a theme that ran through many of the shooters' stories, especially those from rural and suburban communities. While some of the shooters displayed symptoms of mental illness prior to their shootings, others did not do so until afterwards. All of the rural and suburban shooters displayed some type of suicide ideation or attempted suicide before, during, or after their shooting incident.

The prior research, paired with the NRC/NIM report (2003), provides some provocative implications regarding the potential predictors of in-school weapon-carrying. The next section delves into the possible theoretical explanations that are linked to the student-level factors suggested to be important by the NRC/NIM report (2003) and weapon-carrying literature in predicting in-school weapon-carrying.

Connectedness to Parents and School. Hirschi's social-control theory is generally supported in its assertion that attachment to school and family will reduce one's likelihood of engaging in delinquent acts (e.g., Hirschi, 1969; Payne et al., 2003; Stewart, 2003; Wiatrowski and Anderson, 1987). The NRC/NIM report (2003)

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highlights the importance of such attachments as well. Specifically relating to school attachments, the report suggests that positive relationships between students and their schools were important for preventing future violence. The empirical literature on school connectedness reflects a similar theme—if school connectedness is absent, one is more likely to engage in delinquent behavior on and off of school property (Hoffmann and Dufur, 2008; Payne et al., 2003; Stewart, 2003; Wilcox and Clayton, 2001).

In addition to school connectedness, connection to other adults, specifically parents, is deemed important in the NRC/NIM report (2003). The report suggests that adults need to improve their communication with youth and instill values such as civility, respect, and empathy towards others. Empirical evidence indicates that improved morals and beliefs in the legitimacy of law are all inversely related to delinquency (e.g., Hirschi and Stark, 1969). Generally the report found that none of the shooters came from families with histories of family violence or neglect. Thus, the report proposes that nonviolence within families is important but not sufficient. Involvement on the part of parents and children's sense of attachment are required in order to instill the moral values necessary to deter delinquent activity (NRC/NIM, 2003.

The empirical literature provides a consensus regarding the importance of attachment and involvement of family in influencing the delinquent behavior of youth (Brookmeyer, Fanti, and Henrich, 2006; Dornbusch, et al., 2001; Henrich, Brookmeyer, and Shahar, 2005; Hoffmann and Dufur, 2008; Patterson and Dishion, 1985; Stewart et al., 2002). Patterson and Dishion's (1985) study supports the idea

that parents are important in reducing delinquency and violent behavior among youth. In accordance with Hirschi's (1969) social control theory, which states that proper socialization and controls must be in place to deter deviant behavior, Patterson and Dishion (1985) found that parental monitoring acted as such a control. Parental monitoring directly and indirectly reduced the delinquent behavior of youth.

More recent work has examined other elements of the social bond between parents and children. Henirch, et al. (2005) found parental connectedness (measured with questions such as "how much do you feel your parents care about you?" and "most of the time your mother/father is warm and loving towards you") to be negatively related to weapon violence. In a subsequent investigation, Brookmeyer, et al. (2006) reported that connectedness to parents acted as a buffer against the harmful effects of exposure to violence. However, this relationship was only significant when school connectedness was also high. Thus it appears as though parental bonds have the potential to both prevent weapon-use among youth as well as mitigate the harmful effects of exposure to violence.

In a study that examined both the effects of psychosocial and neighborhood-level characteristics, quality of parenting was found to be an important predictor of childhood violence (Stewart et al., 2002). Quality of parenting included measures of consistent discipline, child monitoring, positive reinforcement, quality time, warmth and support, parental influence, and inductive reasoning.

As reflected above, the parental bond is consistently shown to be an important predictor of delinquent behavior. Given the previous literature combined with the findings of the NRC/NIM report (2003), the present investigation seeks to confirm

the importance of parental bonds in predicting weapon-carrying. More interestingly, the investigation examines the influence of school-level factors on the relationship between parental bonds and weapon-carrying.

Two scales are used in order to understand this complex relationship between parent and child (e.g., Dornbusch, Erickson, Laird, and Wong, 2001; Hoffmann and Dufur, 2008); specifically, parental attachment and parental supervision are examined. These scales have also been considered important in previous investigations [see Hoffmann and Dufur (2008) for review] and correspond with the related issues discussed in the NRC/NIM report (2003).

Peer Relationships. The influence of peers on crime has long been a research topic of great interest and debate (e.g., Demuth, 2004; Haynie, 2001, 2002; Kreager, 2004; Schreck, Fisher, and Miller, 2004; Warr and Stafford, 1991). However, despite all of this focus, only little attention is given to those who report having no friends (Demuth, 2004).

Just recently has research begun to focus on determining the consequences of social isolation and peer conflict (e.g., Demuth, 2004; Kreager, 2004; Kreager, 2007). The assumption that isolation from peers is a risk factor for deviant behavior is contested in Demuth's (2004) investigation on the influence of social status on delinquent behavior. He found that loners (those who report no friends) had lower levels of delinquency than non-loners. However, the loner category of youth was more susceptible to other negative outcomes including isolation in school and poorer academic performance when compared to non-loner youths. Nevertheless, the simple loner/non-loner measurement of social status did not appear to predict crime.

Kreager (2004) offers an alternative method of evaluating the effects of social status. As opposed to a binary model of social status, Kreager identified four different categories of social status including the typical adolescent, the invisible isolate [similar to Demuth's (2004) loner category], friends and conflict (individuals who reported having friends but also had trouble with peers) and the peer-troubled isolate (individuals who identified no friends but reported conflict with peers). These peer-troubled isolates were individuals who did not really have social status but were not completely ignored by their peers. Unfortunately, their relationships with peers were typically characterized by negative interactions. This latter category was most at risk for increased delinquency and delinquent associations.

Kreager's (2007) most recent work examined how the use of violence during adolescence impacted acceptance by peers. He found that generally, the use of violence reduced peer acceptance. However, for males with low academic standing, violence appeared to increase peer acceptance. While no individual level characteristics (such as academic standing) moderate the negative relationship between violence and peer acceptance for females, school-level measures of violence did predict the direction of the relationship between female violence and peer acceptance. Specifically, violent girls were more popular in violent schools than they were in non-violent schools. However, in no situation did higher levels of violence increase a female's level of prestige. Kreager (2007) concluded that violence was more accepted at more violent schools.

The research described above indicates that peers play a complex role in predicting negative outcomes such as delinquency. While isolation does not

necessarily predict offending (Demuth, 2004), a lack of social attachments combined with negative peer interactions produces criminal outcomes (Kreager, 2004). Furthermore, school attachment and academic performance contribute to the complexity of peer influence--school attachment and performance can suffer as a consequence of social status (Demuth, 2004) or can predict the types of peers one will come to associate with (and consequently the behaviors that one will engage in; Kreager, 2007). Kreager's (2007) most recent work finds that low academic performance influences whether or not violence is considered an acceptable behavior by one's peer group. For those youth who are in low academic standing, violent behavior is more likely to be rewarded by peers.

This research is consistent with the conclusions made in the NRC/NIM report (2003). The report suggested that negative interactions with peers were a catalyst for the shootings as was dissatisfaction with social status. In general, shooters were "intensely interested in defending or elevating their social standing. They believed that they were being ignored, or were under attack, or had been unjustly treated" (NRC/NIM, 2003, p. 251). Also related to status, the report notes that just prior to the shooting incidents several of the shooters began associating with other troubled youth. In other words, their immediate peer groups changed.

Given the findings of the NRC/NIM report (2003) and the empirical literature, the influence of peers is included in the present investigation. More specifically, the deviant behavior of peers is measured as is the interaction between social status and negative peer interactions. The primary hypothesis concerning the influence of peers

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explores the influence of school-level factors on the relationship between social status, negative peer interactions, and in-school weapon-carrying.

Mental Health. Mental health issues were considered important in understanding the underlying causes of the shootings described in the NRC/NIM report (2003). Several of the shooters suffered from severe mental health problems, ranging from depression to schizophrenia. Most of the mental health problems were diagnosed after the shootings, leading the authors of the report to question whether the diagnoses were simply a desperate attempt to provide some explanation for the unfathomable events that occurred. That being said, suicidal thinking was a common trait to several of the shooters. Two displayed suicidal gestures during their attacks and one repeatedly tried to commit suicide while in custody.

The empirical literature concerning mental health is consistent with the beliefs asserted in the NRC/NIM report. Generally, violent and delinquent offenders have higher levels of mental health problems (Birnbaum et al., 2003; Borowsky, Ireland, and Resnick, 2001; Ellickson, Saner, and McGuigan, 1997; Lowry et al., 1999; Markowitz, 2001; Wasserman et al., 2002). In fact, when examining the behaviors associated with suicide attempts, Borowsky et al. (2001) found that alcohol use, marijuana use, violent victimization and violent offending were associated with suicide attempts for both boys and girls. Carrying a weapon at school was predictive of male suicide attempts. While the present study is not investigating the predictors of mental health problems such as suicide, Borowsky et al's (2001) work highlights the relationship between the two behaviors. Given these findings, the possibility exists that mental health problems may be a precursor to offending. Given the

consistent findings within the empirical literature and the observations in the NRC/NIM report (2003) the present study examines the effects of suicidal ideation on in-school weapon-carrying. Although it would be preferable to delve into the mental illness histories of the sampled students, data on severe mental issues are not available. Thus, suicidal thinking and attempts act as proxies for mental illness.

Prior Delinquency. All of the subjects followed in the NRC/NIM report (2003) had histories of delinquency. While only two of the urban shooters came into contact with the police, all had some experience with delinquent behavior, mostly vandalism and theft. The prior empirical literature concerning weapon-carrying supports such findings. Adolescents who carry weapons, both in and out of school, typically have prior juvenile records or self-reports of delinquent behavior (Barlas and Egan, 2006; Brookmeyer et al., 2006; DuRant et al., 1997; Wilcox and Clayton, 2001). Given such findings, the current investigation explores the effects of delinquency on in-school weapon-carrying behavior.

Summary of Student and School Predictors of Weapon-Carrying

The NRC/NIM report (2003) suggests that student-level characteristics have a differential effect depending on location. In the rural and suburban communities student-level factors, such as attachment, social status, and mental health, better explain weapon-carrying than in urban areas. In urban schools, subcultures that permit and encourage violence exist and explain school violence. The present analysis will explore these relationships.

Summary of Control Variables

Control variables are included in both levels of the model. The variables are selected due to their established relationships with weapon-carrying. Student-level control variables include demographics, weapon-carrying at Wave I, peer deviance, exposure to violence, GPA, and drug and alcohol use. At the school level, student and teacher race, school size, grade-levels, and school sector are controlled.

The Proposed Research

Prior research and criminological theory converge to suggest that the individual and school characteristics shown in Figure 1 are important when explaining in-school weapon-carrying behavior. Further, the research summarized above indicates that the causes of weapon-carrying will vary by school location, with violent subcultures being more influential in urban schools and individual characteristics more influential in suburban and rural schools.

This investigation tests the model illustrated in Figure 1. Watkins (2008) tests a similar model using the same data as used in this investigation but with some important differences: Watkins (2008) used only a sub-set of the schools used in this investigation, used only cross-sectional data, and did not consult criminological theory to inform his selection of weapon-carrying predictors. This study concluded that school characteristics were unimportant in explaining student weapon-carrying.

The study herein improves upon Watkins' (2008) work as well as earlier multilevel investigations into student weapon-carrying. First, it uses all of the schools available in the sample (sample to be discussed subsequently). Secondly, it incorporates more refined measures of school characteristics identified in

criminological theory and earlier research as important when studying the causes of weapon-carrying. Finally, this study makes use of two waves of data. Watkins (2008) used only the first wave of Add Health data for his analysis. Subjects were identified as weapon-carriers if they indicated carrying a weapon to school during the past month.

Kodjo et al. (2003) and Wilcox and Clayton (2001) also relied on measures of weapon-carrying that were collected during the same time period as predictors. Using cross-sectional data it is not possible to establish time ordering between the dependent and causal measures. This study separates the timing of the dependent measure from the presumed causes by using two waves of data. In an attempt to isolate causal effects to the extent possible with non-experimental data, this study also employs stringent controls for individual propensity to carry weapons. Because any association between weapon-carrying and the independent variables of interest might be due to common reliance on factors that causes both, statistical controls are applied for individual- and school-level predictors that are anticipated to lead to weapon-carrying. Included in these measures is a control for weapon-carrying at time 1.

By applying such stringent controls in my test, I limit the time frame during which the presumed causes might operate to the period between time 1 and time 2. By controlling for time 1 weapon-carrying, any variability in time 2 weapon-carrying that operated through time 1 weapon-carrying is eliminated. The influence of persistent personal characteristics (e.g., impulsiveness, gender, race) and stable school characteristics that may have determined time 1 weapon-carrying are controlled away in this investigation. Hence, the focus is on those characteristics that influence

changes in weapon-carrying between Waves I and II. This approach may prove conservative to the extent that causes of weapon-carrying are stable across time. However, given the findings of the NRC/NIM report (2003), which suggests that in certain instances, an affront by another person (e.g., gang member, romantic interest) or changes in social conditions precipitated the acts of violence, the predictors of weapon-carrying do not appear to be fully static. I anticipate considerable change in weapon-carrying behavior between Waves I and II, and expect that the model shown in Figure 1 will predict these changes.

Hypotheses Related to School-Level Factors

Hypotheses 1 through 4 predict how variables measured at the school-level are related to changes in in-school weapon-carrying:

Hypothesis 1: Schools serving communities characterized by elements of social disorganization will experience a greater increase in in-school weapon-carrying.

Hypothesis 2: Schools serving communities characterized by elements of a violent subculture will experience a greater increase in in-school weapon-carrying.

Hypothesis 3: The effect of violent subculture characteristics on in-school weapon-carrying will be greater in urban than in suburban/rural schools.

Hypothesis 4: Higher levels of average school connectedness will be inversely related to increases in weapon-carrying on school property

Hypotheses Related to Cross-Level Interactions

Until now, no investigation has examined how school-level contextual characteristics condition the effects of student-level risk factors on weapon-carrying. Thus, the final two hypotheses predict that school-level characteristics will condition

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the relationships between student-level predictors and changes in weapon-carrying. The school-level characteristics selected to examine conditioning effects are chosen based on the findings of the NRC/NIM report and the literature related to the subculture of violence.

Hypothesis 5: Individual factors will be more predictive of in-school weapon-carrying in rural and suburban areas than in urban ones.

Hypothesis 6: Individuals factors will be more predictive of in-school weapon-carrying in areas that do not have elements of a violent subculture.

Figure 1. Conceptual Model

School-Level IVs
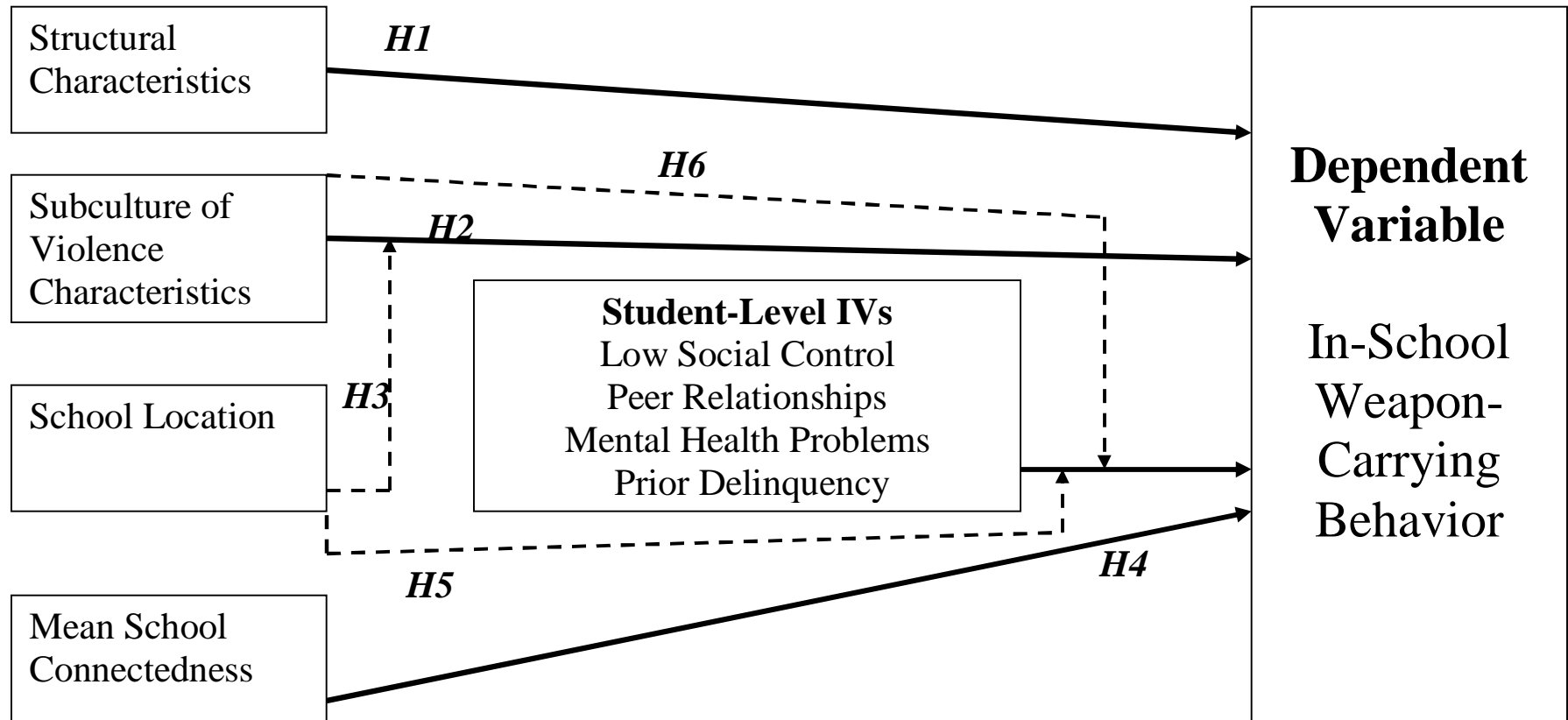
Note: Solid lines indicate direct of relationships and dotted lines reflect conditional relationships.

Key (description of those concepts measured by more than one variable):

Structural Characteristics = low SES scale, heterogeneity scale
Subculture of Violence Characteristics = violent environment scale, gun accessibility, and lethal expectation
School Location = urban, suburban, rural

Social Control = school connectedness, parental attachment, parental supervision
Peer Relationships= peer conflict, social isolation, social isolation x peer conflict
Mental Health =suicidal contemplation and suicide attempts

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Chapter 3: Data and Methods

Data Source and Sample

The present analysis uses data from the National Longitudinal Study for Adolescent Health (Add Health; Udry, 2003). The sample consists of 80 randomly selected high schools and 52 feeder middle schools that are stratified by enrollment size, region, location, curriculum, and percent white[3]. The procedure, which gives schools an unequal probability of selection, produces a sample representative of the U.S. school population when weighted (Harris, Florey, Tabor, Bearman, Jones, and Udry, 2003)[4]. Data were collected in three Waves. The first Wave occurred during the 1994-1995 school year. The second Wave of data collection took place during the following school year, 1995-1996. The most recent data collection efforts, Wave III, were completed between July, 2001 and April, 2002[5].

The first wave of data collection consists of an in-school survey, school administrators' survey, an in-home interview, and a parental survey (see Table 1 for survey response rates). All of the students in the selected schools, approximately 90,000 in grades 7 through 12, completed the in-school survey[6]. This survey, not used in my analysis, asked about behavior, friendships, and health among other topics. Additionally at Wave I, school administrators completed a survey describing

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[3] Two of the 132 schools are omitted because they contained incomplete data. The 130 schools included in the sample have complete data on all school-level measures.

[4] For a more detailed description of the Add Health research design see the project's website at http://www.cpc.unc.edu/projects/addhealth/designfacts.

[5] Wave III data is not used for the present investigation as most students had completed high school.

[6] The in-school survey was only offered one time in each school; thus students who were not present on the day that the survey was administered were not able to complete it. These students were still eligible to be selected for the in-home sample.

the characteristics and policies of their schools. The in-home interview was offered

to a sub-sample of students. Five different selection criteria were used to select

students to participate in the in-home portion of the data collection (Chantala and

Tabor, 1999).

Table 1. Survey Response Rates

Survey	Number of Surveys Completed	Response Rate
Wave I		
Adolescent In-Home Interview	20,745	78.9%
Parents In-Home Questionnaire[1]*	17,669	85.2%
School Administrator Questionnaire, Wave I	130	98.5%
Wave II		
Adolescent In-Home Interview	14,738	88.2%

*Personal communication with Joyce Tabor, Add Health data manager, February 22, 2009.
[1] Response rate based on the number of students who completed the in-home interview, not the number of students eligible to complete the interview (n=20,745).

All students listed on school rosters were eligible to be part of the core sample

that completed the in-home interview. Students were stratified by grade and sex with

approximately 200 students being selected from each high school and middle school

pair. Approximately 12,000 students participated in the Wave 1 in-home

questionnaire as part of the core sample. The remaining students who participated in

the Wave I in-home interview were selected in an effort to oversample certain groups

of the population. In order to analyze social networks, a saturation sample was

created which included all of the students from 16 high schools. All of the students in

those schools completed an in-home questionnaire. Students who reported physical

disabilities on the in-school survey made-up the disabled sample. The ethnic sample

consisted of African-American students from well-educated families as well as

Cuban, Puerto-Rican, and Chinese students. Finally, identical twins, fraternal twins,

full and half siblings, and unrelated children living in the same household made up the genetic sample. Nearly 21,000 students completed the in-home interview during Wave I (this represented approximately 79% of the in-home sample; Chantala and Tabor, 1999). During the two hour interview, interviewers asked students questions and recorded their answers on computers. For more sensitive topic areas, students put on headphones, listened to pre-recorded questions, and entered their responses onto the laptop computers. Parents of those students who participated in the in-home portion of the data collection also completed surveys during Wave I (accounting for 85% of those students who completed the interview).

During Wave II of data collection, school administrators from all participating schools completed a telephone survey updating their information and providing additional information on security procedures. Approximately 15,000 students also completed a second in-home interview, conducted in a similar format to the Wave I interview (representing an 88% response rate)[7].

In addition to survey collection efforts, Add Health researchers gathered contextual data for those students included in the Wave I in-home sample. These data includes information on 4,411 census blocks where students reside (Harris, et al., 2003). The contextual data from students who attend the same school are averaged; providing contextual data for the average student at each school. Such measures can be interpreted as describing the communities of the students who attend each school. A more detailed description of this process is described below.

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[7] Not all students who participated in the in-home sample at Wave I were eligible to participate in Wave II, including those who were seniors at Wave I and the disabled sample. Thus, the response rate is based on 16,708 students for whom Wave II in-home interviews were attempted.

The present analysis includes data from Waves I and II of the Add Health study. The independent and control variables come from the Wave I interview and school administrator surveys as well as contextual data gathered at Wave I[8]. Weapon-carrying is measured at Wave II for the in-home interview.

Sample Reduction

Data from multiple sources is needed at both the student- and school-levels. Schools are required to have data from two sources, a school information file and a school administrator file. These two sources are regarded as "school-level data". Based on these requirements, 130 out of 132 schools are eligible to participate in the analysis.

Table 2. Description of Sample Reduction

Valid N	Percent (%) of Cases Lost	Student-Level Cumulative Percent (%) of Cases Lost	Explanation
20,745			Number of students with valid data from the Wave I in-home interview
16,708	19.5	19.5	Number of students eligible to complete Wave II of data collection
14,738	11.8	29.0	Number students with valid data from the Wave II in-home interview
13,373	9.3	35.5	Number of students with valid data from Waves I and II, and school data
12,875	3.9	37.9	Number of individuals with complete data at the student-level (i.e., those remaining after listwise deletion on all variables used in the final models)

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[8] Efforts were made to use items from the Wave I parental survey in the analysis but high levels of attrition made this infeasible. These efforts are described in more detail below.

Students without the necessary data are also excluded from the sample. See Table 2 for an explanation of case loss at student level. Students must have data from the in-home interviews at Waves I and II,. The sample is further reduced due to missing school data. Administrator surveys were not completed at two schools. Students in those two schools had to be excluded from the analysis. Finally, listwise deletion resulted in a sample of 12,875 students. On average, there are approximately 103 students per school included in the analysis.

Missing Data

As noted above, two schools are removed from the sample due to missing data. Weights correct for this data loss, creating a school sample that is representative of middle and high schools (see more information on weights below). In terms of data loss at the student level, approximately 62% of the students selected to participate in the in-home interviews at Wave I are included in the final sample.

A variety of options are available for handling missing data (Allison, 2002; Schafer and Graham, 2002). The choice of method depends in part upon the assumptions about the distribution or missingness. Table 3 explores correlates of missingness due to attrition and listwise deletion. It shows the differences between missing and nonmissing cases in terms of the variables included in the study (to be described shortly). It is apparent that missingness is not completely random. Although percentages of students carrying a weapon at each time point are similar for included and excluded cases, many other differences are observed. Generally, those not included in the sample appear to be more at risk than those included in the analysis (e.g., lower levels of attachment and higher levels of peer deviance). These

patterns of missingness argue against the use of multiple imputation strategies—

strategies commonly used to avoid biases associated with missing data. Multiple

imputation strategies require the assumption that data are "missing at random", which

implies that missingness is not related to the value of the missing variable when other

variables are controlled for (Schafer and Graham, 2002). Although it would be

possible to control for the observed differences shown in Table 3, I believe that the

assumption that these observed differences are the *only* differences between the

included and excluded groups is tenuous. Because this assumption can not be

justified, listwise deletion is used to eliminate those respondents who do not have

complete data for all variables included in the model. The use of listwise deletion

limits the generalizability of the study results.

Table 3. Attrition Analysis

Variable	Included Students (N=12875)			Students Excluded (N=7870)		
	N	Mean	SD	N	Mean	SD
Dependent Variables						
Weapon-Carrying, Binary	12875	0.054	0.226	1799	0.056	0.230
Independent Variables						
School Connectedness Scale***	12875	3.76	0.861	7438	3.70	0.889
Parental Attachment Scale ***	12875	4.14	0.624	7824	4.07	0.667
Peer Conflict	12875	0.160	0.367	7436	0.154	0.361
Social Isolation***	12875	0.053	0.224	7870	0.074	0.261
Suicide Contemplation	12875	0.131	0.337	7626	0.140	0.347
Suicide Attempts*	12875	0.052	0.279	7621	0.061	0.306
Delinquency Scale	12875	0.287	0.348	7721	0.295	0.367
Control Variables						
Age	12875	16.212	1.615	1861	16.254	1.849
Gender (1=Male) **	12840	0.487	0.500	7868	0.508	0.500
Student Race: White***	12875	0.538	0.499	7829	0.496	0.500
Student Race: Black***	12875	0.208	0.406	7829	0.242	0.429
Student Race: Hispanic	12858	0.169	0.375	7843	0.173	0.378
Student Race: Other	12736	0.085	0.279	7829	0.091	0.288
Exposure to Violence Scale ***	12858	-0.014	0.631	7719	0.025	0.673
Gun Accessibility	12868	0.220	0.415	7695	0.215	0.411
GPA***	12875	2.770	0.775	7297	2.714	0.766
Alcohol Use Scale***	12875	-0.051	0.892	7681	0.088	0.929
Drug Use Scale***	12875	0.041	0.661	7663	0.137	0.966
Weapon-Carrying, Wave I	12875	0.095	0.293	7689	0.099	0.299
Peer Deviance Scale***	12875	0.797	0.871	7621	0.947	0.917

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

Weights

     Although weights are provided for both the individual and school levels, only

weights at the school level are applied when running the analysis. Models utilizing

the student weights would not converge[9]. Despite these computational problems

relating to the student weights, school weights are used to create a nationally

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[9] Subsequent versions of this paper will identify and use the correct student weights in order to account for attrition between Waves I and II as well as for the unequal probability of selection into the sample within schools.

representative sample of middle and high schools (Tourangeau and Shin, 1999).

However, students included in the analysis may not be representative of their schools.

Choice of school weight varies depending on whether an analysis is examining one level or two levels simultaneously. Descriptive analyses examine only one level of data at a time, thus, weights used for these analyses account for unequal probability of selection into the school sample and non-response at the school-level (SCHADMWT; Chantala and Tabor, 1999).

A different school weight is required to estimate multilevel models (SCHWT1). Each school in the sample is assigned a weight based on the number of schools in represents in the sampling frame. This is computed by taking the inverse of the probability of a school being selected from the sampling frame. Non-response and post-stratification adjustments are also adjusted for when computing this weight (Chantala, Blanchette, and Suchindram (2006).

The inclusion of school weights helps to protect against biased estimates of population parameters and standard errors. The above weights are the recommended school-level weights to be used for descriptive and multilevel analyses (Chantala, 1996). All weight components are provided within the Add Health data.

Measures

Table 4 provides a list of variables and data sources used in the analysis. Table 5 shows descriptive statistics for each measure and Appendix B provides the correlations among all variables.

Dependent Variable

The hypotheses are investigated using a dichotomous dependent variable. Students were asked "since the [Wave I] interview, have you carried a weapon to school?" during the Wave II in-home interview. As noted earlier, controlling for a time 1 measure of weapon-carrying changes the interpretation of effects from effects on weapon-carrying at time 2 to effects on weapon-carrying at time 2, net of individual propensity to carry weapons. This amounts to focusing on factors that predict *change* in weapon-carrying after time 1. Approximately 10% of students change their response to questions of whether they ever carried a weapon to school (at Wave I) and whether they carried a weapon to school during the past year (at Wave II). Thus, there is still variance to be explained in the present model.

Although the amount of variance that can be explained is greatly reduced by estimating the model in this manner, it helps to ensure that the relationships between independent variables and weapon-carrying are not spurious. Early investigations of in-school weapon-carrying have adequately assessed the cross-sectional relationships between student and school characteristics and weapon-carrying, including one that uses these same data (e.g., Kudjo et al., 2003; Watkins, 2008). In order to build upon these prior works, this investigation attempts to isolate causal effects by separating the dependent and independent measures in time and by controlling for factors that may produce spurious relationships.

Responses for weapon-carrying at Wave II are dichotomously coded with "1" indicating that the subject carried a weapon to school since the [Wave I] interview and "0" indicating that the subject had not carried a weapon to school since the

[Wave I] interview. Nearly 6% of students report carrying a weapon to school since

the Wave I interview.

Table 4. List of Variables, Data Sources, and Associated Hypotheses

Dependent Variables	Data Source	Related Hypothesis
In-School Weapon Carrying	In-Home Questionnaire, Wave II	All

Independent (Causal) Variables		
Student Level		
Social Control		
School Connectedness Scale	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Parental Attachment Scale	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Peer Relationships		
Social Isolation	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Peer Conflict	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Mental Health Problems		
Suicidal Ideation	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Suicide Attempt	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
Delinquent Behavior	In-Home Questionnaire, Wave I	Hypotheses 5 and 6
School Level		
Structural Characteristics		
Low Socioeconomic Status Scale	Contextual Data, Wave I	Hypothesis 1
Heterogeneity Scale	Contextual Data, Wave I	Hypothesis 1
Violent Subculture Characteristics		
Violent Environment Scale	In-Home Questionnaire, Wave I	Hypotheses 2, 3, and 6
Access to Guns	In-Home Questionnaire, Wave I	Hypotheses 2, 3, and 6
Lethal Expectations	In-Home Questionnaire, Wave I	Hypotheses 2, 3, and 6
Mean School Connectedness	In-Home Questionnaire, Wave I	Hypothesis 4
School Location (Urban, Suburban, Rural)	School Administrator Survey, Wave I	Hypothesis 3 and 5

Control Variables		
Student Level		
Age	In-Home Questionnaire, Wave II	All
Gender	In-Home Questionnaire, Wave I	All
Race (White, Black, Hispanic, Other)	In-Home Questionnaire, Wave I	All
Exposure to Violence	In-Home Questionnaire, Wave I	All
Access to Guns	In-Home Questionnaire, Wave I	All
Academic Performance	In-Home Questionnaire, Wave I	All
Drug/Alcohol Use	In-Home Questionnaire, Wave I	All
In-School Weapon Carrying (Wave I)	In-Home Questionnaire, Wave I	All
Peer Deviance	In-Home Questionnaire, Wave I	All
School Level		
School Size (Small, Medium, Large)	School Administrator Survey, Wave I	All
School Sector (Public=1)	School Administrator Survey, Wave I	All
High School	School Administrator Survey, Wave I	All
Teacher Race Proportion (White, Black, Other)	School Administrator Survey, Wave I	All
Student Race Proportion (White, Black, Hispanic, Other)	In-Home Questionnaire, Wave I	All

Table 5. Descriptives Table

A. Individual Level Variables--Unweighted (N=13,373)

Variable	Valid N	Mean	SD	Min	Max
Dependent Variables					
Weapon-Carrying, Binary	13319	.056	-----	0	1
Independent Variables					
School Connectedness Scale	13143	3.759	0.867	1	5
Parental Attachment Scale	13351	4.157	0.620	1	5
Peer Conflict	13142	0.171	-----	0	1
Social Isolation	13373	0.059	-----	0	1
Peer*Isolation	13339	0.010	-----	0	1
Suicide Contemplation	13235	0.133	-----	0	1
Suicide Attempts	13231	0.056	-----	0	2
Delinquency Scale	13291	0.286	0.348	0	3
Control Variables					
Age	13373	15.973	1.666	11	23
Gender (1=Male)	13373	0.502	-----	0	1
Student Race: White	13351	0.666	-----	0	1
Student Race: Black	13351	0.155	-----	0	1
Student Race: Hispanic	13330	0.125	-----	0	1
Student Race: Other	13351	0.054	-----	0	1
Exposure to Violence Scale	13317	-0.006	0.616	-0.69	6.47
Gun Accessibility	13264	0.240	-----	0	1
GPA	12987	2.792	0.776	1	4
Alcohol Use Scale	13260	0.001	0.909	-0.90	2.19
Drug Use Scale	13261	0.076	0.783	-0.31	24.3
Weapon-Carrying, Wave I	13271	0.095	-----	0	1
Peer deviance scale	13223	0.818	0.889	0	3

Table 5 continued

B. School-Level Variables--Weighted (N=130)

Variable	Valid N	Mean	SD	Min	Max
Independent Variables					
Low Socioeconomic Status Scale	130	-.152	0.565	-0.96	1.71
Heterogeneity Scale	130	-0.258	0.552	-0.82	2.48
Violent Environment Scale	130	-.047	0.140	-0.26	0.42
Mean Gun Accessibility	130	0.297	0.169	0.00	0.63
Mean Lethal Expectations	130	1.609	0.162	1.08	2.09
Mean School Connectedness	130	3.851	0.184	3.37	4.26
School Location: Urban	130	0.220	-----	0	1
School Location: Suburban	130	0.595	-----	0	1
School Location: Rural	130	0.184	-----	0	1
Urban*Violent Environment	130	0.020	0.079	-0.17	0.42
Urban*Gun Access	130	0.053	0.105	0.00	0.55
Urban*Lethal Expectations	130	0.359	0.678	0.00	1.89
Control Variables					
School Size: Small	130	0.590	-----	0	1
School Size: Medium	130	0.309	-----	0	1
School Size: Large	130	0.101	-----	0	1
Public School	130	0.828	-----	0	1
High School	130	0.473	-----	0	1
Teacher Race: % White	130	87.102	23.32	0	100
Teacher Race: % Black	130	10.491	22.609	0	100
Teacher Race: % Other	130	2.409	6.274	0	56
Mean Student Race: % White	130	0.693	0.332	0	1
Mean Student Race: % Black	130	0.182	0.285	0	0.99
Mean Student Race: % Hispanic	130	0.088	0.143	0	0.90
Mean Student Race: % Other	130	0.038	0.067	0.02	0.69

Student-Level Variables of Interest

Appendix C provides a complete list of items that are used to form the scales described below.

Social Control. The NRC/NIM report (2003) indicates that a general disconnect between students and their schools may have precipitated the school shootings. Given such findings, it is reasonable to expect that higher levels of attachment or connectedness to school might dissuade students from putting

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themselves or others at risk while on school property. The empirical literature supports such expectations (e.g., Payne et al., 2003; Stewart, 2003; Wilcox and Clayton, 2001).

A measure of *school connectedness*, capturing the attachments and closeness students feel to people at their school, is included in the model. The scale includes the following items from the in-home interview at Wave I: you feel close to people at your school; you feel like you are part of your school; and you feel happy to be at your school. Responses are reverse coded and range from strongly disagree to strongly agree. Higher scores indicate higher levels of school connectedness. All valid cases are used to compute the scale. Approximately 98% of students have valid data for all three items included in the scale. Variations of this scale have been used previously with alphas ranging from .75 to .77 (Brookmeyer et al., 2006; Dornbusch et al., 2001; Resnick et al., 1997). The Cronbach's alpha for the current scale is acceptable at 0.772. The average school connectedness is 3.8.

An additional measure examining parental attachment also taps into concepts associated with social control theory[10]. Although families of the shooters reviewed in the NRC/NIM report (2003) were structurally stable, the report stresses the lack of communication between adults and youth. The report cites several examples of youth having knowledge, stress, or concern about violence without their parents being made aware of the problem. Given this apparent disconnect, as well as the importance of the parental bond in restraining delinquent behavior, as reflected in the empirical

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[10] Attempts were made to include a measure of parental supervision, as the prior literature commonly includes two different measures to establish parental relationships (e.g., Dornbusch et al., 2001; Hoffmann and Dufur, 2008). Unfortunately, low response rates prevented the inclusion of this measure.

literature (e.g., Hirschi, 1969; Patterson and Dishion, 1985), the relationship between parents and students is included into the model.

A *parental attachment* scale captures information regarding the students' perceptions about their closeness to their parents, whether they feel loved and attended to by their family, and whether or not they feel satisfied with their relationships with their parents. These items all come from the in-home interview at Wave I. When necessary, items are reverse-coded so that high scores indicate high attachment. Interview questions asked in reference to both the mother and father are averaged to create a parental measure. For example, students were asked whether they felt close to their mother and whether they felt close to their father. Responses are averaged together to measure closeness to parents. If responses are not available for one parent, the computed average includes the response of only one parent. Approximately 28% of the sample did not respond to questions regarding their relationship with their fathers. Thus, for these students, only responses regarding maternal relationships are incorporated in the attachment scale. All valid values are used to compute the scale. Approximately 98% of students had valid values for all items included in the scale. When previously used, this scale showed high levels of reliability ($\alpha > .80$; Dornbusch et al., 2001; Resnick et al., 1997). The reliability alpha is equally high in this case ($\alpha=.850$). Generally students show high levels of parental attachment with the average score equal to 4.2 on a 5 point scale.

Peer Relationships. Peer relations also played a seemingly large role in the school shootings reviewed by the NRC/NIM (2003). The case studies revealed shooters who felt the need to defend themselves against their peers or avenge

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perceived bullies. Although capturing peer relationships can be complicated and done in a variety of ways, Kreager (2004), using the Add Health data, constructed a variable that measures both social isolation as well as peer conflict. Given the descriptions of the shooters' relationships with their peers, both of these qualities seem important to examine. Thus, a measure adapted from the variable created by Kreager (2004) is used to investigate the influence of peer status on in-school weapon-carrying.   Two variables are created in order to investigate this hypothesis, *social isolation* and *peer conflict*. These variables identify those students who appear to be socially isolated both inside and outside of school and those students who report having negative interactions with other students.

The in-home survey at Wave I is used to identify social isolates. Students were given the opportunity to nominate up to five male and five female friends. Approximately 6% of the sample did not nominate any friends and are defined as social isolates (coded as 1). Those who identified at least one friend (male or female) are coded as 0.

To determine the frequency of negative interactions with other students, respondents were asked during the in-home interview at Wave I, "Since the school year started, how often have you had trouble getting along with other students?" Responses included "never", "just a few times", "about once a week", "almost every day", and "everyday". For the purposes of the present investigation, the peer conflict variable is dichotomized so that students who report trouble with youth on a weekly basis or more are coded as 1 while those youth who never experienced conflict with

students or only experienced conflict a few times are coded as 0^{11}. Approximately 17% of the sample report experiencing conflict with peers on a weekly basis or more frequently.

An interaction term is created to investigate the consequences of reporting both social isolation and peer conflict. Approximately 1% of the sample reports being socially isolated and experiencing conflict with peers[12]. Given the prior literature and the findings of the NRC/NIM report (2003) it is expected that reporting both social isolation and peer conflict will put students more at risk for weapon-carrying behavior in schools.

Mental Health Problems. Four of the shooters reviewed in the NRC/NIM report (2003) attempted suicide prior to, during, or after the shooting incident. This finding, combined with the empirical literature linking violent offending and suicide ideation, suggests that mental health may be a possible predictor of in-school weapon-carrying. *Suicide contemplation* is defined using the following question from the Wave I in-home interview: "During the past 12 months, did you ever seriously think about committing suicide?" Affirmative answers are coded as 1 and negative responses are coded as 0. Students were also asked in the same interview to report the number of times they actually attempted suicide. Their responses compose the *suicide attempt* variable. Students reported no attempts, one attempt, two or three attempts, four or five attempts, or six or more attempts. Missing values are coded as

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[11] Kreager (2004) uses this same definition for "conflict with peers" and found no differences between using the dichotomous versus the ordinal variable.

[12] The interaction is equal to 1 if students report experiencing peer conflict and identify no friends. If responses are missing for one of the variables included in the interaction and the response for the other variable equals zero, students are coded with a zero for the interaction. Thus, the valid n is larger for the interaction than for the peer conflict variable (see Table 4).

zero if students responded negatively to the question regarding suicide ideation. Due to limited variability in the distribution of subject responses, the variable is collapsed to identify those youth who never attempted suicide (coded as 0), attempted suicide one time (coded as 1), and students who attempted to commit suicide two or more times (coded as 2).   Approximately 13% of students contemplated suicide during the past year while nearly 6% of students reported attempting suicide at least one time.

Delinquent Behavior. Given that both urban and non-urban shooters had histories of delinquent behavior (NRC/NIM report, 2003; although only the urban shooters had criminal records), combined with the consistent empirical findings relating prior criminal behavior to present behavior (e.g., DuRant, Getts, Cadenhead, and Woods, 1995; Eisenbraum, 2007; Resnick, et al., 2004; Sheley and Wright, 1995; Wilcox and Clayton, 2001), measures of prior delinquent behavior are included in the model. The delinquency scale includes items from the Wave I in-home interview related to a variety of delinquent behaviors. Students were asked how often they had participated in each delinquent behavior during the past 12 months. Responses included: never (coded as 0); 1 or 2 times (coded as 1); 3 or 4 times (coded as 2); 5 or more times (coded as 3). Fourteen delinquent behaviors are included in the scale with approximately 99% of the sample having valid responses for all 14 items. Cronbach's alpha indicates that the scale is sufficiently reliable ($\alpha= .824$).   Subject scores on the delinquency scale range from zero to 3 with an average of 0.286.

Student-Level Control Variables

Although the variables discussed above are believed to be linked to in-school weapon-carrying, the following set of student-level variables must also be controlled

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for in the present model, given their relationship with in-school weapon-carrying in the previous literature.

   Demographics. The NRC/NIM report (2003) as well as other sources indicate the importance of including demographic measures in the current investigation. Thus, age, gender, and race will be controlled for in the multilevel analyses[13]. The NRC/NIM report (2003) finds consistencies regarding the ages and genders of the eight offenders. All were adolescent males, ranging in age from 11 to 15. The empirical literature related to these demographics share similar findings. For example, there is overwhelming evidence that for the bulk of the population, crime tends to peak during adolescence and decline during adulthood (Gottfredson and Hirschi, 1990; Hirschi and Gottfredson, 1983; Moffitt, 1993). Given that an adolescent sample is used for the current investigation, age is included as a control variable. A calculation of age is taken from the Wave II in home-questionnaire. *Age* at Wave II ranges from age 11 to age 23. The average age in the sample is approximately 16 years old at Wave II.

   While the NRC/NIM report was only limited to eight boys, it is notable that no females were involved as offenders in the school shootings. However, the overwhelming involvement of males in delinquent and criminal behavior as compared to female involvement is a phenomenon that has perplexed criminologists for some time (e.g., Broidy and Agnew, 1997; Hagan, Simpson, and Gillis, 1979; Heimer and De Coster, 1999; LaGrange and Silverman, 1999). In 1997, 97% of persons held in

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[13] Attempts were made to include measures of low income and public assistance, as indicators of low socioeconomic status (SES), in the present investigation; however low response rates to those items prevented their inclusion in the analyses. That being said, the empirical relationship between SES and juvenile delinquency is typically weak at best [see Tittle and Meier (1990) and Tittle, Villamez, and Smith (1978) for reviews].

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prison and 92% of those admitted were male (Strom, 2000). Given the reality of a

male-dominated offending population, as reflected in the empirical research, *gender*

is controlled for in the present investigation. Data from the Wave I in-home

questionnaire is used to identify males (coded as 1) and females (coded as 0).

Approximately 50% of the sample is male.

     Race is also included in the investigation as a control variable. Race of the

offenders reviewed in the NRC/NIM report (2003) varied by location of the

shootings. The three shooters from the urban case studies were African American

while the remaining five rural and suburban shooters were White. While the authors

of the NRC/NIM report (2003) do not make any predictions regarding the influence

of race specifically on violent outcomes, there is an abundance of literature

highlighting the disparities in criminal behavior between African Americans and

Whites [see Loeber and Farrington (1989) for a review]. Furthermore, Stewart and

Simons (2006) find race to be especially important in predicting violent subcultures—

experiencing racial discrimination increases violent behavior.

     For the current investigation, race is controlled with dummy variables for

White non-Hispanic, Black non-Hispanic, Hispanic, Asian, Native American, and

Other. Students who identified more than one race (approximately 5% of the sample)

were asked what race they most identified with. In the case of a subject reporting

more than one race, the response to this question is used to identify race. If students

chose not to answer this question and identified more than one race, they are coded as

Other. Students were also given the opportunity to report their Hispanic origins in

addition to reporting their race. Students who reported Hispanic origins are coded as

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Hispanic and not coded as any other race. By this coding technique, Hispanic origin is favored over identification with another race.

Approximately 67% of the sample is White, non-Hispanic; nearly 16% of the sample identifies themselves as African American, non-Hispanic and approximately 13% of the sample reports being Hispanic. Students who identify themselves as Asian, Native American, or other, make-up a combined 5.4% of the sample. These race categories are collapsed into a category identified as 'other'. Initially, the White dummy variable will be used as the reference category. If the remaining variables are related to the dependent variable in the same direction, the analysis will include only a measure of White versus non-White in an effort to retain parsimony.

Exposure to Violence. A scale is created to capture students' exposure to violence. This scale includes measures of fighting behavior, witnessing violence, and violent victimizations. Group-fighting, a behavior linked to gang activity, is included in the scale as the subculture literature historically points at the presence of gangs as a catalyst for the creation of deviant values (e.g., Anderson, 1999; Cohen, 1955; Merton, 1938; Miller, 1958; Shaw and McKay, 1942). The NRC/NIM report (2003) finds gang-related conflict to be related to the urban shootings. In the broader literature, weapon-carrying both inside and outside of school is linked to gang involvement as well (Rainone, Schmeidler, and Frank, 2006; Simon, Dent, and Sussman, 1997; Vaughn, Howard, and Harpe-Chang, 2006). Students were asked the following question: In the past 12 months, how often did you take part in a fight where a group of your friends was against another group? Responses include never (coded as 0), 1 or 2 times (coded as 1), 3 or 4 times (coded as 2), and 5 or more times

(coded as 3). While this item does not indicate membership in a named gang, it suggests students' involvement in gang behaviors[14].

Witnessing violence and being a victim of violence have both been found to be risk-factors for violence, antisocial behavior, weapon-carrying in general, and weapon-carrying on school property (e.g., Colder, Mott, Levy, and Flay, 2000; DuRant, Cadenhead, Pendergrast, Slavens, and Linder, 1994; DuRant, et al., 1995; DuRant et al., 1997; Kolbo, Blakely, and Engleman, 1996; Miller et al., 1999; Patchin, Huebner, McCluskey, Varano, and Bynum, 2006; Rainone, Schmeidler, and Frank, 2006; Vaughn, Howard, and Harpe-Chang, 2006). In the instances of urban violence reviewed in the NRC/NIM report (2003), the shootings occurred as a result of self-defense. Violence was prevalent in these neighborhoods and victimization was common. In the rural and suburban shootings, bullying and perceived aggression towards the students appeared to motivate, in some part, the shooting attacks. These offenders did not appear to be exposed to violence on any consistent or frequent basis. Nevertheless, prior victimizations as well as instances in which students witnessed violence are controlled for. The following items are included in the scale: the frequency in which (1) you saw someone shoot or stab another person; (2) someone pulled a knife or gun one you; (3) someone shot at you; (4) someone cut or stabbed you; and (5) you were jumped. Response choices included never (coded as

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[14] Although this measure does not directly identify gang membership or behavior, it identifies a specific type of behavior that is commonly associated with gang membership. Such a measure is often seen as a more accurate indicator of gang involvement that identification with a gang (Curry, Decker, and Egley, 2002; Decker and Curry, 2000; Decker, Katz, and Webb, 2008; Decker and Van Winkle, 1996; Fagan, 2008). Furthermore, Curry et al. (2002) find evidence of elevated levels of delinquency for youth who participate in gang behavior whether or not they identify themselves as part of a gang. Thus, the measure being used for the present investigation should appropriately detect whether gang participation is influencing weapon-carrying whether or not students identify themselves as gang members.

0), once (coded as 1), and more than once (coded as 2). High scale scores indicate higher levels of exposure to violence. The scale, computed by taking the average of the standardized scores of the six items, has an acceptable reliability (α= .720). Approximately 99% of the sample has valid data on all six items.

Gun accessibility. A measure of gun accessibility is also controlled for in the model. Five of the shooters studied in the NRC/NIM report (2003) were part of a gun culture. They had experience using guns and in two instances, guns were part of their daily lives. Furthermore, access to guns has been empirically shown to increase chances of gun-carrying and violence (e.g., Resnick et al., 2004; Rountree, 2000; Wilcox and Clayton, 2001). Given that without access to a weapon, the opportunity is not available to bring them onto school property, information regarding gun accessibility provides an important control in the model. Students reported whether a gun was easily accessible in their homes. An affirmative response is coded as 1 and a negative response as 0. Twenty-four percent of the sample report having guns accessible to them.

All items used to create the exposure to violence scale as well as the gun accessibility information come from the Wave I in-home interview.

Academic Performance. Most of the offenders reviewed in the NRC/NIM report (2003) had poor grades at the time of the shootings. Many had good grades at some point but during middle school grades began to fall. Poor academic performance has been found to be a risk factor for violent behavior in youth (e.g., DuRant et al., 1997; Hoffmann and Dufur, in press; Herrenkohl, et al., 2000; Resnick et al., 2004). Given such findings, school GPA is controlled for. GPA is computed

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as an average of math, science, language arts, and social studies grades. Grade data comes from the Wave I in-home questionnaire. Items are reverse-coded so that students who report receiving an A in a subject matter are coded as 4 for that subject. Students who report Bs are coded as 3, Cs are coded as 2, and Ds and lower are coded as 1. High scores on the GPA calculation indicate higher grades in school. Approximately 78% of the sample has grades for all four students. In the case where students did not have grades for each subject area, GPA is computed based on the grades for the available subject areas. The average GPA for the sample is 2.8.

Drug/Alcohol Use. Only one of the shooters from the NRC/NIM report (2003) showed signs of drug and alcohol addiction. However, other studies link the use of drugs and alcohol to violent youth outcomes. Lowry et al. (1999) found that involvement in school violence is more likely for those high school students who report substance use on school property. Furthermore, Markowitz (2001) found a positive relationship between beer and marijuana use and subsequent fighting among youth. Given the findings of the NRC/NIM report (2003), it does not seem likely that drug and alcohol use are directly related to in-school weapon-carrying. However, the findings of the empirical literature indicate that drug and alcohol use should be controlled for.

Two scales are used to measure alcohol and drug use respectively. Items used to compose this scale come from the Wave I in-home interview. Both scales incorporate information on first use and frequency of use. The alcohol scale includes a binary item indicating whether students had used alcohol more than two or three times in their life as well as a measure of how many days during the past 12 months

students used alcohol. Both items are standardized and averaged to create the alcohol use scale (α=0.788). Approximately 54% of the sample report having consumed more than two or three drinks of alcohol and 28% report drinking more frequently than one or two times in the past month.

The drug scale is composed of items that asked students to identify the first time that they tried marijuana, cocaine, or other drugs. Responses are collapsed into binary variables indicating that a subject had tried the drug before (coded as 1) or the subject never experimented with the drug (coded as 0). Additional measures included in the drug scale are the frequency of marijuana, cocaine, or other drug use over the past 30 days. Students were permitted to enter the number of days (responses ranged from zero times to 111 times). All eight items are standardized and averaged to create a drug use scale (α=0.688). All valid responses are included in the scales. Ninety-nine percent and 72% of the sample responded to all items in the alcohol and drug scales respectively.   Over 90% of the sample responded to seven or more items of the drug scale.

In-School Weapon-carrying (Wave I). Students were asked if they had ever carried a weapon to school during their Wave I in-home interview. This binary measure is included as a control in the model as it captures the behavior of interest at Wave I when all of the other predictors of weapon-carrying are being measured. By including this measure, all factors that caused weapon-carrying at Wave I are controlled for.

A positive response to this variable is coded as 1. Nearly 10% of the sample report ever carrying a weapon to school.

Peer Deviance. The NRC/NIM report (2003) reported that each of the shooters had recently changed their group of friends prior to the shootings. Some were described as increasing their time spent with more troubled youth while others simply were spending time with youth who were considered to be on the "fringe". Generally, the shooters were spending time with individuals considered to be deviant. These peers were not necessarily delinquent but they stood out as being unconventional as compared to the dominant peer groups in their schools.

A *peer deviance* measure is based on the students' perceptions of their friends' behaviors. Students were asked to report, out of three friends, how many smoked at least one cigarette a day; and drank alcohol and smoked marijuana at least once a month. Responses to all three questions included: no friends (coded as 0), one friend (coded as 1), 2 friends (coded as 2) and three friends (coded as 3). All valid responses are used to compose the scale. Approximately 97% of the sample has valid scores on all three items. Higher scale scores indicate higher amounts of peer deviance. The Cronbach's alpha score indicates acceptable reliability for this scale ($\alpha = .760$).

Despite the peer deviance scale being a sound measure, it arguably does not measure behaviors that are overly delinquent or violent. Thus, this is *not* a measure of peer delinquency or peer violence. However, given the findings of the NRC/NIM report (2003) that the shooters did not necessarily begin to associate with delinquent or violent peers, just more alternative youth, this measure appears to be appropriate.

School-Level Variables of Interest

Structural Characteristics. The findings from the NRC/NIM report (2003) suggest that structural characteristics may have affected the probability of the school shootings. Many of the victimized communities were racially heterogeneous, especially the urban ones. Nearly all experienced changes in their economy, for better or worse, as well as changes in their populations. While data constraints limit evaluation on the impact of structural changes on in-school weapon-carrying, block-level characteristics are included in the model for a static time period. In this case, block-level characteristics are used to compute a low socioeconomic status scale ($\alpha= 0.932$) and a heterogeneity scale ($\alpha=0.734$). Information regarding structural characteristics is included in the Add Health data. This information originally comes from the 1990 census. Items used to compose the low SES scale include information on unemployment rates, female-headed households, proportion of African Americans, and proportion of individuals living under the poverty line. The heterogeneity scale contains measures that indicate diversity within the community. Items include the proportion of individuals who are foreign-born within a census-defined block, the proportion of individuals age five or older who have lived in the same house for five or more years, and the proportion of Asian, Hispanic, and Other ethnicities residing on those blocks. Items used to create both the low SES and heterogeneity scales are aggregated to the school-level and standardized prior to the average of items being taken to compute the scale. Thus, these measures describe the contextual environment of the students who attend each school. Higher scores on the low SES scale indicate lower SES. High scores on the heterogeneity scale indicate higher

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levels of heterogeneity.   Identification of two scales is confirmed using factor analysis.

Violent Subculture Characteristics. A subculture that uses violence to maintain respect and to resolve conflicts will likely see a rise in in-school weapon-carrying. Such a relationship is supported with the findings of the NRC/NIM report (2003) as well as the work of subculture theorists such as Wolfgang and Feracutti (1982) and Anderson (1999). These subcultural theorists find both quantitative and qualitative evidence linking violent subcultures to an increase in criminal behavior. While data constraints make it difficult to identify violent subcultures, the three school-level characteristics included in the model can arguably be recognized as consequences of subcultures of violence within communities. All three measures are composed of items from the Wave I at-home interview.

The first measure, a *violent environment scale*, is computed by aggregating the exposure to violence scale included at the student-level to the school-level. Research also shows that weapon-use is linked to violent subcultures (Anderson, 2003). Thus, the second measure, *mean gun accessibility*, is the student-level gun accessibility item aggregated to the school-level.   On average, approximately 17% of students report having access to guns in each school. The final measure, *lethal expectations*, consists of one item from the Wave I in-home interview aggregated to the school-level. Students were asked, "What do you think the chances are that you will be killed by age 21?" Responses include almost no chance (coded as 1), some chance but probably not (coded as 2), a 50-50 chance (coded as 3), a good chance (coded as 4), almost certain (coded as 5). This variable reflects students' involvement

in a violent lifestyle and time spent in a violent environment. Those who are frequently involved in violent activity or exposed to violence (both symptoms of an underlying violent subculture) will likely have fewer expectations for a long life. Anderson (1999) finds evidence of this hopelessness in is ethnographic work in Philadelphia. Young peoples' exposures to violence leave them little hope that they will live well-into adulthood.

Mean School Connectedness. A disconnect between adults and youth observed in the NRC/NIM report (2003) extended beyond parent-child relationships; it also surfaced within the schools. While the report did not suggest that schools were criminogenic or causing criminal behavior, they lacked the necessary protective factors to safeguard their campuses from crime and violence. One incident was described in the report where a school newspaper article was published picking on a specific student who later became one of the shooters. School sponsorship of the paper made it appear as if the hurtful article was condoned by the school. Occurrences such as this highlight the lack of caring within the schools reviewed in the NRC/NIM report (2003). An improved climate has been shown to lead to reductions in student delinquency. Schools where students feel welcome and like they are part of a larger school community will likely experience fewer problems with criminal behavior (e.g., Reiss, et al., 1997; Gottfredson et al., 2005; Payne et al., 2003). Examining school connectedness at the school-level offers a narrow, but valid indication of the level of school climate within a school. While connectedness does not fully encompass all of the possible components of school climate, at the very

least, it provides some evidence as to the effectiveness of relationships between students and schools in protecting students from school-violence or weapon-carrying.

Given these findings, the *mean school connectedness scale* composed at the student-level is aggregated to the school-level and included in the model. Scale scores were taken from all students who completed the in-home interview and whose schools were included in the sample (n=19,619). All valid responses are used to compute the scale. Approximately 98% of the sample has valid responses to all three items in the scale. The computed scale (Cronbach's alpha= 0.774) is aggregated to the school-level with an average of 3.851.

School Location. The NRC/NIM report (2003) found distinct differences in what triggered the shootings in urban schools versus rural and suburban schools. Thus a measure of school location included in the model. Information for this measure was obtained from the Quality of Education (QED) data. The QED uses the LOCALE variable from the National Center for Educational Statistics (NCES) data to gather the information used to define school location in the Add Health data. Using the NCES definitions, schools located in the following areas are considered urban: (1) Central cities of a Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA) with population of 250,000 or more; (2) central city of CMSA or MSA but not designated as a large central city. Schools located (1) within the MCSA or MSA of a large central city; (2) within the MCSA or MSA of a mid-size central city; (3) not within a CMSA or MSA but with a population of 25,000 or more and defined as urban; or (4) not within a CMSA or MSA with a population of at least 2,500 but less than 25,000 are considered suburban. Finally, those schools

located in the following areas are defined as rural: (1) not within a CMSA or MSA and designated rural; and (2) within a CMSA or MSA designated as rural (Harris et al., 2003). Dummy variables are created to identify urban, suburban, and rural locations. Approximately 22% of schools are located in urban areas; 60% in suburban areas; and 18% in rural areas. If it is found that the relationship with the dependent variable is the same for rural and suburban schools, the model will include the urban dummy variable, comparing urban schools to non-urban schools.

Interaction Terms. The NRC/NIM report (2003) describes the complex relationship it found between urban school locations and violent subcultures. The impact of violent subcultures appears to be more detrimental in urban schools than in non-urban schools. In order to detect whether urban schools that display violent subcultures are more at risk for weapon-carrying, interaction terms are created to examine the interaction effects of urban location and violent environments, mean access to guns, and mean lethal expectations. Interactions are computed as follows: urban*mean violent environment scale; urban*mean gun access; and urban*mean lethal expectations.

School-Level Control Variables

The following measures of school structural characteristics have been shown in prior research to be related to delinquent outcomes (e.g., Gottfredson and Gottfredson, 2005; Payne et al., 2003), and are therefore included as school-level control variables.

School Size. At Wave I, school administrators were asked to report the sizes their schools. The Add Health data provide an item that identifies small schools (1-

400 students), medium schools (401-1000 students), and large schools (1001-4000 students). Dummy variables are created to identify small, medium, and large schools. Over half of the schools are considered small (59%) while 10% of schools are identified as large.

School Sector. The correlates of crime at the school-level have indicated that students who attend public schools are more at risk to be effected by school violence than those who attend private schools (Nolan, Davies, and Chandler, 1995; Ringwalt, Messerschmidt, Graham, and Collins, 1992). Given such findings, school sector is controlled for in the analysis. School administrators were asked to report whether their school was considered to be public or private. One hundred and eighteen schools are identified as public (83%; coded as 1) while the remaining twelve are private (17%; coded as 0).

Grade Level. Research examining the correlates of school violence also indicates a relationship between being in middle school and school violence. Self-report surveys consistently find that middle-school students report higher levels of victimization than high-school students (Bastian and Taylor, 1991; Nolan et al., 1995; Ringwalt et al., 1992). Thus, school grade-level is also included as a control variable in the analysis. A school information file included in the Add Health data provides demographic information of each school, including the grade-levels taught at each school. Schools are considered to be middle schools if their highest grade is eighth or ninth grade. Schools that served students through 12th grade or higher are considered high schools. Four schools were labels as 'grades special' did not have the necessary information to determine grade level. For these cases data from the

school administrator survey is used to identify grade level. School administrators were asked to report the grade-levels taught in their school. Both middle schools and high schools can contain grade levels as low as kindergarten. The main consideration in grade-level assignment is the highest grade in the school.   This investigation focuses on differences in in-school weapon-carrying between middle and high schools. Thus, a binary variable identifies high schools (coded as 1) and middle schools (coded as 0). Slightly under half of schools are coded as high schools (47%).

Mean Teacher Race. School administrators reported the percentage of full-time teachers that were White, African American, Asian, Native American, and other. Given the low proportion of Asian and Native American teachers (less than 2% combined) the race categories are collapsed into the 'Other' category. Thus, administrators report that Asian, Native American, and Other teachers account for slightly more than 2% of teachers in the sampled schools. An overwhelming majority of teachers are identified as White in the sampled schools at nearly 87%. African American teachers account for approximately 10% of teachers in the sampled schools.

Mean Student Race. Mean student race is computed by student-race to the school-level. All students that completed the in-home interview and had school data were included in the aggregation (n=19,619).   Approximately 70% of school populations are white, while African American and Hispanic students make-up 18% and 8% of school populations respectively.

School-level measures have no missing data while student-level variables have less than 5% of missing data.

As a first step, univariate analyses are conducted. Frequency distributions for all variables from both the first (within school) and second (between-school) levels are analyzed to better understand the shapes of distributions, identify outliers, and establish whether there is a need for any variable transformations. Secondly, biavariate analyses are conducted in order to establish a relationship between the student-level variables and the dependent variable.

Bivariate relationships between the weapon-carrying dependent variable and student-level variables are established using bivariate logistic regression models. Each independent and control variable is singly entered into a logistic regression, estimating the association of that independent or control variable with the probability of weapon-carrying. Those control variables which have no relationship with the weapon-carrying dependent variables are excluded from subsequent multilevel models.

Hierarchical generalized linear modeling (HGLM) is then used to test the effects of school and student-level variables on in-school weapon-carrying. Given the binary nature of the dependent variable, adjustments must be made for its nonlinear distribution (Luke, 2004; Raudenbush and Bryk, 2002). Traditional HLM modeling assumes that dependent variables contain homoscedastic errors and a normal distribution. Given the nonlinearity of the dependent variable for the present analysis, an adapted HLM model, HGLM, is used to account for the nonlinear structure of the data as well as its nonnormal distribution (Raudenbush and Bryk, 2002).

This methodology permits the incorporation of covariates at multiple levels of analysis without violating the assumptions of traditional logistic regression (Luke, 2004; Raudenbush and Bryk, 2002). Generally, regression analyses assume that error terms will be statistically independent from one another. However, if clusters are identified within samples and share some trait such as attending the same school or living in the same neighborhood, an HGLM analysis becomes more appropriate. The similarities that students share due to clustering will lead to a violation of the regression independent errors assumption, thus biasing the outcomes of a traditional logistic regression analyses. HGLM accounts for the correlated errors that occur by people sharing the same context (Luke, 2004). Additionally, HGLM allows for the investigation of relationships at both levels and across levels. Logistic models that create cross-level interactions produce biased estimates. HGLM offers a more accurate estimation of the effects of contextual variables on student-level variables.

The dependent variable presents a binary structure, thus requiring a logit link:

$$\eta_{ij} = \log\left(\frac{\varphi_{ij}}{1 - \varphi_{ij}}\right)$$

Where η_{ij} represents the log of odds of success and φ_{ij} signifies the probability of success.

Model 1: Fully Unconditional Model

A one-way ANOVA with random-effects model provides preliminary information regarding the variation between schools on in-school weapon-carrying:

Level 1: $\eta_{ij} = \beta_{0j}$

Level 2: $\beta_{0j} = \gamma_{00} + u_{0j}$

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Where, η_{ij} represents each student's expected odds of in-school weapon-carrying .

β_{0j} represents the expected odds of weapon-carrying across the sample and the unmodeled variability between schools. Thus, γ_{00} is the the expected odds of in-school weapon-carrying across all schools and u_{0j} represents the unmodeled variability between schools. This model provides information regarding the proportion of variance in in-school weapon-carrying that can be explained by differences between schools, otherwise known as the intraclass correlation coefficient (ICC; Raudenbush and Bryk, 2002). Additionally, the model indicates whether variation between schools on the dependent variable is significant.

Model 2: Within-School Model

The next step of the multilevel analysis incorporates the student-level predictors and the control variables that are shown to be significantly related to the dependent variable in the bivariate analyses. Level 2 continues to be unconditional with no predictors or control variables incorporated into the model. This step allows for individual predictors to be estimated independently for each school (Raudenbush and Bryk, 2002). The model offers baseline evidence as to the effects of student-level factors on deviations in expected odds of in-school weapon-carrying net of students' past characteristics. Furthermore, this model provides evidence as to whether the influences of student-level factors vary across schools. If variation across schools is present, further analyses are required to test hypotheses five and six. The second HLM model is specified below (if predictors and all control variables are included in the model):

$Level\ 1: \eta_{ij} = \beta_{0j} + \beta_{1j}(\text{school connectned ness}) + \beta_{2j}(\text{parental attachment}) + \beta_{3j}(\text{peer conflict}) + \beta_{4j}(\text{social isolation}) +$
$\qquad \beta_{5j}(\text{social isolation x peer conflict}) + \beta_{6j}(\text{suicidal ideation}) + \beta_{7j}(\text{suicide attempts}) + \beta_{8j}(\text{delinquent behavior}) + \beta_{9j}(\text{age}) +$
$\qquad \beta_{10j}(\text{gender}) + \beta_{11j}(\text{race : black}) + \beta_{12j}(\text{race : hispanic}) + \beta_{13j}(\text{race : other}) + \beta_{14j}(\text{exposure to violence}) +$
$\qquad \beta_{15j}(\text{gun accessibility}) + \beta_{16j}(GPA) + \beta_{17j}(\text{alcohol use}) + \beta_{18j}(\text{drug use}) + \beta_{19j}(\text{in} - \text{school weapon} - \text{carrying}) +$
$\qquad \beta_{20j}(\text{peer deviance})$

$Level\ 2: \beta_{qj} = \gamma_{q0} + u_{qj} \quad for\ q = 0, 1, 2, 3, ...8$
$\qquad \beta_{qj} = \gamma_{q0}\ for\ q = 9, 10, 11, ...20$

This model offers an analysis of how level-1 predictor and control variables influence deviations from expected odds of weapon-carrying net of individual factors within each school. For the independent variables, γ_{q0} represents the change in expected odds of weapon-carrying adjusted for the student-level grand-mean centered variables. The random coefficients (represented by u_{qj}) indicate that these effects vary across schools. Outcomes of this analysis are helpful is determining the final specification of the level-1 predictors and control variables. Hypothesis testing indicates whether individual effects do, in fact, vary across schools.

In order to establish whether these effects do vary across schools, an initial within-schools sub-model includes only the student-level variables of interest, all group-mean centered. Those slopes that are shown to significantly vary between schools are left free to vary (e.g., $u_{qj} \neq 0$) in the final within-schools model and their indicators are group-mean centered. For those slopes that do not vary between schools, random coefficients are removed from the model (e.g., $u_{qj} = 0$) and the effect of those predictors is assumed to be fixed across schools (Raudenbush and Bryk, 2002). The measures corresponding to these slopes are grand-mean centered in the final within-schools model, thus allowing the corresponding intercepts to be interpreted as adjusted school means.

The second within-schools sub-model includes only the student-level control variables that are significant in the bivariate analysis. All variables are grand-mean centered and their slopes are not permitted to vary. The research questions do not suggest that the impact of these variables on weapon-carrying will vary between schools. The control variables that are no longer related to weapon-carrying when entered into a multivariate within-schools model are excluded from the final within-schools model and subsequent analyses.

Given the large number of variables (at both levels) suggested to be important in predicting in-school weapon-carrying, the elimination of variables unrelated to the dependent variable is necessary to preserve the power and parsimony of the analysis. The final within-schools model will be similar to the equation above with certain variables being group-mean centered and their slopes free to vary while the remaining variables are grand-mean centered and their slopes fixed.

Model 3: Intercept-as-Outcomes Model

The third step of the multilevel analysis incorporates level 2 predictors and control variables to determine their effects on deviations in the expected odds of weapon-carrying in schools, net of individual characteristics. Model 3 tests hypotheses one through four:

$Level\ 1: \eta_{ij} = \beta_{0j} + \beta_{1j}(\text{school connectnedness}) + \beta_{2j}(\text{parental attachment}) + \beta_{3j}(\text{peer conflict}) + \beta_{4j}(\text{social isolation}) +$
$\quad \beta_{5j}(\text{social isolation x peer conflict}) + \beta_{6j}(\text{suicidal ideation}) + \beta_{7j}(\text{suicide attempts}) + \beta_{8j}(\text{delinquent behavior}) + \beta_{9j}(age) +$
$\quad \beta_{10j}(\text{gender}) + \beta_{11j}(\text{race: black}) + \beta_{12j}(\text{race: hispanic}) + \beta_{13j}(\text{race: other}) + \beta_{14j}(\text{exposure to violence}) +$
$\quad \beta_{15j}(\text{gun accessibility}) + \beta_{16j}(GPA) + \beta_{17j}(\text{alcohol use}) + \beta_{18j}(\text{drug use}) + \beta_{19j}(\text{in-school weapon-carrying}) +$
$\quad \beta_{20j}(\text{peer deviance})$

$Level\ 2: \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{low SES}) + \gamma_{02}(\text{heterogeity}) + \gamma_{05}(\text{suburban}) + \gamma_{06}(\text{rural}) + \gamma_{07}(\text{violent environment}) +$
$\quad \gamma_{08}(\text{gun accessibility}) + \gamma_{09}(\text{lethal expectations}) + \gamma_{010}(\text{avg school attachment}) + \gamma_{011}(\text{school size: small}) + \gamma_{012}(\text{school size: medium}) +$
$\quad \gamma_{013}(\text{proprotion Black teachers}) + \gamma_{014}(\text{proprotion Other teachers}) + \gamma_{015}(\text{proportion Black students}) + \gamma_{016}(\text{proportion Hispanic students}) +$
$\quad \gamma_{017}(\text{proportion Other students}) + \gamma_{018}(\text{school sector}) + \gamma_{019}(\text{high school}) + \gamma_{020}(\text{school location * violent environment}) +$
$\quad \gamma_{021}(\text{school location * gun access}) + \gamma_{022}(\text{school location * lethal expectations}) + u_{0j}$

$\quad \beta_{qj} = \gamma_{q0} + u_{qj} \quad for\ q = 1, 2, 3, \ldots\ldots 8$
$\quad \beta_{qj} = \gamma_{q0} \quad for\ q = 9, 10, 11, \ldots\ldots 20$

The purpose of this model is specifically to identify the relationship between level 2
predictors and control variables and deviations in the expected odds of in-school
weapon-carrying at each school. Once again, a sub-model is estimated prior to the
final intercept-as-outcome model. This sub-model incorporates only school-level
control variables in order to establish which school control characteristics are related
to in-school weapon-carrying. Those control variables that are not significantly
related to the dependent variable are excluded from the final intercept-as-outcome
model and subsequent models. The final model includes all of the school-level
variables of interest as well and those control variables shown to be related to
deviations from the expected odds of the dependent variable net of individual
charachteristics. Level 1 variables are modeled identically to the final within-schools
model.

Model 4: Slopes-as-Outcomes Model

The final model tests hypotheses five and six by estimating the influence of
school-level characteristics on the relationship between student-level predictors and
in-school weapon-carrying. The variability of level-1 slope coefficients is determined

in model 2, the within-schools model. Those student-level characteristics that influence weapon-carrying differently in different schools are group-mean centered in this model and their slopes are free to vary. This variability is modeled using school characteristics. Level-2 equations are estimated separately to predict the effects of urbanicity and violent subcultures on the slope coefficients. Those student characteristics that do not influence weapon-carrying differently between schools are controlled for in this analysis. These variables are grand-mean centered and their slopes are fixed.

A sub-model estimates the effect of school-level control variables on each slope to determine if they should be included in the final model. Those control variables that are related to the slope are included in the final model along with school location, the subculture of violence measures, and the interaction terms (if significant). The student-level model is estimated identically to the final within-schools model.

Chapter 4: Results

This chapter describes the results of the analysis starting with a description of the dependent variable followed by bivariate statistics and finally, the multilevel findings organized by model and research question.

Student Characteristics and In-School Weapon-Carrying

Approximately 6% of students report carrying a weapon to school during Wave II of data collection. This findings is consistent with the prior research which indicates that approximately four to six percent of students carry weapons to school (Mercy and Rosenberg, 1998; Rountree, 2000; Sickmund, Snyder, and Poe-Yamagata, 1997; Watkins, 2008; Wilcox and Clayton, 2001)

Logistic regression analyses show that nearly all student-level variables of interest are significantly related to in-school weapon-carrying (see Table 6)[15]. School and parental attachment variables both have significant relationships with in-school weapon-carrying in the expected direction. Students who report higher levels of school connectedness and/or higher levels of attachment to parents are less likely to carry a weapon to school. Students who report high levels of school connectedness are 28% less likely to carry a weapon to school while those who have high levels of parental attachment are 33% less likely to carry a weapon to school than those with one unit less of school connectedness or parental attachment ($p<.001$).

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[15] Variance Inflation Factors (VIFs) indicate that variances of independent variables are not being affected by multicollinearity. The average VIF is 1.33 and all variables VIFs are below 2.

Table 6. Bivariate Relationship Between Weapon-Carrying and Student-Level Variables

Variable	b	SE	OR	p-value
School Connectedness Scale	-0.334	0.041	0.716	0.000
Parental Attachment Scale	-0.399	0.055	0.671	0.000
Peer Conflict	0.906	0.085	2.476	0.000
Social Isolation	-0.036	0.167	0.964	0.828
Peer*Isolation	-0.367	0.391	0.692	0.347
Suicide Contemplation	0.648	0.094	1.912	0.000
Suicide Attempts	0.611	0.092	1.843	0.000
Delinquency Scale	1.785	0.075	5.961	0.000
Control Variables				
Age	-0.089	0.023	0.915	0.000
Male	1.056	0.085	2.874	0.000
Student Race: White	-0.434	0.077	0.648	0.000
Student Race: Black	0.268	0.088	1.308	0.002
Student Race: Hispanic	0.321	0.093	1.379	0.001
Student Race: Other	0.121	0.131	1.129	0.353
Exposure to Violence Scale	0.861	0.039	2.365	0.000
Gun Accessibility	0.551	0.083	1.735	0.000
GPA	-0.435	0.050	0.647	0.000
Alcohol Use Scale	0.524	0.042	1.689	0.000
Drug Use Scale	0.287	0.038	1.333	0.000
Weapon-Carrying, Wave I	2.526	0.082	12.501	0.000
Peer Deviance Scale	0.496	0.038	1.642	0.000

Of the social status variables, only peer conflict predicts in-school weapon-carrying (OR=2.476, p<.001). Students who experience peer conflict have a higher probability of carrying a weapon to school. Neither social isolation nor the interaction between peer conflict and social isolation significantly predict the dependent variable.

Students who report contemplating suicide have nearly twice to the odds of carrying a weapon to school as those who do not contemplate suicide (*p*<.001).

Those who actually attempt suicide also are almost two times as likely to carry a weapon to school ($p<.001$). The characteristic that most overwhelmingly predicts in-school weapon-carrying, out of the student-level variables of interest, is self-reported delinquency. For every unit increase in self-reported delinquency, weapon-carrying is nearly 6 times as likely ($p<.001$).

Despite some student-level variables of interest not predicting the dependent variable, all are included in the multilevel analysis as they are potentially important in testing how school-level characteristics moderate the student-level relationships with in-school weapon-carrying. For example, even though social isolation is not a strong predictor of weapon-carrying overall, the relationship might be different for students attending urban versus non-urban school.

Bivariate analyses are also used to establish the relationship between the student-level control variables and the dependent variable. Those control variables that do not have a significant relationship with in-school weapon-carrying are excluded from subsequent models.

Nearly all of the demographic variables appear to have a significant relationship with in-school weapon-carrying ($p<.05$). As students get older, they are less likely to carry a weapon to school. Such a relationship is not unexpected given the findings of Gottfredson and Gottfredson (1985) who found higher rates of problem behavior and victimization in middle schools than in high schools using the Safe School Study data.

Identifying one's self as male is a significant predictor of in-school weapon-carrying; males are 2.9 times as likely to carry a weapon to school when compared

with their female counterparts. Similarly, minorities are also more at risk for carrying

a weapon to school. Students coded as Hispanic, Black, or other are all more likely to

carry a weapon to school than all other races respectively; although the relationship

between other and the dependent variable does not reach significance (p>.05). While

not all of the race relationships are significant, the directions of the relationships are

consistent. Thus, all subsequent analyses use a binary variable comparing White

students to non-white students (p<.001).

The remaining student-level control variables are strongly related to in-school

weapon-carrying. Weapon-carrying at Wave I has the strongest relationship with the

dependent variable. Students who report having ever carried a weapon are twelve and

a half times more likely to report carrying a weapon at Wave II (p<.001). Finally,

substance use and association with deviant peers also increase the probability of in-

school weapon-carrying while having a high GPA reduces the probability of weapon-

carrying.

Multilevel Analyses of Students, Schools, and In-School Weapon-Carrying

Model 1: Fully Unconditional Model

The fully unconditional model partitions the overall variance in in-school

weapon-carrying into within-school and between-school components.[16] In this case,

the model confirms that in-school weapon-carrying does vary between schools (see

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[16] Given the dichotomous nature of the dependent variable, a meaningful student-level variance
component can not be computed. However, if the student-level model is conceived as a latent variable,
the student-level random effect can be assumed to have a standard logistic distribution with a mean of
0 and a standard deviation of $\pi^2/3$. Thus, using the between-schools random effect and the student-
level random effect, the intra-class correlation (ICC) can be calculated as: $\rho = \tau_{00} / (\tau_{00} + \pi^2 / 3)$ (see
Snijders and Bosker, 1999, cited in Raudenbush and Byrk, 2002, 334).

Table 7 for the results of this model as well models two and three). The ICC

indicates that approximately 9.5% of the variation in in-school weapon-carrying at

Wave II can be attributed to differences between schools (p<.001), thus a multilevel

model incorporating school characteristics is appropriate for explaining variability in

in-school weapon-carrying.[17]

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[17] Attempts were made to determine whether frequency of weapon-carrying varied between schools. Students were asked on how many days they carried weapons to school during the past 30 days. Unfortunately, the variability in responses was limited. The predictors of the frequency of weapon-carrying could not be estimated in a multilevel model.

Table 7. Logistic HGLM Models 1-3

Independent Variable	Coefficient	SE	Odds Ratio	Coefficient	SE	Odds Ratio	Coefficient	SE	Odds Ratio
	Model 1			Model 2			Model 3		
Average In-School Weapon-Carrying (β_0)									
Intercept (γ_{00})	-2.884***	0.143	0.056	-3.347***	0.078	0.035	-3.405***	0.070	0.033
Low Socioeconomic Status Scale (γ_{01})							0.069	0.068	1.071
Heterogeneity Scale (γ_{02})							-0.052	0.079	0.949
Violent Environment Scale (γ_{03})							0.200**	0.064	1.222
Mean Gun Accessibility (γ_{04})							0.032	0.066	1.033
Mean Lethal Expectations (γ_{05})							-0.152**	0.053	0.859
Mean School Attachment (γ_{06})							0.050	0.055	1.052
School Location (Urban=1) (γ_{07})							0.248*	0.116	1.282
School Connectedness (β_1)				-0.104	0.070	0.901	-0.112	0.076	0.894
Parental Attachment (β_2)				-0.039	0.065	0.962	-0.044	0.067	0.957
Peer Conflict (β_3)				0.247	0.175	1.281	0.220	0.169	1.246
Social Isolation (β_4)				-0.098	0.310	0.907	-0.107	0.303	0.898
Peer Conflict*Isolation (β_5)				0.122	0.720	1.130	0.046	0.726	1.047
Suicide Contemplation (β_6)				-0.001	0.161	0.999	0.007	0.173	1.007
Suicide Attempts (β_7)				0.323	0.200	1.381	0.318	0.206	1.375
Delinquency Scale (β_8)				0.298***	0.080	1.348	0.300***	0.077	1.349
Age (β_9)				-0.167***	0.038	0.846	-0.153***	0.033	0.858
Gender (Male=1) (β_{10})				0.676***	0.141	1.966	0.696***	0.142	2.007
Race (White=1) (β_{11})				-0.758***	0.167	0.469	-0.580**	0.178	0.560
Exposure to Violence (β_{12})				0.080	0.055	1.083	0.052	0.059	1.054
Weapon Carrying, Wave I (β_{13})				1.709***	0.171	5.525	1.717***	0.174	5.570
Peer Deviance (β_{14})				0.106	0.061	1.112	0.124*	0.058	1.132

Table 7 Continued

Variance Components

		SD	Variance	df	χ^2
Model 1: Fully Unconditional Model	Intercept (β_0)	0.588	0.346	129	544.515***
Model 2: Within Groups Model	Intercept (β_0)	0.283	0.080	129	198.481***
	Peer Conflict (β_3)	0.282	0.080	129	179.762**
Model 3: Intercept as Outcome as Model	Intercept (β_0)	0.207	0.043	122	154.418*

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

Model 2: Within-Schools Model

This analysis models the within-school predictors of in-school weapon-carrying. Although the research hypotheses do not pertain to the relationships between student-level predictors and the dependent variable, the model is necessary in order to determine whether student-level relationships vary by school and can be impacted by school-level characteristics (hypotheses 5 and 6).

Continuous variables are standardized for ease of interpretation. Control variable are grand-mean centered and their slopes are fixed; thus, they are not permitted to vary between schools. The coefficients represent the average effect across schools. In order to increase the power of the analysis, additional steps are taken to reduce the number of variables incorporated into the model. A preliminary within-schools sub-model estimates the relationship between only those student-level control variables found to be related to the dependent variable using bivariate statistics (shown in Table 6). This step incorporates only the control variables into a multivariate HLM analysis and indicates that access to guns, GPA, and the alcohol and drug use scales have no significant relationship with in-school weapon-carrying at time 2, net of individuals' propensities for weapon-carrying at time 1 ($p>.05$; results not displayed). These variables are excluded from the final within-schools model (see model 2 of Table 7) and the remaining analyses.

A second within-schools sub-model includes only the student-level variables of interest. Initially, these variables are group-mean centered and their effects are free to vary between schools. Hypotheses 5 and 6 predict that the impact of student-level characteristics can be aggravated or mitigated by school-level characteristics.

Only the peer conflict coefficient varies significantly between schools ($p<.01$); thus the indicator of peer conflict remains group-mean centered in the final analysis and its effects are free to vary between schools. The peer conflict slope is modeled in a subsequent analysis to determine whether school characteristics alter the relationship between peer conflict and weapon-carrying. The remaining student-level variables are included in the model as control variables and are grand-mean centered. Their slopes are not permitted to vary across schools.

The first step in interpreting the results of this model is to determine the fixed effect relationships between student-level predictors and in-school weapon-carrying. Recall that weapon-carrying at Wave I is included in the model as a control variable, thus the remaining analyses examine how predictors' are related to the odds of weapon-carrying at Wave II net of individuals' propensities to carry weapons at Wave I.

While the bivariate analyses indicate that many of the student-level variables of interest are related to in-school weapon-carrying, multilevel multivariate analyses show alternative findings. Self-reported delinquency is the only independent variable that is significantly associated with in-school weapon-carrying. Students who have a standard deviation increase in self-reported delinquency from the mean are nearly 35% more likely to carry a weapon at Wave II, net of time 1 propensity to carry weapons (change in odds= 1.348, $p<.001$). The remaining variables of interest are found to be unrelated to the odds of in-school weapon-carrying once controls for demographics, exposure to violence, weapon-carrying at Wave I, and peer deviance are included in the model. Students who report being older, female, or white, are less

likely to carry a weapon to school at Wave II (p<.001) relative to younger, male, or non-white students and net of time 1 propensity to carry weapons. Those students who report having carried a weapon to school at Wave I of data collection are more likely to carry a weapon at Wave II ($p<.001$).

After exploring the fixed effects model, the next step involves examining the variance components. Specifically, I confirm that in-school weapon-carrying continues to vary between schools, as it did in the fully unconditional model. Additionally, I determine whether the slope for peer conflict also varies between schools. Results of this analysis are displayed in the bottom panel of Table 7.

Table 7 shows that the variance component for the intercept, (β_0), is significant, implying that the odds of weapon-carrying continue to vary between schools net of individual characteristics including past weapon-carrying, ($p<.01$). The relationship between peer conflict and the dependent variable (β_3) also significantly varies between school ($p<.05$). Attempts to model this variability are described below.

In addition to examining the variability in the intercept and random slope, I also identify the amount of variance in weapon-carrying behavior between schools that is explained by student-level predictors. Recall, the variability between schools estimated by our fully unconditional model, with no level 1 predictors, is approximately 9.5%. The ICC (not shown) indicates that the inclusion of student-level variables substantially decreases the variability between schools to 2.4%. In other words, student-level predictors explain the majority of variance in the odds of

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weapon-carrying between schools, net of individuals' propensities for weapon-carrying at time 1.

Model 3: Intercept-as-Outcome Model

The impact of characteristics related to school climate, social disorganization, and violent subcultures are all estimated using the intercept-as-outcome model. School-level predictors, both independent and control variables, are grand-mean centered. Continuous variables are standardized for ease of interpretation. The student-level predictors are also grand-mean centered and acts as control variables in the model. Student-level predictor slopes are fixed and are not permitted to vary between schools. While not directly related to the research questions, note that the significance levels for the student-level relationships with weapon-carrying are identical to the within-schools model, with the exception of the peer deviance slope, which becomes significant in the intercept-as-outcome model.

In the initial intercept-as-outcome submodel, only the school-level control variables are entered into the model in order to establish their relationships with the dependent variable (not shown). School-level measures of student and teacher race are excluded from this analysis and subsequent analyses in order to avoid misleading findings related to multicollinearity[18]. None of the control variables included in this submodel (school size, school sector, or high school designation) are related to changes in weapon-carrying behavior and are not, thus, included in subsequent analyses. All school-level variables of interest are included in the final model (shown in model 3 of Table 7). Results pertaining to each hypothesis follow.

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[18] Variance Inflation Factors (VIFs) indicated that race variables at the school-level were linearly related to other independent variables in the model.

Hypothesis 1. Hypothesis 1 predicts that schools whose students come from neighborhoods characterized by high levels of socioeconomic disadvantage and heterogeneity are more likely to have inflated odds of weapon-carrying compared to neighborhoods with less disadvantage and heterogeneity. Neither indicator appear to be related to in-school weapon-carrying (p>.05). In other words, schools whose students come from low SES neighborhoods or those high in heterogeneity are at no more risk for weapon-carrying behaviors in schools, net of propensity for weapon-carrying at time 1, than those schools whose students come from neighborhoods of high SES or low heterogeneity. Given these findings, there is no support for hypothesis 1.

Hypothesis 2. Hypothesis 2 predicts that students in schools with characteristics related to violent subcultures will have an increased odds of weapon-carrying, net of weapon-carrying at Wave I. While it was not possible to specifically identify violent subcultures, important components of such subcultures are captured and included in the analysis. Violent environment is measured by an aggregated scale that includes items related to participation in and exposure to violence. Additional measures include aggregated indicators of gun access and lethal expectations.

Although the exposure to violence scale at the student-level does not predict whether a student will carry a weapon to school, the aggregated violent environment scale is associated with increased odds of weapon-carrying. For every standard deviation increase in the violent environment scale, students' odds of carrying a weapon to school increase by 22%, net of individuals' propensities for weapon-carrying at time 1 (OR= 1.222, $p<.01$). Another characteristic of violent subcultures,

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lethal expectations, also significantly predicts the dependent variable; although not in the expected direction. Schools with higher levels of lethal expectations are more likely to experience a reduction in weapon-carrying behavior compared to time 1, relative to schools with lower levels of lethal expectations ($p<.01$). The final subculture measure, access to guns, does not significantly predict the dependent variable ($p>.05$).

Hypothesis 3. Given the findings of the NRC/NIM report (2003), subculture characteristics are further investigated to determine whether their effects vary in urban and non-urban schools. If the interactions between urban school location and subculture characteristics are found to be significant, as predicted in hypothesis 3, conclusions should not be made based on the effects of subculture across schools; the effects should be examined separately in urban and non-urban schools.

Interaction terms are created to establish whether schools located in urban areas that have characteristics associated with violent subcultures are more likely to experience an increase in weapon-carrying as compared to non-urban schools with violent subculture characteristics. This is especially important given that urban school location also increases the odds of weapon-carrying at time 2. Interaction terms may help to explain why weapon-carrying is more likely in urban schools than in non-urban schools.

Evidence does not support hypothesis 3. As shown in table 8[19], where each subculture characteristic interaction term is modeled separately, the effects of characteristics related to violent subcultures are not different in urban and non-urban

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[19] Student characteristics are controlled for in the model shown in Table 8. Results are similar to those already presented.

school. Further, characteristics of subcultures do not explain why urban schools

experiences a higher probability of weapon-carrying at time 2, net of students'

propensities for weapon-carrying at time 1.

Table 8. Intercept-as Outcome Model with Interactions

Independent Variable	Change in log odds	SE	Change in Odds	Change in log odds	SE	Change in Odds	Change in log odds	SE	Change in Odds
	Urban*Violent Environment			Urban*Mean Access to Guns			Urban*Mean Lethal Expectations		
Average In-School Weapon-Carrying (β_0)									
Intercept (γ_{00})	-3.405***	0.070	0.033	-3.408***	0.071	0.033	-3.406***	0.071	0.033
Low Socioeconomic Status Scale (γ_{01})	0.075	0.063	1.078	0.061	0.069	1.063	0.067	0.068	1.070
Heterogeneity Scale (γ_{02})	-0.048	0.077	0.953	-0.054	0.079	0.947	-0.054	0.079	0.948
Violent Environment Scale (γ_{03})	0.180	0.102	1.198	0.223**	0.067	1.250	0.202**	0.064	1.223
Mean Gun Accessibility (γ_{04})	0.031	0.067	1.032	0.005	0.074	1.005	0.030	0.067	1.031
Mean Lethal Expectations (γ_{05})	-0.150**	0.055	0.861	-0.164**	0.056	0.849	-0.158*	0.061	0.854
Mean School Attachment (γ_{06})	0.051	0.055	1.052	0.058	0.054	1.060	0.051	0.055	1.052
School Location (Urban=1) (γ_{07})	0.233	0.121	1.262	0.263*	0.105	1.300	0.246*	0.117	1.279
Urban*Violent Environment(γ_{08})	0.033	0.119	1.034						
Urban*Access to Weapons(γ_{08})				0.144	0.112	1.155			
Urban*Lethal Expectations(γ_{08})							0.029	0.106	1.030

Variance Components		SD		Variance		df		χ^2	
Urban*Violent Environment	Intercept (β_0)	0.209		0.044		121		153.843*	
Urban*Access to Guns	Intercept (β_0)	0.218		0.047		121		154.804*	
Urban*Lethal Expectations	Intercept (β_0)	0.212		0.045		121		154.623*	

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

Hypothesis 4. Hypothesis 4 states that schools that have with high levels of school connectedness among students will experience a decline in weapon-carrying behavior as compared to time 1. This hypothesis evaluates one component of school climate. The average level of school connectedness offers an understanding of how high quality relationships, a component of school climate, are related to in-school weapon-carrying. Contrary to expectations, schools that maintain higher levels of average school connectedness are no more likely to experience less weapon-carrying behavior net of individual propensities for weapon-carrying at time 1, than schools with lower levels of school connectedness among students. Hypothesis 4 is unsupported in the present analysis.

An analysis of the variance components for the full intercept-as-outcome model (including urban and non-urban schools) indicates that in-school weapon-carrying continues to vary significantly between schools even when controlling for school and student-level characteristics ($p<.001$); however, that variability has decreased. The ICC (not shown) indicates that approximately 1.3% of the remaining variability in student weapon-carrying is between schools. While the student and school characteristics included in the models are not sufficient in explaining variability in student weapon-carrying between schools, net of individuals' propensities for weapon-carrying at time 1, they explain more variability in weapon-carrying than student characteristics alone.

Slopes-as-Outcomes Model

Hypotheses 5 and 6 predict that school characteristics are also important in understanding the relationship between student characteristics and the probability of

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carrying a weapon to school. The peer conflict slope is modeled in order to establish

which, if any, school characteristics can explain the varying effect of peer conflict on

weapon-carrying. More specifically, the model determines whether peer conflict

impacts weapon-carrying differently in urban schools as compared to non-urban

schools, net of individuals' propensities for weapon-carrying at time 1. The model

also estimates whether the role of peer conflict in predicting the dependent variable

varies in schools that exhibit characteristics of violent subcultures versus those that do

not exhibit characteristics of violent subcultures.

An initial slopes-as-outcome sub-model explores whether school-level control

variables influence the relationship between peer conflict and weapon-carrying. The

only control variable that is related to the random slope is high school designation.

Thus, the final slope-as-outcome model includes an indicator of school location,

aggregated measures of violent environment, gun accessibility, and lethal

expectations, and an indicator identifying high schools. The model also includes all

school and student-level predictors used in the intercept-as-outcome model as control

variables (not shown). Table 9 displays the results pertaining to the final slopes-as-

outcomes model.

Table 9. Slope-as-Outcome Model

Independent Variable	Coefficient	SE	Odds Ratio
Peer Conflict (β_3)			
Intercept (γ_{30})	0.346*	0.155	1.413
School Location (Urban=1) (γ_{31})	0.359	0.307	1.432
Violent Environment Scale (γ_{32})	-0.253	0.152	0.776
Mean Gun Accessibility (γ_{33})	-0.172	0.139	0.842
Lethal Expectations (γ_{34})	0.017	0.228	1.017
High School (γ_{35})	0.741*	0.306	2.099

Variance Components				
	SD	Variance	df	χ^2
Intercept (β_0)	0.236	0.056	122	164.953**
Peer Conflict (β_3)	0.183	0.033	124	151.580

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

As indicated in Table 9, no support is found for hypotheses 5 or 6. Neither school location nor indicators of violent subcultures explain the varying relationship between peer conflict and in-school weapon-carrying ($p>.05$)[20]. However, peer conflict appears to heighten the odds of weapon-carrying in high schools as compared to middle schools, net of individuals' propensities for weapon-carrying at time 1.

In regards to the variance components, in-school weapon-carrying continues to vary significantly between schools ($p<.001$). However, modeling the peer conflict slope appears to have explained a good amount of the variability in the relationship between peer conflict and weapon-carrying as the relationship no longer continues to vary significantly between schools ($p>.05$). Accounting for the strong effect of high schools designation on the slope seems to explain the variation in the slope.

Hypotheses 5 and 6 also imply that the percentage of variance in in-school weapon carrying that is between as opposed to within schools will be greater for

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[20] Attempts were made to model interactions between school location and violent subculture indicators but those were also found to be nonsignificant (not shown).

urban than for non-urban schools (because in non-urban schools, the potent predictors are thought to be individual-level factors). These hypotheses can also be tested by comparing the ICC's for urban and non-urban schools. In the unconditional model, the ICCs for urban and non-urban schools are: 12.6% and 4.9% respectively, indicating a greater amount of between-school variance in weapon-carrying in urban schools. Once student-level predictors are added to the level one model, the percentage of between-school variance is reduced by nearly 10% in urban schools and slightly more than 3% in non-urban schools to 3.1% and 1.2%. We see that uneven distributions of students with different levels of risk for carrying weapons across schools accounts for a considerable proportion of the between-school variance in urban schools, contrary to prediction. That being said, the inclusion of school-level predictors reduces between-school variance in urban schools (to 1.8%) while it does not explain any additional between-school variance in non-urban schools. The current findings indicate that student-level predictors are important in both urban and non-urban schools but that school-level characteristics are also important in explaining the variability in weapon-carrying in urban schools.

In summary, school characteristics appear to be important in explaining in-school weapon-carrying, specifically in urban schools. While structural characteristics and a school-level measure of school connectedness appear to have no impact on weapon-carrying, schools that have a higher proportion of students exposed to violence have a higher probability of weapon-carrying. Further, schools located in urban areas appear to have a greater likelihood for student weapon-carrying, net of individuals' propensities for the behavior at time 1. However, the effects of

subculture characteristics are no more detrimental in urban schools than in non-urban schools. Other possible school characteristics that may interact with urban location are not explored in this study.

The impact of peer conflict on weapon-carrying also varies between schools. The expected causal predictors do not explain this relationship. This variability is, instead, explained by school level: peer conflict is more predictive of weapon-carrying in high schools than in middle schools.

Chapter 5: Discussion

Violent behavior in schools has grabbed the attention of parents, schools, and the media. This heightened awareness has driven schools to implement policies to reduce and prevent violent occurrences (Mawson, Lapsley, Hoffmann, and Guignard, 2002; O'Neil and McGloin, 2007). The attention has also prompted an increase in research regarding school environment, school safety, and school violence prevention (e.g., Gottfredson, 2001; Gottfredson and Gottfredson, 2001; Gottfredson et al., 2005; Payne et al., 2003). Ideally, empirical investigations focused on school violence, should identify the risk factors associated with the most severe instances of this behavior-- school shootings. Given the infrequency of such events, quantitative investigations are not feasible. Alternatively, the present research investigates the predictors of weapon-carrying in schools. If policy-makers have a better understanding of what triggers students to bring weapons to school, efforts can be made to prevent such behavior, and in doing so, prevent school shootings and other forms of weapon violence.

Prior literature suggests that school, community, and individual characteristics are important in predicting in-school weapon-carrying (e.g., Wilcox and Clayton, 2001). A recent qualitative investigation of six infamous school shootings concludes that the importance of school, community, and individual characteristics varies depending on school locations (NRC/NIM, 2003). According to the NRC/NIM report (2003), individual characteristics play a less important role in explaining school shootings in urban schools that are overcome by violent subcultures. In rural and suburban schools, which are less likely to experience violent subcultures, individual

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characteristics such as mental health and social dynamics are more important in explaining in-school weapon-carrying. These findings create a foundation for the present study when combined with quantitative research findings related to in-school weapon-carrying, social structure, violent subcultures, and school climate. This prior research reinforces the importance of including measures of school characteristics in studies of deviant behavior in schools (e.g., Felson et al., 1994; Gottfredson et al., 2005; Haynie et al., 2006; Welsh, 2001; Welsh et al., 1999).

Quantitative research findings also highlight the importance of incorporating student characteristics into in-school weapon-carrying models. While school characteristics have been less studied and deserve special attention, student-level predictors must continue to be studied. In the present investigation, both student and school characteristics are included in multilevel models to determine the risk factors associated with in-school weapon-carrying at time 2, net of individuals' propensities for weapon-carrying at time 1. Generally, the research finds that characteristics at both levels are important in explaining in-school weapon-carrying. While the hypotheses related to specific relationships in the current investigation are predominantly unsupported, the investigation offers an improved understanding of the complex relationships involving both student and school characteristics that predict weapon-carrying.

The findings of this study contribute to the inconsistencies in the literature relating to in-school weapon-carrying, specifically regarding school effects. Like Wilcox and Clayton (2001), the current findings suggest that school characteristics reduce the variability in weapon-carrying between schools; although neither Wilcox

and Clayton (2001) nor the present study were successful in identifying specific school characteristics related to the decline in variability. While both studies found one or two school characteristics to be related to weapon-carrying, the majority of school characteristics included in the models were unrelated to the dependent variables.

The present findings are in conflict with those of Watkins (2008), who also explored in-school weapon-carrying using the Add Health data. Watkins (2008) found school characteristics to be unimportant in explaining in-school weapon-carrying while the present investigation finds school characteristics to be quite important, especially in urban schools. Several factors may explain these conflicting findings. First, Watkins (2008) measured each of his school characteristics in separate models in order to avoid problems related to multicollinearity. By doing so, his school-level models were weak. Had Watkins used a multivariate school-level model of student weapon-carrying (avoiding multicollinearity among independent variables), he may have been more successful in identifying school characteristics related to weapon-carrying.

Another possible reason that Watkins (2008) may not have been able to identify school effects is due to his selection and modeling of school-level variables. The current findings indicating the importance of school characteristics are largely conditional on urban school location as there is substantially more between school variance in urban schools than in nonurban schools. Watkins (2008) did not explore school effects separately in urban and nonurban schools. Further, Watkins' measure of school violence used county-level FBI Uniform Crime Reports (UCR) data rather

than students' self-reported experiences with violence. Perhaps students' own experiences with exposure to violence and victimization are more important in predicting student weapon-carrying than UCR measures of violence within the community. Finally, it is possible that the exclusion of a student-level weight in the current analysis created conflicting findings. Perhaps, school characteristics are not important in explaining student weapon-carrying in a nationally representative sample. Future research should explore possible explanations for the conflicting findings within this small body of literature.

The next section identifies the main limitations of the research. A discussion of the findings and implications of the investigation as well as directions for future research follow.

Limitations

Perhaps the biggest limitation in this investigation is attrition. More than a third of the sample is removed from the analysis due to incomplete data. Further, without the inclusion of student-level weights, the unequal probability of selection into the student in-home sample is left unadjusted for. Although listwise deletion is deemed the most appropriate method for dealing with the data loss, it severely limits the generalizability of the findings to only those students and schools included in the sample.

The study is also hindered by data limitations; specifically relating to peer relationships, mental health, and criminological theory. Although the Add Health data provides social network data for the sampled students, the high levels of missing data relating to social network characteristics prevent it from being used to study

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infrequent behavior such as in-school weapon-carrying. Mental health is also an area in which the Add Health data provides some information on students but not enough. Variables relating to students' depressive symptoms and suicidal behavior are available but information on more severe forms of mental illness is not collected.

It is also difficult to identify constructs related to theories of crime, specifically social disorganization and subculture theories. Although characteristics related to both theories are included in the analysis, the more nuanced portions of the theories can not be tested using the Add Health data. Thus, conclusions can not be made regarding the effectiveness of social disorganization theory or subculture theory in explaining student weapon-carrying.

Finally, the present investigation is unable to explain variations in types or amounts of student weapon-carrying behavior. While it is helpful to understand why students bring weapons to school, it would also be beneficial to explore this behavior in different ways. In other words, are the predictors different for gun-carrying versus other types of weapon-carrying? Do the student and school characteristics related to the prevalence of weapon-carrying differ from the characteristics related to the frequency of weapon-carrying? The variability in student weapon-carrying behavior in the Add Health data does not allow for explorations into these questions.

Discussion of Major Findings

The investigation uses longitudinal data that include information regarding whether middle and high school students carried a weapon to school during the past year. Student and school characteristics were gathered from an earlier wave of data collection than the dependent variable, allowing for increased certainty in the causal

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order of predictors and weapon-carrying outcomes. The inclusion of extensive controls for propensities to carry weapons, including a measure of time 1 weapon-carrying, helps to avoid the misinterpretation of spurious relationships as meaningful. Given that the prior literature has focused less on the impact of school-level predictors associated with weapon-carrying in schools, the current hypotheses predict that school-level characteristics related to characteristics of school climate, social disorganization, violent subcultures, and school location —will predict in-school weapon-carrying at time 2, net of students' propensities for weapon-carrying at time 1. Two additional hypotheses explore the interaction between school and student characteristics. A discussion of these hypotheses, the related findings, and possible explanations for the findings are offered below.

Student Characteristics

While no formal predictions regarding the relationship between student characteristics and in-school weapon-carrying are made, the investigation focuses a good deal of attention on establishing these relationships. The main reason for the this lack of formal predictions is that the prior literature has done a sufficient job of establishing the student characteristics associated with in-school weapon-carrying (e.g., DuRant et al., 1999; Furlong et al, 2001; Kudjo, Auinger, and Ryan, 2003; Rountree, 2000; Simon et al., 1999; Watkins, 2008; Wilcox and Clayton, 2001; Wilcox et al., 2006). The purpose of the present investigation is focused more on school characteristics: first, the investigation establishes the relationship between school characteristics and weapon-carrying at time 2, net of students' propensities for weapon-carrying at time 1; and secondly, it determines whether school characteristics

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can moderate the relationships between student characteristics and weapon-carrying. In order to successfully estimate the interaction effects of school and student predictors, the direct effects of student characteristics must be established.

A wide variety of student characteristics are included in the model, ranging from attachment, to mental health, to delinquency. Consistent with earlier findings, self-reported delinquency increases the probability of weapon-carrying at time 2, net of weapon-carrying propensity at time 1 (Barlas and Egan, 2006; Brookmeyer et al., 2006; DuRant et al., 1997; Wilcox and Clayton, 2001). Conflicting with the prior literature, school and parental attachments are found to be unrelated to weapon-carrying at time 2 (Brookmeyer, Fanti, and Henrich, 2006; Dornbusch, et al., 2001; Henrich, Brookmeyer, and Shahar, 2005; Hoffmann and Dufur, 2008; Patterson and Dishion, 1985; Stewart, 2003; Stewart et al., 2002; Wilcox and Clayton, 2001). Variables related to peer relationships are also found to be unrelated to weapon-carrying at time 2 net of propensities for weapon-carrying at time 1; however, the relationship between peer conflict and student weapon-carrying varies between schools. Thus, while the fixed effect coefficient indicates that peer conflict is unrelated to weapon-carrying at time 2, the variance component suggests that peer conflict predicts weapon-carrying at time 2 in some schools and not others. This finding is discussed in more depth subsequently.

Also inconsistent with expectations, suicidal ideations and attempts are found to be unrelated to weapon-carrying at time 2, net of propensities for weapon-carrying at time 1. The NRC/NIM report (2003) found that mental health was an important predictor of school shootings. Perhaps, broader indicators of mental health are

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required to explain weapon-carrying. Information on extreme mental illnesses such as personality disorders or schizophrenia was not available in the Add Health data. Thus, suicidal thoughts and attempts are used to indicate mental health problems. Neither measure predicts in-school weapon-carrying. Future research would benefit from incorporating a variety of mental health measures into investigations of weapon-carrying.

It is important to note that while the student-level variables of interest are unrelated to student weapon-carrying at time 2, this does not necessarily mean that they are unrelated to earlier student weapon-carrying. By controlling for weapon-carrying at time 1, the analysis only identifies the predictors' influence on *changes* in weapon-carrying. For example, mental health is considered to be a fairly stable trait. Thus, it is likely to have an influence on weapon-carrying but not on changes in weapon-carrying from time 1 to time 2. Its effect is controlled for with the inclusion of the weapon-carrying at time 1 variable. This same rationale can be used to explain the lack of effects of parental and school attachments on student weapon-carrying. If these are stable traits, they are more likely to impact earlier weapon-carrying and less likely to impact changes in weapon-carrying. This is possibly why earlier studies show these variables to be important in explaining student weapon-carrying and the present one does not (Watkins, 2008; Wilcox and Clayton, 2001).

In order to extend our understanding of weapon-carrying behavior, the present investigation must include a control for weapon-carrying at time 1, thus limiting the amount of variability in the dependent variable. This allows for conclusions to be made regarding the temporal relationship between the independent variables and

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weapon-carrying and helps to avoid erroneous conclusions due to spurious relationships.

The following sections discuss the remaining findings, organized by research question.

Structural Characteristics

Gottfredson and Gottfredson's (1985) reanalysis of the Safe Schools Study data highlighted the importance of examining the structural characteristics of the communities surrounding schools. They found that attributes in the immediate school communities impacted what went on inside of schools. Poverty and community disorganization explained a large amount of the variability in teacher victimization. Additional research reinforces the necessity of examining the social structure of the immediate communities surrounding schools when trying to understand deviant behavior within schools (Haynie et al., 2006; Welsh et al., 1999).

Given these findings, the present investigation includes two different measures of structural characteristics; both related to elements of social disorganization: a low socioeconomic status (SES) scale and a scale that identifies high levels of heterogeneity within communities. Neither measure is found to be related to in-school weapon-carrying at time 2, net of individuals' propensities for weapon-carrying at time 1. These findings are consistent with those of Welsh et al. (1999) whose research concluded that simply coming from a bad community does not predict deviance within schools. They also found that the characteristics of the community in which the schools were located in did not explain much variability in school deviance either.

Conclusions regarding community characteristics can be made in two different directions. First, it is possible that community characteristics simply do not impact deviant behavior within schools. Prior research has been unable to directly identify relationships between community characteristics, such as poverty, and delinquent behavior (e.g., Kodjo et al., 2003; Osgood and Chambers, 2000). The findings of Welsh et al. (1999) also support this notion.

Alternatively, it could be that community characteristics do not uniformly predict all types of school deviance. For example, Gottfredson and Gottfredson (1985) found community characteristics, such as poverty and community disorganization, to be important in predicting teacher victimization, but not as important in explaining student victimization. Furthermore, additional findings regarding the impact of community characteristics on in-school weapon-carrying and other forms of school deviance have also been inconsistent (e.g., Rountree, 2000; Wilcox and Clayton, 2001; Watkins, 2008). Community structure appears to have a differential impact on delinquent behavior, ranging from no effect to different effects for different types of behavior.

Such inconsistent findings may be a result of how community characteristics are being measured. Perhaps the problem is the static natures of community characteristics in the prior literature. The NRC/NIM report (2003) suggested that it was not simply the present status of a community that increased the probability of school violence but rather, it was the *change* in community social status that predicted violence. The report noted that both positive and negative changes in community status, including changes in economy or population, occurred in the communities that

experienced school shootings. If the findings of this report are generalizable to weapon-carrying behavior, static measures may not predict weapon-carrying at time 1 or time 2, and they may be unrelated to *changes* in weapon-carrying from time 1 to time 2. Given that Watkins (2008) did not find structural characteristics to be related to student weapon-carrying at time 1 using the Add Health data, it seems unlikely that static characteristics are causally related to student weapon-carrying. Future investigations should consider including more dynamic measures of structural characteristics to determine whether changes in such characteristics are important in explaining student weapon-carrying behavior.

Although structural characteristics are included in the present analysis given their relationship to social disorganization, actual measures of social disorganization are not included in the study. More direct measures of the informal ties that are expected to mediate the effects of structural characteristics on school deviance might be more strongly related to weapon-carrying (Sampson and Groves, 1989; Sampson et al., 1997). That is, schools located in highly organized communities may experience improved communication and trust between residents, collective efficacy, leading to reduced weapon-carrying.

Thus, future research should identify changes in the structural characteristics of both the communities where schools are located as well as the communities where students actually live. It should also attempt to identify communication and trust within communities. Finally, this research should not assume that changes in community structures or levels of collective efficacy will influence all types of school deviance uniformly.

Violent Subculture Characteristics

Research suggests that communities which embrace violent subcultures are more common in urban and lower socioeconomic areas (Anderson, 1999; Baumer et al., 2003). The NRC/NIM report (2003) concluded that urban communities were more apt to be overwhelmed by violent subcultures, increasing violent behavior, such a school shootings, in these communities. Given that earlier evidence showed that violent subcultures were not necessarily unique to urban areas (Felson et al., 1994; Stewart et al., 2002), the present investigation explores the impact of school location, characteristics related to violent subcultures, and an interaction between the these characteristics on in-school weapon-carrying.

Findings in the present investigation indicate that students in schools that experience elevated levels of violence have higher probabilities of in-school weapon-carrying at time 2, net of weapon-carrying at time 1. That is, enrollment in a school that is characterized by heightened levels of violence is related to increases in weapon-carrying between waves 1 and 2. The remaining two indicators related to violent subcultures, mean access to guns and mean lethal expectations, do not increase the probability of weapon-carrying at time 2, net of time 1 propensities for weapon-carrying . Further, violent subculture characteristics do not predict student weapon-carrying differently in urban and non-urban schools. Such findings are inconsistent with the previous literature. NRC/NIM report (2003) as well as other research on violent subcultures showed that elements of a violent subculture promote weapon-carrying more so in urban schools than in non-urban schools (e.g., Anderson, 1999).

Although the measures of violence in the environment predict weapon-carrying, the fact that the other two measures of violent subculture do not, and the fact that the measures of violent subculture are no more influential in predicting weapon-carrying in urban schools than in other schools suggests that the measures of violent subculture used in this study are not ideal. As noted in Felson et al. (2004), in order to identify of subculture of violence, indicators related to violent values, beliefs, and attitudes should be included in the analysis. While the present measures, if related to weapon-carrying in the expected directions, would have suggested that violent subcultures *may* exist and be causally related to weapon-carrying, no firm conclusions could be made regarding the impact of violent subcultures on student-weapon-carrying. Further, given that only the measure of violent environment was related to the dependent variable, no conclusions can be made regarding the importance of violent subcultures in explaining weapon-carrying in schools.

Although the findings do not permit conclusions to be made regarding the influence of violent subcultures on weapon-carrying, this investigation offers the first look at the different characteristics related violence subculture. Watkins (2008) only explored school-level measures of fighting and fear. The current investigation goes beyond levels of fighting to include more severe measures of exposure to and participation in violent behavior. Additionally, the measure of lethal expectations and gun accessibility are especially appropriate as students who are exposed to subcultures of violence will have increased expectations of being killed at a young age and carrying guns. Their inclusion in the model offers a limited but multifaceted

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measure of violent subculture that has not previously been explored when examining weapon-carrying in school.

Watkins (2008) does not include a measure of gun accessibility in his study but Wilcox and Clayton (2001) do. Wilcox and Clayton (2001) found that gun ownership was an important predictor of weapon-carrying at the student-level but not at the school level. The present investigation found gun accessibility to be unimportant at either level. It is possible that gun-accessibility is a stable trait—once a gun is accessible, it is unlikely to become inaccessible. If that is the case, access to guns may predict earlier student weapon-carrying but not changes in weapon-carrying—the measure here. This is somewhat consistent with Wilcox and Clayton's (2001) findings.

The direction of the relationship between mean lethal expectations and weapon-carrying is contrary to expectations--as the average likelihood of lethal expectations increases the probability of weapon-carrying decreases. These findings are perplexing and deserve more attention. Although there is no literature available to support this, I suspect that when there are heightened levels of expectations of death within a student body, students can react two ways. One would be with anger which may cause an increase in weapon-carrying. Alternatively, some students react with fear or another more passive emotion. Evidence shows that at the individual-level, different emotions result in different types of behavior (Sherman, 1993; Wilcox et al., 2006). Perhaps students' reactions to a pervasive assumption of an early and violent death cause a reaction that does not elicit self-protection through violence. Wilcox et al. (2006) found that students who perceived that they would be victimized were *less*

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likely to carry a weapon to school. While Wilcox et al. (2006) utilized only individual-level characteristics, the findings offer some explanation of the present findings, at least in regards to non-urban schools. Perhaps, even when there is a common expectation of death by homicide, this does not motivate students to bring weapons to school. Future research should investigate these possibilities.

Future research should also more broadly investigate the relationship between school location, violent subcultures, and weapon-carrying. More comprehensive subculture measures should identify values or beliefs that support the use of toughness, aggression, or violence to resolve conflicts and regain or maintain respect (Anderson et al., 2002; Corzine and Huff-Corzine, 1989; Messner, 1983; Wolfgang and Ferracuti, 1967).

Despite the lack theoretical implications related to violent subcultures, the finding suggesting that violent environments are important in explaining student weapon-carrying should be of interest independent of the other subculture characteristics. The findings of this analysis indicate that a violent environment increases the odds of weapon-carrying in both urban and non-urban areas even when controlling for weapon-carrying at Wave I. Schools that have high numbers of students exposed to violence and/or victimized are more likely to have students carrying weapons in their schools. Policy implications related to this are discussed shortly.

School Climate

Earlier research by Gottfredson and others confirmed the importance of looking at school climate when examining deviant behavior in schools (e.g., Eitle and

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Eitle, 2004; Gottfredson et al., 2005; Welsh, 2001). School climate, as described by Tagiuri (1968; cited in Cook et al., in press) consists of four broad components, including ecology, milieu, social systems, and culture. Unfortunately, data constraints prevented a full measure of school climate. However, the measure included, school connectedness, allows for the exploration of one component of school climate--culture. Unfortunately, despite predictions, an aggregated measure of school connectedness does not act as a protective factor against weapon-carrying in schools—at least not after controlling for earlier weapon-carrying.

Reflection on the prior literature offers some explanation for the finding. While a review of the literature convincingly shows that school climate should be important when attempting to understand negative behavioral outcomes at school, perhaps the relationship is dependent on the outcome of interest. Gottfredson and others have shown that all four components of school climate are important in explaining various outcomes ranging from school disorder to aggressive and delinquent behavior (e.g., Gottfredson and Gottfredson, 1985; Gottfredson et al., 2005; Hoffmann and Dufur, 2008; Reiss et al., 2007). However, studies relating to weapon-carrying in school have not found aspects of school climate to be important predictors (Watkins, 2008; Wilcox and Clayton, 2001). Additionally, Welsh (2001) found that school climate indicators were more important in predicting student misconduct than serious offending. Adding to the inconsistency of findings, Welsh et al. (1999) found that the relationship between school climate and student misconduct failed to reach significance. Given these findings, subsequent investigations should

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identify whether any elements of school climate are related to in-school weapon-carrying.

Cross-Level Interactions

Current hypotheses explore the possibility that urban school location or violent subcultures indirectly effect weapon-carrying through their impact on the relationship between student characteristics and weapon-carrying. While modeling the peer conflict slope does not suggest that school location or characteristics of violent subcultures are important in explaining variability in the relationship between peer conflict and student weapon-carrying, variability in the relationship is explained by the grade-levels served by schools. Peer conflict increases the probability of weapon-carrying, net individuals' propensies for weapon-carrying at time 1, more so in high schools than in middle schools. The impact of high school completely explained the variability of the peer conflict slope. Future research should explore why the negative effect of peer conflict on weapon-carrying is notably stronger in high schools as compared to middle schools.

Although the relationship between peer conflict and weapon-carrying varies between schools, the relationship is not different in urban and non-urban schools, as predicted by the NRC/NIM (2003) report. This finding, and the findings related to the other peer relationship measures—social isolation and an interaction between conflict and isolation, require speculation given that the effects of these peer relationships on in-school weapon-carrying have not been well-studied in the previous literature. The NIC/NIM report (2003) found that social status was pertinent in explaining school shootings in rural and suburban schools. Specifically, the

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shooters were not necessarily isolated but rather existed on the periphery of social groups. They also experienced frequent negative interactions with their peers; often times hyperbolizing the hurtfulness of these interactions in their minds. The report suggests that location within one's social group, combined with peer conflict, is important to explaining the shootings.

The findings of the current investigation related to peer relationships are inconsistent with the NRC/NIM report (2003) findings. Perhaps findings from the NRC/NIM report (2003), taken from in-depth ethnographic study, do not generalize beyond the six communities studied. Or perhaps the predictors of the actual perpetration of lethal school violence are different from the predictors of in-school weapon-carrying. Demuth (2004) found support for the idea that social isolation had reduced delinquent behavior. Thus, maybe the unpopular status of youth does not necessarily put them at risk for weapon-carrying behavior. Another possibility is that social isolation and periphery membership in peer groups have differential effects on weapon-carrying and deviant school behavior. Future research should continue to look at these peer relationships. This area of research requires unique data that can examine the location of students within peer groups as well as peer interactions. Such data is difficult to find and has resulted in less research on this topic area (Demuth, 2004)[21]. In order to properly test the NRC/NIM report (2003) findings, social network data is required to identify a subject's location within a peer group. Additionally, the NRC/NIM report (2003) suggested that several of the shooters changed their peer groups just prior to the shootings. Given the static nature of the

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[21] The Add Health data does provide in-depth social network data but large amounts of missing data in these items prevented their use in the current investigation.

data, changes in peer groups could not be identified for the current analysis. Subsequent analyses should include social network data as well as information regarding changes in peer groups.

Although the effect of only one student characteristic on student weapon-carrying at time 2 varied between schools, and the variability of that slope was not explained by school location or characteristics related to violent subcultures, there is evidence to show that school characteristics are more important in explaining variability in weapon-carrying in urban schools than in non-urban schools, as suggested in the NRC/NIM report (2003). The results indicate that there is a greater amount of variability in weapon-carrying between schools in urban areas than in non-urban areas. Furthermore, school-level predictors are more effective in explaining the variability in weapon-carrying across urban schools and than in non-urban schools. Contrary to predictions, student-level characteristics are important in both urban and non-urban schools in explaining in-school weapon-carrying. While this is inconsistent with the findings of the NRC/NIM report (2003), the present analysis supports the NRC/NIM finding that that school-level predictors are more important in explaining urban school violence than non-urban school violence.

Theoretical Implications

The purpose of this investigation is not to test criminological theory but rather, to use theory to identify possible predictors of in-school weapon-carrying. This section describes whether those predictors with theoretical relevance are successful in predicting in-school weapon-carrying. Further, theoretical implications already mentioned, are discussed in more depth.

Social control theory supports the incorporation of attachment measures at the student-level into the present investigation. Both school connectedness and parental attachment reflect a central component of Hirschi's (1969) social control theory--attachment. No support was found for these components of social control theory in predicting weapon-carrying at time 2. This finding is inconsistent with other findings related to social control theory (Hirschi, 1969; Payne et al., 2003; Stewart, 2003; Wiatrowski and Anderson, 1987). Although Hirschi states that several different types of attachment are important in predicting deviant behavior, perhaps in the case of weapon-carrying, this is not true. Or, it is possible that parental and/or school attachment do not impact weapon-carrying at time 2, net of controlling for weapon-carrying at time 1. Perhaps control variables are in fact associated with weapon-carrying, but not *changes* in the behavior from time 1 to time 2. Future research should test this possibility and provide a more complete test of this theory.

The NRC/NIM report (2003) also suggested that structural characteristics were important in predicting weapon-carrying. Social disorganization theory coincides nicely with such a prediction (Show and McKay, 1942). However, findings indicate that structural characteristics do not play much of a role in explaining weapon-carrying at school. Given the findings of Shaw and McKay, it was reasonable to expect that predictors of social disorganization—low SES and heterogeneity—would predict weapon-carrying. However, more contemporary versions of social disorganization theory suggest that informal social networks, or levels of collective efficacy, within a community, more accurately reflect social disorganization and should be used to test this theory (Sampson et al., 1997). Future

research should provide a more complete test of social disorganization theory and its relevance in explaining in-school weapon-carrying.

Finally, it is important to reiterate the theoretical implications related to theories of violent subcultures. The conclusions of the NRC/NIM (2003) report suggest hypotheses that most directly coincide with theories related to violent subcultures. The NRC/NIM report (2003) found distinct differences in the use and prevalence of violence in urban schools as compared to non-urban schools. However, the findings of the present study can not confirm nor refute the NRC/NIM report findings. The measures used in the present study are not adequate to identify violent subcultures. Given that earlier research is able to identify subcultures using more comprehensive measures, such as indicators of violent values and beliefs, it is concluded that, despite its efforts, the present investigation did not use appropriate measures to identify violent subcultures (Felson et al., 1994).

That being said, the importance of violent environments in predicting weapon-carrying at time 2, net of individuals' propensities for weapon-carrying provides a starting point for future researchers investigating subculture effects. The current findings, combined with the findings of Felson et al. (2004) suggest that violent subcultures may exist in schools. Further research is needed to provide a better test of the impact of violent subcultures on weapon-carrying.

Policy Implications

Schools shootings and violent behavior in schools occur much less frequently than the media portrays. Nevertheless, schools go to great lengths to avoid serious

forms of victimization. In recent years, schools have invested in specific tactics, ranging from increased security to metal detectors, to prevent delinquency and violence in schools (Gottfredson and Gottfredson, 2001; Gottfredson et al., 2000; O'Neill and McGloin, 2007). For the most part, these costly initiatives have gone untested or show weak relationships with school crime (O'Neill and McGloin, 2007).

This investigation focuses mainly on the school characteristics associated with changes in student weapon-carrying from time 1 to time 2. Schools are frequently concerned about improving certain elements within the school community in order to protect against violent outcomes. The NRC/NIM report (2003) cautions that schools located in communities experiencing a decline in socioeconomic status and an increase in heterogeneous populations are more apt to experience violent outcomes. Although the present analysis could not determine the impact of changing structural conditions, schools whose student bodies mainly comes from low SES, highly heterogeneous neighborhoods are no more apt to have increased weapon-carrying than schools with higher SES student bodies. Schools should not focus as much on SES but rather other factors that will promote safety in schools.

Similarly, the present investigation does not find that school connectedness at the school-level greatly impacts the probability of weapon-carrying in schools. However, this does not mean that school climate is unimportant. In fact, the broader literature on school climate consistently shows that elements of school climate *are* related to school deviance (see Gottfredson et al., 2005). While school connectedness may not reduce student weapon-carrying, schools should not ignore the other

components of school climate that are consistently shown to be beneficial in creating a positive environment for learning and safety.

In terms of policy implications, perhaps the most important ones stem from the findings related to violent environments and school location. Schools that have large numbers of students exposed to violence and schools located in urban areas have increased probabilities of weapon-carrying at time 2, net of individuals' propensities for weapon-carrying at time 1. These two predictors appear to be independently related to the dependent variable. Schools must do a better job of protecting students from witnessing or being victims of violence. Given that this measure identifies expose to violence outside of schools, this is a problem that schools can not solve alone. Interestingly, a student's individual exposure to violence is unrelated to his or her weapon-carrying behavior in school. Thus the problem seems to be related to the prevalence of violence at the school-level. Schools and their surrounding communities should make improved efforts to reduce this level of violence. These efforts should reduce the number of students carrying weapons to schools.

The findings suggest that urban schools are more likely to experience weapon-carrying than non-urban schools. While the current study does not offer an explanation of why this may be (given that subculture characteristics did not play a larger role in weapon-carrying in urban areas), school administrators in urban areas must acknowledge this problem and prioritize research that can explain why this problem is more unique to urban areas. If these factors that promote weapon-carrying

in urban areas more so than non-urban areas can be identified, programs specifically targeting these factors can be implemented.

The investigation hypothesizes that not only will school characteristics be important in predicting in-school weapon-carrying, but that they will also influence the relationship between student characteristics and weapon-carrying. This is the first investigation to quantitatively study such hypotheses. Perhaps the most important implication of these findings relate to how student behavior predicts in-school weapon-carrying differently in different schools. Only peer conflict has a differential effect on the dependent variable across schools. While neither school location nor violent environment indicators can explain the variability in the relationship between peer conflict and weapon-carrying, the fact that the relationship varies is important. Research must be conducted to identify why this relationship is so much stronger in high schools. In the mean time, high schools should make special efforts to provide students with more appropriate ways of dealing with student conflict as a means of avoiding student weapon-carrying. None of the remaining student characteristics vary in their impact on weapon-carrying between schools. This is valuable knowledge to schools as they can identify student characteristics to focus prevention efforts and be confident that those efforts do not need to change for different schools in their jurisdiction.

Directions for Future Research

Suggestions for future research have been inter-dispersed throughout this discussion chapter. A broader discussion of the directions researchers should take to improve the study of in-school weapon-carrying follows.

First, and foremost, future research must use nationally representative samples. The level of attrition present in this data limits the generalizability of these findings beyond this sample. Although the sample of schools is representative, students are not necessarily representative of their schools. Future investigations should replicate this study using a nationally representative sample of students.

Subsequent investigations should also consider the possibility that different risk factors are important in explaining different types of deviant behaviors. The foundation for the present investigation uses literature examining deviant school behavior in general, more so than the specific in-school weapon-carrying literature. Mainly this occurred because literature focusing specifically on in-school weapon-carrying is less available. However, many of the student and school characteristics that are thought to be associated with general delinquency at school are found to be unrelated to in-school weapon-carrying in the present investigation. Given the work of Simon et al. (1999), who found that the predictors of weapon-carrying varied for weapon-carrying in school versus outside of school, it is not improbable that the predictors of deviant behavior more broadly are not appropriate for explaining all types of deviant or violent behavior. This should be taken into consideration for future studies of in-school weapon-carrying as well as other types of deviant or violent behavior.

Future investigations should also explore the measures of student weapon-carrying. Studies should examine the predictors of gun-carrying versus other forms of weapon-carrying. Further, investigations should study whether predictors vary in

their relationships with prevalence of weapon-carrying versus frequency of weapon-carrying.

Finally, future research can improve how predictors of weapon-carrying are defined. As noted, school characteristics should be examined based on school locations and events that take place within schools, rather than based on student residences and student experiences outside of school. The present investigation could not capture such relationships. Additionally, dynamic predictors should also be included in future investigations, such as changes in peer groups or structural characteristics.

Some of the predictions set forth in the NRC/NIM report could not be adequately investigated here. For example, the report focused a good deal of attention on peer relationships. It stated that several of the shooters misinterpreted their relationships with peers, often exaggerating the negative treatment and opinions offered by their peers. The report also suggested that severe mental disorders such as schizophrenia and bi-polar disorder were responsible for some of the shootings. The relationships between mental health and weapon-carrying as well the peer relationships and weapon-carrying should be should be focuses of future research.

The present investigation offers a rigorous exploration into the complex predictors of in-school weapon-carrying. It is one of only three multilevel analyses to explore this topic to date. In addition to including both student and school characteristics of weapon-carrying, the present investigation also explores the interaction effects between student and school characteristics. Thus, through its use of a nationally representative sample of schools, more refined measures of student

and school characteristics informed by criminological theory, exploration into more complex relationships between the dependent variable and its predictors, and its use of longitudinal data that makes it possible to establish time ordering between the dependent measure and presumed causal measures, this study improves upon earlier studies of student weapon-carrying and extends the current state of knowledge on the behavior. Given that this rigorous investigation is the first of its kind, its most important contribution is creating a starting point for future research. Improved measures and theories specific to weapon-carrying should lead to more conclusive findings. Such findings will allow for improved school prevention needs assessments based on specific student and school characteristics.

Appendices

Appendix A. Review of Previous Literature Related to In-School Weapon-Carrying

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
DeVoe (2007)	▪ N=7,521 ▪ 2003 School Crime Supplement to the National Crime Victimization Survey ▪ Cross-sectional data ▪ Purpose to examine the effects of bullying on protective behaviors in school; also examined the effects of school-level mediators on protective behaviors	▪ Bullied ▪ Direct Bullied ▪ Indirect Bullied ▪ Avoidance ▪ Truancy ▪ Weapon-Carrying ▪ Fighting	School Security (measures of student perceptions of communication, consistency, and enforcement of school rules) School Rules (student perceptions of fairness and clarity of school rules) Sex Race/Ethnicity Grade Level Household Urbanicity Criminal Victimization Fear of Threat or Attack School Sector (Public or Private) School Level (Elementary or Secondary)	▪ Victims of bullying were more likely to use self-protective behaviors in school than were those that were not bullied. This further weakened school climate and safety. ▪ School guardianship measures did not interact with bullying to predict protective behaviors. ▪ Type of bullying (direct or indirect) did not differ in their ability to significantly predict self-protective behaviors.
DuRant, Kahn, Beckford, and Woods (1997)	▪ Massachusetts Youth Risk Behavior Survey ▪ N=3,054 ▪ Purpose to determine the relationship	▪ Number of days subject carried weapon to school during 30 days prior to survey	Gender Age Grade Ethnicity SES	▪ Males were more likely to carry a weapon on school property than females (15% vs. 5% respectively) ▪ Multiple regression analyses

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
	between weapon-carrying on school property and other at-risk behaviors	administrations	Absence from School Due to Fear Victimization Physical Fighting Academic Achievement Frequency of Violence Frequency of Drug Use Number of School Sports Teams Substance Use Offered or Sold Drugs	indicated that carrying a weapon to school was associated with being male, physical fighting, being threatened or injured, use of alcohol or cigarettes, and being offered or sold illegal drugs while on school property. ▪ Lower SES, age, low academic achievement, low attendance due to fear, number of times threatened or injured with a weapon at school, and frequency of fighting at school were also significant when the dependent variable was dichotomized.
DuRant, Krowchuk, Kretter, Sinal, and Woods (1999)	▪ Analysis of a modified version of the Youth Risk Behavior Survey ▪ N=2227 from 53 randomly selected middle schools in North Carolina	▪ Weapon-carrying—specified gun-carrying versus other weapons	Gender School Grade Age Ethnicity 2-Parent Home Type of Student Threatened With a Weapon at School	▪ 3% of students reported carrying a gun to schools and 14% carried a knife or club to school. ▪ Gun-carrying related to increased age, male gender, being a minority, alcohol, cocaine, and marijuana use,

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
			Being in a Fight Injured in a Fight Cigarette Use Alcohol Use Substance Use Team Sport Participation Organized Physical Activity Suicide Ideation Suicide Plan Suicide Attempt	early age of onset for cigarette use, and frequency of cigarette, marijuana, and drug use. ▪ Knife and club-carrying was related to increased age, male gender, early use of cigarettes, marijuana and alcohol, frequency of alcohol and cigarette use, carrying a gun, being threatened with a weapon at school, and a suicide plan.
Furlong, Bates, and Smith (2001)	▪ Secondary analysis of Youth Risk Behavior Surveillance Survey ▪ Cross-sectional analysis ▪ N=40,435 individuals from 3 different Waves ▪ Purpose to determine whether self-reported risky behaviors predict in-school weapon-carrying	▪ "During the past 30 days, how many days did you carry a weapon such as a gun, knife, or club on school property"	Sex Grade Level Ethnicity Parental Education YRBS Risk Index (9 items)	▪ While the behavior risk factors did correlate with weapon-possession on school property, the prediction ability of the survey was limited.
Kodjo,	▪ Secondary analysis of	▪ Whether subject	Age	▪ 9.3% of sample carried a

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
Auinger, and Ryan (2003)	the 1994-1995 National Longitudinal Study of Adolescent Health data ▪ N=6504	ever carried a weapon to school	Gender Race Ethnicity Parental Level of Education Urbanicity Neighborhood Poverty Status Perceived Longevity School Suspension Safety in the Community Witnessing Violence Substance Use at School Involvement in Domestic, Dating, or Sexual Violence Access to Gun at Home Perpetration Scale Interpersonal Connectedness Scale Perpetration of Physical Violence Mental Health Issues School Connectedness Violent Victimization Impulsivity	weapon to school ▪ Weapon-carriers were mostly male (77%) and mostly reported carrying a knife (67%). ▪ Neighborhood poverty and parental education less than or equal to high school degree significantly predicted weapon-carrying at school but lost there significance in the full model. ▪ In the full model, partner violence, perpetration of physical violence, witnessing violence, interpersonal connectedness, and school connectedness were the most significant predictors of in-school weapon-carrying for males.

Malecki and Demaray (2003)	▪ N=461 middle school students
	▪ Cross-sectional analysis
	▪ CASSS (measures social support)
		▪ How many times over the past year have you carried a knife to school?
		▪ ….a gun to
			Gender
			Grade
			Poverty Status
			Social Support
			   Emotional Support scale
			   Informational Support scale
				▪ Students who carried weapons reported less social support than those who did not carry weapons.

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
	- Purpose to examine the relationship between perceived social support and carrying a weapon to school.	school? - …another weapon to school? (Combined to make a binary variable (1=carried weapon to school))	Instrumental Support scale Appraisal Perception of Social Support Risk Code (12 item scale) Bullying Being Bullied Delinquent Behavior Gang Membership Drug and Alcohol Use	
Rountree (2000)	- N_{Urban}=1,460 - $N_{Western}$=1,226 - $N_{Eastern}$=1,322 - Secondary analysis of the Kentucky Youth Survey (grades 6-12) - Compared weapon-carrying in an urban, western, and eastern county as a means of controlling for contextual differences - Analysis conducted separately for each county	- Did you take weapon to school within last 30 days?	Controls Sex Age (10-21) Race Father and Mother Education Level (proxy for SES) Place of Residence (e.g., farm, city, town) Threatened at School Property Stolen at School Afraid at School Previous Arrest Involvement in Drug Dealing Drug Use Weapon Ownership/Carrying by family Weapon Ownership/Carrying by Peers	- Generally, contextual effects had little influence on weapon-carrying. - Fear and victimization appeared to have little impact. - Family and peer socialization important as was criminal and deviant lifestyle

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
			Self Firearm Ownership School Attachment Religious Involvement	

Simon, Crosby, and Dahlberg (1999)	▪ Secondary analysis of Youth Risk Behavior Survey
	▪ N=10,904 students
	▪ Cross-sectional analysis
	▪ Purpose to examine if risk factors vary for weapon-carrying on and off school property
		▪ "During the past 30 days, how many days did you carry a weapon such as a gun, knife, or club on school property"
		▪ "During the past 30 days, how many days did you carry a gun?
		▪ "During the past 30 days, how many days did you carry a weapon such as a gun, knife, or club"
			Use of Cigarettes, Alcohol, and Marijuana (overall and on school property)
			Involvement in Physical Fights (overall and on school property)
			Exposure to Crime and Violence on School Property
			Absent From School Because Unsafe
			Demographics
			   Gender
			   Ethnicity
			   Age
			   Parents' Education
			   % Students Receiving
			     Subsidized Lunch
			   Metropolitan Status
			   Region of Country
				▪ Low parental education, substance use on school grounds, involvement in physical fights, exposure to school crime and violence, and frequent weapon and gun carrying were factors that distinguished in-school weapon-carriers from off-school property weapon-carriers
				▪ Appears some deterrence from weapon-carrying onto school grounds (only 48% of weapon-carriers carried onto school grounds)
				▪ Those who carry to school might have lower regard for school policy (engage in other problem behaviors on school grounds, e.g., drug use fighting, etc.)
				▪ Authors suggest looking at 2 factors when studying

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
				weapon-carrying behavior-consequences of behavior and motivation of behavior.

Welsh, Stikes, and Greene (2000)	▪ N=43 middle schools
	▪ Used path analysis in order to determine the effects of community and school-level variables on school disorder
	▪ Examined the influence of both the community where the school was located (local community) and the community where students came from (imported community)
		▪ School disorder (school incident and disciplinary data).
		  o School incident data comprised of type of offense (e.g., property or personal crime), location of offenses (e.g., on or off school grounds), and police response (e.g., arrest)
		Disciplinary data included number of dismals from school during 1990
			Community Poverty and Stability (census tract data)
			    Poverty Rates
			    Racial Composition
			    Residential Stability
			    Family Structure
			Community Crime
			School Size
			School Stability
				▪ Poverty was the strongest predictor of school disorder of all of the community-level factors but it was moderated by school stability.
				▪ Local community was a stronger predictor of school disorder than important community; however the indirect effect of community poverty was found for both types of communities.

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Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
		school year		

Wilcox and Clayton (2001)	▪ Multilevel model
	▪ N= 21 schools
	▪ N= 6,169 individuals
	▪ Secondary analysis of the Kentucky Youth Survey (grades 6-12)
	▪ Cross-sectional analysis
	▪ Purpose to simultaneously estimate the individual and school level predictors of in-school weapon-possession.
	▪ Examine individual effects related to fear and victimization, criminal lifestyle, pro-gun socialization, and social engagement
	▪ Contextual factors included indicators relating to school structure, school
		▪ Report of whether student had taken weapon to school during past 30 days (binary) (see Rountree (2000) for explanation of why broader definition of weapon use)	Individual Level Characteristics
			  Sex
			  Age
			  Race
			  SES
			  Problem Behavior
			  Parental Gun Ownership
			  Self Gun Ownership/Use
			  Peer Weapon Carrying to School
			  Family Dysfunction
			  School Attachment
			  Religious Ties
			  Threatened at School
			  Property Stolen at School
			  Afraid at School
			Contextual Variables
			  Proportion Nonwhite
			  Proportion Male
			  Proportion Free Lunch
			  Middle School
			  School Deficits Scale
			    School-Level Proportion
			      Students Afraid
			    Proportion Students
			      Threatened
			    Proportion Experiencing
				▪ Both individual and school-level factors explained in-school weapon possession although individual factors counted for a greater amount of variance
				▪ The effects of school-level SES was moderated by school capital and school deficits.

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings

	capital, and school deficits		Property Victimization
			School-Level Mean Problem Behavior
			School Level Mean Family Dysfunction
			Mean Gun Ownership/Use Among Students
			Mean Parental Gun Ownership Among Students
			School Level Mean Weapon-Carrying by Peers
			School Capital Scale
			   Mean School Attachment
			   Mean Church Attendance
			   Mean Religious Commitment	

Wilcox, May and Roberts (2006)	▪ N=113 schools
	▪ N= 3,692 individuals
	▪ Longitudinal analysis
	▪ Purpose understand the directional relationship between student weapon-carrying and school-crime experiences such as victimization,
		▪ Gun-carrying (how often carried to school during school year)
		▪ Non-gun weapon-carrying
			<u>Wave 1</u>
			Fear of Crime
			Risk Perception
			Victimization
			Controls
			  Gender
			  Race
			  Parent Education
			School Attachment
			Delinquent Offending
				▪ Little support for the fear and victimization hypothesis
				▪ Strongest predictor of weapon-carrying was previous weapon-carrying
				▪ Authors suggest that policy makers must address access to weapons to curb possession in school.

Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
	perceived risk of victimization, and fear of school victimization (i.e., examine fear, cognitive risk perception, and actual victimization and their links to in-school weapon-carrying) ▪ Surveyed three Waves through middle school and into high school		Parent Gun Ownership Self-Gun Ownership Peer Weapon-Carrying In-School Gun Carrying In-School Non-gun Weapon Carrying Wave 2 Gun Carrying Non-Gun Weapon-Carrying Wave 3 Fear of Crime Risk Perception Victimization Delinquent Offending	

Watkins (2008)	▪ N=55 high schools
	▪ N=10,308 students
	▪ Secondary Analysis of the Longitudinal Study of Adolescent Health Wave I data (1994-1995)
	▪ HLM analysis investigating the individual and
		▪ Did the student carry a weapon to school at least once during the past 30 days?	Individual-Level
			Demographics
			  Gender
			  Age
			  Race
			  Parental education (proxy for SES)
			  Single-parent household
			  Parental attachment
				▪ Six percent of the sample carried a weapon to school during the 30 days prior to the interview
				▪ Gender is the only demographic variable significantly related to weapon-carrying
				▪ Parental and school attachments reduce likelihood

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Authors	Method	Dependent Variable(s)	Independent/Control Variables	Findings
	school-level predictors of in-school weapon carrying		GPA School Suspension Mean School Attachment Mean Fear at School Mean Weapon Victimization Mean Peer Drug Use	of weapon-carrying on school campuses ▪ Being suspended at least one time from school, weapons victimization, and peer drug use all are associated with a positive response to weapon-carrying ▪ School-level predictors exert no significant influence on weapon-carrying

Appendix B. Correlations Tables

A. Student-Level Variables

Variables	1	2	3	4	5	6	7	8
1. Weapon-Carrying, Binary	1							
2. School Connectedness Scale	-.072**	1						
3. Parental Attachment Scale	-.064**	.319**	1					
4. Peer Conflict	.096**	-.251**	-.121**	1				
5. Social Isolation	-.002	-.023**	.010	.007	1			
6. Peer*Isolation	.011	-.072**	-.038**	.224**	.406**	1		
7. Suicide Contemplation	.061**	-.153**	-.269**	.109**	-.014	.023**	1	
8. Suicide Attempts	.061**	-.106**	-.150**	.090**	.009	.031**	.482**	1
9. Delinquency Scale	.247**	-.204**	-.286**	.187**	-.027**	.023**	.235**	.195**
10. Age	-.033**	-.090**	-.170**	-.037**	.004	-.005	.036**	.009
11. Male	.113**	.015	.083**	.029**	.021*	.007	-.100**	-.081**
12. Student Race: White	-.049**	.019*	-.003	.004	-.063**	-.032**	.016	.000
13. Student Race: Black	.027**	-.026**	.034**	.033**	.065**	.051**	-.037**	-.017
14. Student Race: Hispanic	.030**	-.005	-.015	-.030**	.014	-.011	.005	.009
15. Student Race: Other	.008	.010	-.024**	-.017	.002	-.002	.019*	.014
16. Exposure to Violence Scale	.239**	-.149**	-.127**	.175**	.002	.018*	.119**	.133**
17. Gun Accessibility	.059**	-.018*	-.064**	.030**	-.02**3	-.017	.067**	.041**
18. GPA	-.078**	.199**	.139**	-.150**	-.014	-.035**	-.074**	-.063**
19. Alcohol Use Scale	.111**	-.160**	-.238**	.082**	-.050**	-.015	.166**	.124**
20. Drug Use Scale	.084**	-.170**	-.189**	.071**	.003	-.004	.176**	.169**
21. Weapon-Carrying, Wave I	.326**	-.128**	-.146**	.113**	-.007	.015	.128**	.106**
22. Peer deviance scale	.114**	-.204**	-.231**	.096**	-.026**	.003	.169**	.123**

	9	10	11	12	13	14	15	16
9. Delinquency Scale	1							
10. Age	.035**	1						
11. Male	.132**	.053**	1					
12. Student Race: White	-.034**	-.078**	.002	1				
13. Student Race: Black	-.021*	-.017	-.028**	-.552**	1			

14. Student Race: Hispanic	.062**	.079**	.012	-.485**	-.235**	1		
15. Student Race: Other	.008	.056**	.021*	-.328**	-.158**	-.139**	1	
16. Exposure to Violence Scale	.548**	.043**	.208**	-.119**	.063**	.097**	-.010	1
17. Gun Accessibility	.098**	.032**	.135**	.218**	-.112**	-.115**	-.073**	.072**
18. GPA	-.220**	-.125**	-.142**	.133**	-.100**	-.128**	.078**	-.227**
19. Alcohol Use Scale	.399**	.250**	.041**	.082**	-.100**	.037**	-.052**	.248**
20. Drug Use Scale	.386**	.118**	.036**	.044**	-.073**	.035**	-.020*	.253**
21. Weapon-Carrying, Wave I	.420**	.043**	.164**	-.038**	.017	.043**	-.014	.386**
22. Peer deviance scale	.405**	.248**	.040**	.089**	-.088**	.011	-.046**	.302**

	17	18	19	21	21	22
17. Gun Accessibility	1					
18. GPA	.007	1				
19. Alcohol Use Scale	.123**	-.193**	1			
20. Drug Use Scale	.051**	-.170**	.315**	1		
21. Weapon-Carrying, Wave I	.124**	-.141**	.198**	.184**	1	
22. Peer deviance scale	.088**	-.267**	.557**	.393**	.201**	1

*p<.05 **p<.01

B. School-Level Variables

Variables	1	2	3	4	5	6	7	8	9
1. Weapon-Carrying, Binary	1								
2. Low Socioeconomic Status Scale	.315**	1							
3. Heterogeneity Scale	.139	-.003	1						
4. Violent Environment Scale	.541**	.507**	.266**	1					
5. Mean Gun Accessibility	-.269**	-.254**	-.452**	-.351	1				
6. Mean Lethal Expectations	-.019	.126	-.038	.259	.321**	1			
7. Mean School Attachment	-.154	-.073	-.086	-.353	.180*	-.210*	1		
8. School Location: Urban	.219*	.160	.429**	.331	-.266**	-.014	-.016	1	
9. School Location: Suburban	-.132	-.186*	-.225*	-.176	-.027	-.058	-.105	-.731**	1
10. School Location: Rural	-.101	.053	-.244**	-.184	.385**	.100	.170	-.276**	-.454**
11. Urban*Violent Environment	.465**	.220*	.165	.700	-.219**	.166	-.273**	.256**	-.187*
12. Urban*Access to Guns	.094	-.037	.177*	.121	.071	.114	.058	.782**	-.572**
13. Urban*Lethal Expectations	.224*	.153	.428**	.350	-.247**	.037	-.026	.995**	-.728**
14. School Size: Small	.014	.143	-.115	-.101	.190*	-.128	.355**	-.009	-.161
15. School Size: Medium	.019	-.013	-.198*	-.058	.023	-.024	.025	-.183*	.193*
16. School Size: Large	-.033	-.116	.319**	.155	-.197**	.143	-.351**	.206*	-.062
17. Public School	.011	.155	.015	.114	-.009	-.097	-.280**	-.133	.083
18. High School	-.244**	-.080	.032	-.021	.219**	.378**	-.259**	-.011	-.068
19. Teacher Race: White	-.079	-.589**	-.231**	-.343**	.342**	-.076	.022	-.067	-.004
20. Teacher Race: Black	.139	.665**	-.060	.351**	-.228**	.106	-.023	-.021	.048
21. Teacher Race: Other	-.108	-.004	.666**	.047	-.283**	-.058	.003	.214*	-.102
22. Mean Student Race: White	-.363**	-.653**	-.539**	-.596**	.585**	-.108	.128	-.314**	.148
23. Mean Student Race: Black	.225**	.761**	-.138	.431**	-.289**	.131	-.096	.040	.006
24. Mean Student Race: Hispanic	.257**	.093	.871**	.360**	-.426**	-.027	-.030	.489**	-.310**
25. Mean Student Race: Other	.090	-.130	.544**	.094	-.352**	.040	-.105	.005	.084

	10	11	12	13	14	15	16	17	18
10. School Location: Rural	1								
11. Urban*Violent Environment	-.071	1							
12. Urban*Access to Guns	-.216*	-.009	1						
13. Urban*Lethal Expectations	-.274**	.287**	.802**	1					
14. School Size: Small	.239**	-.165	.073	-.014	1				
15. School Size: Medium	-.034	-.052	-.152	-.188*	-.507**	1			
16. School Size: Large	-.181*	.206*	.098	.215*	-.365**	-.617**	1		

17. Public School	.057	.091	-.259**	-.144	-.267**	.082	.155	1	
18. High School	.109	-.036	.080	.010	-.158	-.299**	.467**	-.093	1
19. Teacher Race: White	.094	-.035	.065	.065	.072	-.024	-.039	-.136	.074
20. Teacher Race: Black	-.039	.038	-.095	-.021	-.021	.064	-.050	.153	-.132
21. Teacher Race: Other	-.135	.000	.052	.207*	-.119	-.073	.187*	-.008	.102
22. Mean Student Race: White	.202*	-.266**	.037	-.310**	.118	.049	-.161	-.071	.060
23. Mean Student Race: Black	-.061	.108	-.069	.035	-.012	.069	-.064	.101	-.117
24. Mean Student Race: Hispanic	-.202*	.283**	.195*	.489**	-.125	-.152	.278**	.058	.008
25. Mean Student Race: Other	-.124	.036	-.061	.006	-.125	-.071	.191*	-.164	.117

	19	20	21	22	23	24	25
19. Teacher Race: White	1						
17. Teacher Race: Black	-.906**	1					
18. Teacher Race: Other	-.433**	.012	1				
19. Mean Student Race: White	.747**	-.65**5	-.364**	1			
20. Mean Student Race: Black	-.729**	.849**	-.089	-.719**	1		
21. Mean Student Race: Hispanic	-.158	-.052	.479**	-.524**	-.149	1	
22. Mean Student Race: Other	-.154	-.102	.571**	-.339**	-.119	.268**	1

*p<.05 **p<.01

Appendix C. Scale Descriptions

Level 1

School Connectedness
(In-Home Questionnaire, Wave I, student data)

(Response options for items 1-3: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree)

1. You feel close to people at your school.*
2. You feel like you are part of your school.*
3. You are happy to be at your school.*

(α= 0.772)

Parental Attachment
(In-Home Questionnaire, Wave I, student data)

(Response codes for items 1-5: Not at all, very little, somewhat, quite a bit, very much)

1. Average: How close to you feel to your mother/father?
2. Average: How much do you think your mother/father cares about you?
3. How much do you feel that people in your family understand you?
4. How much do you feel that you and your family have fun together?
5. How much do you feel that your family pays attention to you?

(Response codes for items 6 and 7: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree)

6. Average: Most of the time, your mother/father is warm and loving toward you.
7. Average: Overall, you are satisfied with your relationship with your mother/father.

(α= 0.850)

Delinquent Behavior
(In-Home Questionnaire, Wave I, student data)

(Response options: never, 1 or 2 times, 3 or 4 times, 5 or more times)

1. In the past 12 months, how often did you paint graffiti or signs on someone else's property or in a public place?
2. In the past 12 months, how often did you deliberately damage property that didn't belong to you?
3. In the past 12 months, how often did you lie to your parents or guardians about where you had been or whom you were with?
4. How often did you take something from a store without paying for it?
5. How often did you get into a serious fight?
6. How often did you hurt someone badly enough to need bandages or care from a doctor or nurse?
7. How often did you run away from home?
8. How often did you drive a car without its owner's permission?
9. In the past 12 months, how often did you steal something worth more than $50?
10. How often did you go into a house or building to steal something?
11. How often did you use or threaten to use a weapon to get something from someone?
12. How often did you sell marijuana or other drugs?
13. How often did you steal something worth less than $50?
14. How often were you loud, rowdy, or unruly in a public place?

(α= 0.824)

Exposure to Violence
(In-Home Questionnaire, Wave I, student data)

(Response options for item 1: never, 1 or 2 times, 3 or 4 times, 5 or more times)

1. In the past 12 months, how often did you take part in a fight where a group of your friends was against another group?

(Response options for items 2 through 6: Never, once, more than once)

During the past 12 months, how often did each of the following things happen:
2. You saw someone shoot or stab another person
3. Someone pulled a knife or gun on you.
4. Someone shot you.
5. Someone cut or stabbed you.
6. You were jumped.

(α= .720)

Alcohol Scale
(In-Home Questionnaire, Wave I, student data)

(Response options for item 1: everyday or almost everyday, 3-5 days a week, 2 or 3 days a week, 1 or 2 days a week, once a month or less, 1 or 2 days in the mast 12 months)

1. During the past 12 months, on how many days did you drink alcohol?

(Response options for item 2: no, yes)

2. Have you had a drink of beer, wine, or liquor—not just a sip or a taste of someone else's drink—more than 2 or 3 times in your life??

(α= .788)

Drug Scale
(In-Home Questionnaire, Wave I, student data)

(Response options for items 1-3: never tried [drug], one year, two years, three years, four years, five years, six years, seven years, eight years, nine years, ten years, eleven years, twelve years, thirteen years, fourteen years, fifteen years, sixteen years, seventeen years, eighteen years and older)

1. How old were you when you tried marijuana for the first time? If you never tried marijuana, enter "0".
2. How old were you when you tried any kind of cocaine—including powder, freebase, or crack cocaine-- for the first time? If you never tried cocaine, enter "0".
3. How old were you when you tried any other type of illegal drug, such as LSD, PCP, ecstasy, mushrooms, speed, ice, heroin, or pills, without a doctor's prescription? for the first time? If you never tried any other type of illegal drug, enter "0".

(Responses were open-ended for items 4-6).

4. During the past 30 days, how many times have you used marijuana?
5. During the past 30 days, many times have you used cocaine?
6. During the past 30 days, how many times have you used other illegal drugs?

(α= .688)

Peer Deviance
(In-Home Questionnaire, Wave I, student data)

(Response options for items 1-3: zero friends, one friend, two friends, three friends))

1. Of your 3 best friends, how many smoke at least one cigarette a day?

2. Of your 3 best friends, how many drink alcohol at least once a month?
3. Of your three best friends, how many use marijuana at least once a month?

(α=0.760)

Level 2

Social Disorganization
(Contextual Data, 1990 census)

(The following continuous variables were used to create a low socioeconomic status scale)

1. Proportion persons with income in 1989 below poverty level
2. Proportion family households that are female householder, no husband present, households
3. Unemployment rate
4. Proportion households with public assistance income
5. Proportion of population that is African American

(α=0.932)

(The following continuous variables were used to create a heterogeneity scale)

1. Proportion aged 5 and over in same house as in 1985*
2. Proportion foreign born
3. Proportion Asian or Pacific Islander STF11/STF2
4. Proportion other
5. Proportion Hispanic origin

(α=0.734)

Violent Environment
(In-Home Questionnaire, Wave I, student data)

This scale is computed using the same items as the exposure to violence scale and is aggregate to the school-level. The sample includes all students who completed the in-home survey

(α= 0.722)

Average School Attachment
(In-Home Questionnaire, Wave I, student data)

This scale is computed using the same items as the school connectedness scale and is aggregated to the school-level. The sample includes all students who completed the in-home survey

(α= 0.774)

*indicates reverse coding

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