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## Cross-gender Social Normative Effects for Violence in Middle School: Do Girls Carry a Social Multiplier Effect for At-risk Boys?

Lisa M. Yarnell, PhD<sup>†</sup> [Postdoctoral Research Associate], Keryn E. Pasch, PhD, MPH<sup>††</sup> [Assistant Professor], H. Shelton Brown III, PhD<sup>†,††</sup> [Associate Professor], Cheryl L. Perry, PhD<sup>†††</sup> [Professor and Regional Dean], and Kelli A. Komro, PhD, MPH<sup>††††</sup> [Professor and Associate Director of ICHP]

<sup>†</sup>University of Southern California, Department of Psychology; SGM 826B, Mailroom 501; Los Angeles, CA 90089-1061; Tel. 213-740-0850; Fax. 213-746-9082; lisa.yarnell@usc.edu

<sup>††</sup>Department of Kinesiology and Health Education, University of Texas at Austin; Bellmont Hall Room 514; Austin, TX 78712; Tel. 512-232-8295; Fax: 512-471-3845; kpasch@austin.utexas.edu

<sup>†††</sup>University of Texas School of Public Health, Austin Regional Campus; Division of Management, Policy, and Community Health; University of Texas Administration Building (UTA); 1616 Guadalupe Street, Suite 6.300; Austin, TX 78701; Tel. 512-391-2521; Fax. 512-482-6185; h.shelton.brown@uth.tmc.edu

<sup>††††</sup>University of Texas School of Public Health, Austin Regional Campus; University of Texas Administration Building (UTA); 1616 Guadalupe Street, Suite 6.300; Austin, TX 78701; Tel. 512-391-2536; Fax. 512-482-6185; Cheryl.L.Perry@uth.tmc.edu

<sup>†††††</sup>Department of Health Outcomes and Policy, Institute for Child Health Policy, College of Medicine, University of Florida, Gainesville; 1329 SW 16th Street, Room 5130; P.O. Box 100177; Gainesville, FL 32610-0177; Tel. 352-265-2518; Fax. 352-265-8047; komro@ufl.edu

### Abstract

*A social multiplier effect* is a social interaction in which the behavior of a person in a social network varies with the normative behavior of others in the network, also known as an endogenous interaction. Policies and intervention efforts can harness social multiplier effects because, in theory, interventions on a subset of individuals will have “spillover effects” on other individuals in the network. This study investigates potential social multiplier effects for violence in middle schools, and whether there is evidence for a social multiplier effect transmitted from girls to boys. Three years of longitudinal data (2003–2005) from Project Northland Chicago

Correspondence to: Lisa M. Yarnell.

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### Author Contributions

LMY conceived of the study, conducted the analyses, and created initial drafts of the manuscript. KEP contributed to the literature review and made improvements to the presentation of literature and results. HSB, III contributed to the literature review, contributed Stata code for normative scores and quantile regression, and provided guidance on presentation of quantile regressions. CLP contributed to the literature review and made improvements to the presentation of literature and results. KAK provided initial suggestions for the study, contributed theory on intervention and policy implications, and guidance on the background, organization, and interpretation of the data. All authors have read and approve of this manuscript.

(PNC) were used to investigate this question, with a sample consisting of youth in Grades 6 through 8 in 61 Chicago Public Schools ( $N = 4233$  at Grade 6,  $N = 3771$  at Grade 7, and  $N = 3793$  at Grade 8). The sample was 49.3% female, and primarily African American (41.9%) and Latino/a (28.7%), with smaller proportions of whites (12.9%), Asians (5.2%) and other ethnicities. Results from two sets of regression models estimating the effects of 20<sup>th</sup> (low), 50<sup>th</sup> (average), and 80<sup>th</sup> (high) percentile scores for girls and boys on levels of violence in each gender group revealed evidence for social multiplier effects. Specifically, boys and girls were both influenced by social multiplier effects within their own gender group, and boys were also affected by normative violence scores among girls, typically those of the best-behaved (20<sup>th</sup> percentile) girls. The finding that girls may have positive social influence on boys' levels of violent behavior extends prior findings of beneficial social effects of girls on boys in the domains of education and risky driving. Further, this social normative effect presents a potential opportunity to improve school-based intervention efforts for reducing violence among youth by leveraging girls as carriers of a social multiplier effect for reduced violence in the middle school environmental context, particularly among boys, who are at greater risk.

## Keywords

violence; middle school; social norms; gender

## Introduction

Violence among youth has become a major public health concern, with juvenile violence as the fourth leading cause of fatal injuries among U.S. adolescents aged 10–14 (CDC 2012). The goal of the current study is to inform school-based violence prevention and reduction programs with the most effective and potentially novel approaches in efforts to reduce violence among those most at risk in middle schools, before violence levels increase later in age. Specifically, we focus on the social presence of girls in schools and their potential to influence levels of violence among boys. The social presence of girls has been shown to improve outcomes for boys in several areas of education and behavior. Notably, the proportion of girls at a given grade level has been found to improve the academic achievement of boys, fostered by an improved school climate—one with lower levels of classroom disruption and violence (Lavy & Schlosser 2011). Further, adolescent boys' risk-taking behavior has also been found to be improved at the individual level in the domain of risky driving by the presence of a female passenger in the car (Simons-Morton, Lerner, & Singer 2005; McKenna, Waylen, & Burkes 1998). Given that these findings center upon reductions in boys' violence and risk-taking, we explore in this article whether this influence of girls on boys may extend to interpersonal violence in schools, focusing on a middle school population. Related literature has highlighted the role of social multiplier effects, or influence from the behavior of others in a social network, in the school-based spread of health outcomes including obesity (Fletcher 2007; Christakis & Fowler 2007; Cohen-Cole & Fletcher, 2008). This article represents a novel, though tentative, link between these literatures in suggesting that girls may be leveraged as carriers of a social multiplier effect (hereafter, as “social multipliers”) in schools, promoting lower levels of violence, particularly among boys, who are at greater risk.

## Violence, Gender, and Development

The focus of this study is violence in middle schools. Violence is a subset of behavior under the more general rubric of *aggressiveness*, a category of behavior that causes or threatens physical harm (Loeber & Hay 1997). Aggressive behaviors are developmentally defined, or defined relative to age-typical manifestations ranging in severity from verbal aggression, bullying, and physical fighting to robbery, rape, and homicide. Distinction has been made in the aggressiveness literature between “covert” and “overt” aggression. Covert aggression follows a developmental progression toward *delinquency*, with behavioral manifestations ranging from minor (e.g., lying) to moderate (e.g., property damage) to severe covert behavior (e.g., fraud; see Loeber & Hay 1994). In contrast, overt aggression tends to focus exclusively on harm done to *other persons*, and follows a developmental progression of *violence*, ranging, for example, from bullying to physical fighting to attack. Our interest is violence, as highlighted in middle schools, because it is by definition a more direct, overt threat to the well-being of youth, as opposed to a threat to a nonliving entity, however valued (such as school property).

Middle school is a critical developmental period in study of school-based violence. Trends in the onset of violent behaviors indicate that the prevalence of physical fighting tends to decrease as adolescents gain interpersonal skills. Yet, the prevalence of *serious* acts of violence tends to increase during these years (Loeber & Hay 1997). The age of onset of violent behaviors has been shown to depend on the severity of the act, with physical fighting accelerating from ages 10 onward, followed by more extreme acts of violence accelerating from ages 11 onward. As stated, we limit our study of violence to its manifestations *in school settings*. That is, we do not focus on manifestations of violence seen among a middle school population in other settings, such as in the home (e.g., in conflicts with parents, Loeber & Dishion 1984; or with siblings, Strauss & Gelles 1990), in romantic partnerships (e.g., as with dating violence), or in situations of violence toward one’s own children (as a subset of middle school students become parents themselves). These manifestations are generally not seen in the school setting. This specification centers our study on the school as a social arena where social multiplier effects may be leveraged, as in other studies of social multiplier effects (e.g., Cohen-Cole & Fletcher, 2008).

Middle school is also a critical period for the social processes underlying the spread of school-based violence. The middle school years are a time of increased social comparison and behavioral modeling, and adolescents are thought to observe, bond to, and model their social influences, including the family, the media, and peers (Paek 2008; Spear 2000, Steinberg et al. 2006; Kobus 2003). Peers are often argued to be the one of the most significant social risk factors in health behavior research (e.g., for substance use; Paek 2008). It has been shown that members of social networks in this age group are similar to each other in levels of aggression (Cairns & Cairns 1994), and that group relations may promote violence and delinquency (e.g., Dishion & Tipsord 2011). Although processes of socialization and selection can operate simultaneously and reciprocally between the observer and the observed (Simons-Morton 2007; Ennett & Bauman 1994), some studies have supported the idea of social “contagion” of these behaviors (Keenan, Loeber, Zhang, Stouthamer-Loeber, & Van Kammen 1995; Sijtsema et al. 2009). In fact, two recent

longitudinal investigations of adolescent violence have tested and supported the idea of a “cascade” model for the progression from minor to serious violence, with drift into a deviant peer group a core component of this progression (Dodge, Greenberg, & Malone, 2008; Dishion, Véronneau, & Myers 2010). This highlights what some researchers and theorists have referred to as the “dark side” of friendship (Hartup 1996; Dishion & Tipsord 2011).

In considering gender as a factor in the social multiplier process, it is important to recognize that trajectories toward violent behavior are similar but not identical for boys and girls. Many studies have conceptualized the progression of violent behavior based on male trajectories, and research suggests that females do follow a similar ordering of violent acts, in terms of level of severity, as males (Loeber & Hay 1997). However, girls have been shown to have later ages of onset (though an earlier peak for serious violence, suggesting a steeper desistance rate), as well as a greater proportion of late-onset offenders developing into persistent offenders (e.g. Elliott 1994). Some studies have shown boys to exert more physical aggression than girls in the early school years (Coie & Dodge 1997; Xie, Drabick, & Chen 2011), and to have higher rates of more extreme forms of violence such as carrying guns in high school (O'Donnell 1995). On the other hand, girls have been shown to engage more frequently in verbal and social forms of violence (though these are harmful nonetheless; Nansel et al. 2001; Nishina, Juvonen, & Witkow 2005), including alienation, ostracism, character defamation, peer exclusion, gossip, and collusion (Crick 1995; Crick & Grotpeter, 1995; Coie & Dodge 1997; Crick & Zahn-Waxler 2003; Tackett & Ostrov 2010). Yet, girls may also be more effective in hiding physical aggression from adults than boys are (Pepler & Craig 1995). Literature on the development of violent behavior, including gender-specific studies, is extensive (e.g., Coie & Dodge 1997; Moffitt 1990, 1993; Pennington & Ozonoff 1996; Plomin, Nitz, & Rowe 1990; Raine 1993; Quay 1993; Reiss & Roth 1993; Loeber & Hay 1997; Loeber, Burke, & Pardini 2009; Broidy et al. 2003) and is not attempted to be reviewed in full here.

### Theories of Social Influence

Given the increased social comparison and behavioral modeling that arises in the middle school years (Paek 2008; Spear 2000, Steinberg et al. 2006; Kobus 2003), and the argument that peers are a strong risk (or protective) factor for health-related behaviors (Paek 2008), it is also important to understand the psychological and social mechanisms underlying these phenomena. There are in fact a number of theories that may explain why these processes occur, including social cognitive theory (Bandura 1972), cognitive developmental theory (Bush & Iannotti 1985), social selection theory (Ennett & Bauman 1994; Fisher & Bauman 1988), and integrative transactional theory (Pentz 1999). However, most applicable to our study are social comparison theory (Festinger 1954a, 1954b) and social multiplier theory (Fletcher 2007, 2011; Christakis & Fowler 2007; Rose 1992).

*Social comparison theory* states that the social comparative process, or evaluation of the self through comparison with others, pressures individuals toward uniformity with those others. According to social comparison theory, humans tend to cease comparison with others who are very divergent and to engage in more comparison when a factor has importance and relevance to the self (Festinger 1954a, 1954b). An added *generality of similarity schema*

states that people who are alike in one way also tend to be alike in other ways (such as being a boy *and* being violent), and that greater similarity between the observer and the observed increases imitation (Stotland & Canon 1972). Social comparison theory thus suggests a personalized, thoughtful process with a central role for important aspects of the “self” (such as gender identity) and self-related emotions (such as pride or embarrassment in social situations in schools). Social comparison theory seems in this sense more applicable than social contagion theory, which does not highlight an individualized process, but instead posits a more passive process in which thought and behavior is spread from one person to an entire *group* of people. This group is thought to focus their collective attention on the same person, object, or event; and to lose self-consciousness, ceasing to think before acting (Locher 2002). For instance, social contagion theory would suggest that boys and girls both focus on the same groups of influential peers in determining their behavior and are not at all conscious of this process. However, given extensive literature on the centrality of the self and identity in the middle school years, including the thought and even rumination involved in adolescents’ consideration of their behavior in various social domains (e.g., “how I am with my peers” vs. “how I am with my parents”; Harter, Bresnick, Bouchey, & Whitesell, 1997), it is more plausible to utilize a theory suggesting an active, self-reflective process in studying the behavioral choices of middle school students.

Recent health literature has additionally focused on a related branch of theory that discusses the role of social multiplier effects in the spread of behaviors in a social network. A *social multiplier effect* occurs when there are endogenous interactions among persons in a network, such that the behavior of persons in this network covaries with the behavior of influential others (Fletcher 2007). Interventions can thus concentrate on the influential persons in the network because changes in their normative behaviors will have “spillover effects” on other individuals in the network, thus increasing the effectiveness, and perhaps reducing the cost, of health intervention efforts. For instance, recent research on obesity has suggested that young people’s social networks may be harnessed for social multiplier effects, so that the benefits of obesity prevention efforts can extend beyond the primary target of the intervention (Cohen-Cole & Fletcher, 2008; Christakis & Fowler 2007; see also Rose 1992). A similar strategy may be implemented for the prevention of violence among youth, particularly boys, if the persons who are influential with regard to violent behavior in a school-based network (the “social multipliers”) can be identified. The social influence of these persons may be unintended or passive (i.e., simply because they are observed) or intentional and active (i.e., if these persons encourage or even demand certain behavior from others), or it may lie somewhere along this continuum. In fact, if interventions are to harness social multipliers to reduce levels of violence in middle schools, they might be encouraged to exert their influence in intentional, active ways, such as in peer leader programs, as we subsequently describe. Further, the magnitude of this potential influence may be modified by any number of factors, such as the popularity, social status, attractiveness, or social connectedness of these influential persons. This slew of potential moderators of the social multiplier process is beyond the scope of the current study, which represents an initial examination of social multiplier effects within and across gender groups in middle schools; though it will indeed be important to later investigate these modifying factors.

## Social Influences on Violence in Schools

In identifying which persons in school-based social networks may carry the most potent social multiplier effects for violent and nonviolent behaviors, so that their influence may be leveraged in social multiplier-based intervention efforts, it is important to consider all potential subgroups of students in their influence on each other, including those that may be overlooked. First, we may divide these students by gender. Second, we may divide them according to high, medium (average), and low levels of violence. Social comparison theory's "similarity of other" schema (Stotland & Canon 1972) would suggest that "like influences like." That is, according to theory, boys should be most strongly influenced by other boys, and girls by other girls. The most violent students could also have the strongest influence on others who are already engaging in some violent behaviors, and relatively weaker influence on students who are not. However, social influence may operate in ways contrary to traditional social comparison theory, and consideration of multiple aspects of social influence that may be at play is warranted, including how these may operate simultaneously or in competition with each other.

For instance, boys may be the most influential on all targets, regardless of gender, because they tend to engage in higher levels of violence (O'Donnell 1995; Loeber & Hay 1997; Stoltz 2005; Hill & Drolet 1999) and thus may be most noticeable to all students. Boys may also be the most noticeable to other boys (those most at risk) simply because social networks at the middle school age are largely gender-segregated (Cairns & Kroll 1994; Fagot & Rodgers 1998; Maccoby 1990; Poulin & Pedersen 2007), so that boys are in closer contact with other boys. Yet, boys may also be the most potent social multiplier for girl targets because in mixed-gender groups, boys are typically more able to influence girls than the reverse (Jacklin & Maccoby 1978; Maccoby 1990; Serbin, Sprafkin, Elman, & Doyle 1982). (Though, it is notable that this body of research has generally focused on play situations among younger children, prior to middle school.) However, the higher levels of violence among boys may not carry the most influence if better, non-violent, behavior is rewarded socially, or even highlighted visibly in the classroom (e.g., pointed out or given verbal praise from teachers, as part of classroom management; Schindler 2010).

On the other hand, girls have been found to have positive social effects on boys in the domains of education and risky driving, as mentioned. While these domains are markedly different, effects in both domains reflect, or occur through, reductions in violent, disruptive, or extreme behavior. Specifically, research has shown that the proportion of girls at the grade level is associated with academic gains among boys. This effect has held in Israeli elementary and middle schools in terms of grades in English, Hebrew, math, and science; and in Israeli high schools in terms of matriculation exam scores (Lavy & Schlosser 2011). This effect has also been found in Texas elementary schools in terms of math scores (Hoxby 2000). These educational benefits have been attributed to a reduction in classroom disruption and violence seen when girls constitute a higher proportion of the student population (Lavy & Schlosser 2011). This calmer and safer school environment is, in turn, associated with improved inter-student and student-teacher relationships and reduced teachers' fatigue, which foster learning (Figlio 2007; Kinsler 2007). Lavy and Schlosser point out that these effects are mostly due to compositional change of the classroom at the



aggregate level rather than changes in boys' individual levels of violent or disruptive behavior per se. However, it is an open question whether, in more direct tests of effects of low, average, and high levels of girls' violence in schools, effects on individual boys may be found.

In support of such individual-level effects are findings that young male drivers are less likely to engage in risky driving behavior, including speeding and short gap distance, when a female passenger is in the car; a male passenger, on the other hand, tends to only heighten their risky driving (Simons-Morton et al. 2005; McKenna et al. 1998). Theoretically, male drivers may drive more carefully if they perceive that the passenger would view this behavior as more desirable or expected; or, female passengers may actively request or demand this less risky driving from the male drivers. Male drivers may also perceive female passengers to be attractive, as increased attraction to a passenger has been associated with reduction in vehicle velocity as focus on the roadway is reduced (White & Caird 2010). The exact mechanism underlying this effect is unknown—whether it is again an instance of the female passenger modifying the climate or environment of the car, or if it is to be thought of as females modeling (verbally) what proper or acceptable driving behavior is like. Regardless, the effect is a reduction in the level of risky behavior enacted by the male driver, at the individual level. Again, it is acknowledged that these domains (academics and driving) are quite different, and different still from a specific focus on violence. However, the positive social effects of girls on boys may be broader or more encompassing than has yet been recognized.

Whether positive effects of girls on boys will be found in more direct tests of social influence on violent behavior in middle schools is the question at hand. Importantly, we test this question using a type of regression that focuses on changes at the *individual level*, while removing school-level effects that are constant over time, such as general school climate. Implications of invoking these potential girl-to-boy social effects in the domain of violence at the middle school age are subsequently discussed, including with regard to the dynamics of gender-based violence at this age, and the feasibility of boys modeling girls' behaviors in specific school contexts, such as the urban school context.

## The Current Study: Girls as Social Multipliers for Lower Violence

In this study, we examine how levels of violence among subgroups of middle school boys and girls affect the violence levels of other boys and girls. We take a nuanced approach to the identification of the most potent social multipliers, including the examination of potentially overlooked effects. We do this by considering effects of boy and girl subgroups first within, then across, gender groups; and further, investigate the effects of three levels of violence (low, average, and high) in each set of models. As mentioned, these effects may operate simultaneously or in competition with each other (e.g., competing influences of boys and girls in the same classroom, or competing influences of good and bad behavior of others, which may both be noticeable to an observer). Last, we consider whether these effects hold for those students arguably most at risk—those in the middle and upper ends of the violence distribution for each gender.

We consider these effects as specific to each school, given that “low,” “average,” and “high” violence are relative terms. We are also interested in the school as a social arena—the arena in which a social multiplier intervention strategy may be implemented. The low, average, and high norms for violence for each gender in each school define what a student of that gender is like, in a specific school, with regard to their level of violent behavior. We define low, average, and high violence using percentiles (20<sup>th</sup>, 50<sup>th</sup>, and 80<sup>th</sup> percentiles) calculated accordingly—by gender, school, and grade level. For instance, a student is at the 80<sup>th</sup> percentile for violence for his gender, school, and grade if his measured level of violence is greater than that of 80% of other boys in his grade and school (Chen 2005).

Using grade-level norms within schools is more appropriate than using classroom norms because in middle school, students are known to spend a smaller portion of the school day with their homeroom class (Lavy & Schlosser 2011). Using grade norms is also arguably more appropriate than using friendship-based norms, even if effects may be stronger for proximal others, because even those who are not close friends are observed. Using grade norms also sidesteps issues of endogeneity and selection inherent in using classroom- or friend-based norms, given that classrooms and friends may be chosen or assigned by parents, teachers, or students themselves. Finally, grade-level norms are more feasibly measured than friendship-based norms, which typically involve friendship nomination tasks, which can be intrusive, time-consuming or taxing for research participants.

Our main hypothesis is that the middle school environment is an apt setting for the social contagion of behaviors, and that the positive influence of girls on boys’ behavior that has been found in several studies to date may represent an important, and as of yet overlooked, component of school-based strategies for preventing and reducing violence, particularly among boys. Our specific hypotheses for investigation are as follow.

First (1), we expected higher mean levels of violence for boys relative to girls at all grades of middle school, in accord with the literature consistently reporting that boys tend to have higher levels of violence compared to girls (e.g., Stoltz 2005; Hill & Drolet 1999; Kenway & Fitzclarence 1997; Xie et al. 2011; Broidy et al. 2003). Whether means would increase with each progressive grade was an open question because literature has suggested increases in *extremity* of violent acts across the middle school years (Dishion & Tipsord 2011; Loeber & Hay 1997), but not necessarily increases in *frequency*, which is assessed here.

Second (2), we expected effects of both high-violence (80<sup>th</sup> percentile) and low-violence (20<sup>th</sup> percentile) youth on the violence scores of same-gender peers at the grade level, for distinct theoretical reasons. While the behaviors of high-violence youth may be the most directly observable (i.e., more extreme, or more frequently enacted), the behaviors of low-violence youth may be highlighted as “model behavior” (Schindler 2010) by teachers, or may be the source of other social benefits such as having more friends, and hence also noticeable. We expect that these effects from high- and low-violence persons occur simultaneously and uniquely in a middle school environment, and do not “cancel each other out” in statistical models of effects on individual student behavior.



Third (3), we expected to find cross-gender (girl-to-boy) effects, with lower violence levels of girls in a given school associated with lower levels of violence among individual boys. This hypothesis is based on several findings in the literature of girls' beneficial social influence on boys, particularly in the domains of risky driving (Simons-Morton et al. 2005; McKenna et al. 1998; White & Caird 2010) and academic achievement, as occurring through reductions in disruptions and violence in the school environment (Lavy & Schlosser 2011; Hoxby 2000). This hypothesis is considered exploratory given that these are varied domains of adolescent behavior, and no statement is made here about the potential mechanisms underlying this effect (e.g., attraction to girls, popularity, etc.). However, given several findings of girls' positive influence, and the common theme of improvements in levels of extreme or risky behavior, this hypothesis focuses on a potentially important, and to date untapped, component of intervention efforts to prevent and reduce violence in schools. Further, we tentatively hypothesized that this effect would hold even among the most at risk groups (those in the middle and upper portions of the violence distribution among boys.)

## Method

### Participants

Data were drawn from the Project Northland Chicago (PNC), a longitudinal, group-randomized controlled trial of alcohol use prevention among students in Grades 6 through 8, which also contains data on violence, delinquency, and other risk-related variables.<sup>1</sup> The data were collected via self-report questionnaires in the fall of 2002, and the spring of 2003, 2004, and 2005. Student participants were sampled from 61 Chicago Public Schools (CPS) that were selected from a list of all CPS that included grades 5 through 8, had low mobility rates (less than 25%), and were larger in size (at least 30 students per grade; Komro et al. 2004, 2006; Komro, Maldonado-Molina, Tobler, Bonds, & Muller 2009). We obtained IRB approval for use of these data from the University of Texas Health Sciences Center at Houston Committee for the Protection of Human Subjects.

We utilize the latter three time points of the data (those collected in spring) to control by design for the effect of being tested at the beginning versus end of the school year. This is important because the first measurement (fall of Grade 6) captures outcomes just after a return from summer break, rather than after an entire year observing the violent and nonviolent behavior of peers. The PNC sample consisted of 4259 students at baseline, 4240 at the second time point, 3778 at the third, and 3802 at the fourth. We utilize cases for which there were violence total scores (described subsequently) at the second through fourth time points, for an analytic sample of  $N = 4233$  at Grade 6,  $N = 3771$  at Grade 7, and  $N = 3793$  at Grade 8 (99.8% of the total data at each time point). At Grade 6, our sample was 41.9% African American, 28.7% Latino/a, 12.9% white, 5.2% Asian, .8% Native American, and

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<sup>1</sup>Assignment to intervention or control condition in PNC was at the neighborhood level (groups of schools), and interventions lasted all three middle school years. However, there was no effect of the intervention on alcohol use, drug use, or any hypothesized mediating factors, such that the intervention was rendered ineffective (Komro et al., 2008). It is possible that the intervention had carry-over effects on levels of violence among students, though this was unintended by the design; however, as mentioned, we utilize a regression model that parses changes at the individual level from effects that are constant over time, such as intervention versus control condition, thus removing from our estimates any effect of assignment to treatment or control condition.

9.7% other (with the remaining .8% not reporting ethnicity data); and was 49.3% female. At Grade 6, 20.1% of the sample reported speaking Spanish at home and 8.0% reported speaking a language than Spanish or English at home. Sixty-six percent (66%) were eligible for free or reduced lunch.

Logistic regressions predicting missingness of violence scores at each utilized time point (1 = missing, 0 = present) revealed that African American students were more likely than youth of other ethnic backgrounds to be missing their violence score ( $p < .001$  at all three grades), as were Native American students ( $p < .01$  at Grades 6 and 7,  $p < .001$  at Grade 8). Those who spoke Spanish at home were less likely to be missing their violence score at Grade 6 ( $p < .001$ ), Grade 7 ( $p < .01$ ), and Grade 8 ( $p < .001$ ). Importantly, students with higher levels of violence were more likely to be missing their violence score at the subsequent time point ( $p < .001$  at Grade 6;  $p < .001$  at Grade 7;  $p = .10$  at Grade 8). This suggests that higher-violence students may be more likely to be absent from school or less inclined to participate in reporting their violent behavior, which presents the potential for somewhat biased results. According to Schafer and Graham (2002), departures from missing at random (MAR) are to be expected, but these departures are rarely serious enough in the social sciences to expect MAR-based analyses, such as those in this study, to be degraded (Graham, Hofer, Donaldson, MacKinnon, & Schafer, 1997; Collins, Schafer, & Kam, 2001).<sup>2</sup> By default, Stata assumes missing at random and deletes observations with one or more missing values. The slightly shifting sample by year for each gender group obviates clear statements of exact rates of missingness, but each gender group had an average of 2.1 observations per person in our main regression models.

## Measures

**Demographic variables**—To describe our sample and run regressions separately by gender, we utilized a dummy variable marking gender (0 = male, 1 = female). We also utilized dummy variables for whether Spanish or another language (each coded 0 = no, 1 = yes) was spoken at home at each wave. Note that while gender is time-invariant, language is not, due to acculturative processes.

**Grade variables**—We also created two effect-coded dummy variables, Seventh and Eighth, to be included as predictors in our fixed effects panel models. These were coded to reflect whether the participant had reached the indicated grade (0 = no, 1 = yes). Thus, students had a 0 on both variables at Grade 6, a 1 on Seventh only at Grade 7, and a 1 on both Seventh and Eighth at Grade 8. In a panel model, this coding decomposes any growth (or change) in the dependent variable into growth/change seen by Grade 7, and growth/change seen by Grade 8 above and beyond the growth/change by Grade 7. Interactions between centered versions of these dummies and centered versions of other variables reflect the moderated effect of those other variables by grade level, as a measure of time. That is, a

<sup>2</sup>For instance, Schafer and colleagues argue that in the social sciences, it is unlikely that missingness related to the variable at hand occurs at a sharp cutoff the way it may in the natural sciences, but more than likely is related in a gradually increasing or decreasing (curvilinear) fashion, such the relationship between the score and missingness is weak. Further, in social sciences research, attrition or nonparticipation is likely due to several causes (i.e., not exclusively caused by higher levels of the variable at hand). Given these rationales, we felt comfortable with an assumption of MAR for our modeling in Stata.

significant interaction involving the grade dummies would indicate that an effect had a stronger effect at one year of middle school than another.

**Violence**—We constructed our Violence scale using 13 PNC items measuring aggressiveness, delineated in PNC protocol as reflecting either violence or delinquency: stolen something from a store; skipped school; done poorly on test or school project; been in trouble for not following school rules; had detention; trouble with parent; trouble with police; damaged property; called someone a name to their face; told someone you'd beat them up; pushed, pulled, or grabbed someone; kicked, hit, or beat someone; and been in a fight between groups. Responses indicated self-reported occurrence in the past month (1 = never, 2 = 1–3 times, 3 = 4 or more times). To determine whether these items factored into the two theoretical subtypes of aggressiveness in the current sample, we conducted exploratory factor analyses (EFAs) separately by year. A two-factor solution was supported for each year of the data, particularly so for the latter years; specifically, fit was improved for the two-factor solution relative to the one-factor solution for CFI and TLI indices, and most dramatically for the RMSEA (.08 vs. .05 at Grade 6, .10 vs. .06 at Grade 7, .11 vs. .06 at Grade 8; see rules of thumb in Browne & Cudeck 1993). Further, the two-factor solution showed a clear pattern of loadings at each wave that aligned with Loeber and Hay's (1994, 1997) distinction between overt (violent) and covert (delinquent) aggressiveness. After dropping one item with low loadings on either factor ("done poorly on test or school project," which could relate to cognitive difficulty, attention problems, or illness rather than delinquency or violence), items loaded at .3 or higher on one of the two factors. The first was interpreted to be a Violence factor and contained only items that reflected overt behaviors that cause or threaten potential physical harm to others (called someone a name to their face; told someone you'd beat them up; pushed, pulled, or grabbed someone; kicked, hit, or beat someone; and been in a fight between groups). The second was interpreted to be a Delinquency factor and contained items that reflected harm done to physical objects or the breaking of rules (damaged property; stolen something from a store; skipped school; been in trouble for not following school rules; had detention; trouble with parent; trouble with police). The five violence items showed good internal consistency at all three grades ( $\alpha = .86$  for boys and  $\alpha = .87$  for girls at Grade 6;  $\alpha = .83$  for boys and  $\alpha = .85$  for girls at Grade 7; and  $\alpha = .84$  for boys and  $\alpha = .85$  for girls at Grade 8). Note that while the first violence item (called someone a name to their face) is not an explicit threat of harm, it can be thought of a precursor of such an act of harm to another person.

We then created Violence total scores by summing responses at each grade. When two or fewer items were missing, we imputed the individual's mode response for the other items at that year (with mode preferred over the mean, given the categorical nature of the scale). Higher modes were imputed in the case of ties. When at least half of the scale items were missing, the total score was considered missing. Violence total scores were normally distributed with good skew (range from  $-.06$  to  $.27$ ) and kurtosis (range from  $-1.17$  to  $-1.07$ ) statistics for both genders at all three grades. All observations fell within two *SDs* of the mean for each grade and gender, indicating that there were no outlier scores for the violence variable.

**Calculation of and school- and gender-norms for Violence**—Finally, we calculated 20<sup>th</sup> (low), 50<sup>th</sup> (average), and 80<sup>th</sup> (high) percentile scores for each gender, school, and grade using the Violence total scores. In calculating the scores for each individual, we omitted that individual. This is one way to mitigate the reflection problem, which occurs when aggregate data measures are influenced by the individual in question (Manski 1993; Angrist & Pischke 2009). This also makes the scores specific to each student rather than school-level variables in the strictest sense, permitting a person-level model. That is, the scores will be more similar within schools than across, and more similar within a given grade and gender group, yet show variance across persons in each cross-section of these three grouping variables, due to the omission of each person's score in the realization of this variable for him or her. Prior analysis of the PNC data (K. A. Komro, personal communication, October 31, 2012) has shown very minimal clustering and no difference in results when clustering of students into schools is taken into account. This suggests that within-school variation on the risk outcomes measured in PNC constitutes a considerable proportion of the overall variation in scores, and enables us to concentrate our analyses on person-level modeling, in accord with this method for calculating the violence scores.

## Analyses

After preparing the data using SAS Version 9, we conducted analyses using Stata Version 12. We examined our hypotheses using three sets of analyses: *t*-tests, fixed effects panel regression models, and quantile regression models.

***t*-tests**—To test our first hypothesis, we ran a series of independent *t*-tests across gender, by grade; followed by paired *t*-tests across grades, by gender. These tests examined whether, at each grade level, there were differences in the Violence total scores across gender groups; and whether there were changes in the levels of Violence from year to year, within each gender group, respectively.

**Fixed effects panel regression models**—To test our second and third hypotheses concerning which subgroups of boys and girls (those with low, average, or high violence) had the strongest effects within and across gender groups, we ran a series fixed effects panel regression models. A *panel model* nests observations within units (here, time points within persons). The *fixed effects* variant includes only characteristics of the unit at hand (here, the person) that vary across levels of the panel unit (across time) in estimating effects of independent variables on the dependent variable (i.e., our models include only characteristics of persons that vary over time). Effects of characteristics that are constant across levels of the panel unit (time-*invariant* characteristics) are relegated to the error term and are understood to be “differenced out” (Baum 2006; Rodríguez & Elo 2003), such that any changes in the dependent variable are due to changes in the included (time-varying) independent variables (Stock & Watson 2003). This makes the model powerful to detect the influence of social norms, which change over time, on violence, while removing effects of any fixed time-invariant characteristics that may “muddy” the estimates, such as temperamental tendencies toward deviance, poor parental support at home, or school climate variables that are more or less constant over time. These parceled effects need not be

explicitly specified, as *all* fixed (time-invariant) characteristics are understood to be removed from the estimated effects. The form of the model is:

$$Y_{it} = \beta_1 X_{it} + \dots + \beta_j X_{it} + \alpha_i + u_{it}$$

where  $i$  = individual and  $t$  = time,  $Y_{it}$  is the dependent variable,  $X_{it}$  represents one independent variable,  $\beta_1$  and  $\beta_j$  are coefficients for the first through  $j^{\text{th}}$  independent variables,  $\alpha_i$  ( $i = 1$  to  $n$ ) is the unknown intercept for each individual, and  $u_{it}$  is the error term (Torres-Reyna 2008).

We ran three fixed effects panel regression models for each gender, for a total of six fixed effects models. Model 1 for each gender included only same-gender violence norms (low, average, and high), in addition to other time-varying covariates (Spanish Language, Other Language, and the Seventh and Eighth effect-coded dummy variables). In Model 2, we added cross-gender violence norms. Finally, in Model 3, we entered interaction terms between centered versions of the violence norm variables and the Seventh and Eighth dummy variables to reveal any potential moderation of these effects by grade (time). As an additional step, we also tested whether any effects uncovered by these models were sensitive to weighting (multiplying) the violence norms by number of boys or girls in the grade and school (i.e., number of persons used in determining the norm) or proportion of the grade comprised by boys or girls (i.e., proportion of persons of the specified gender used in determining the norm).

Running the models separately by gender characterizes them as fully interacted models, in which each predictor is free to have unique effects for each gender group, rather than being constrained across the gender groups; and each variable is further permitted to have a unique variance and covariance with other variables in the model. This is important because literature has shown males and females to have varying trajectories for violence, in terms of onset and speed of progression (e.g., Elliott 1994); hence any two-way interactions between violence norms and the grade dummy variables may be expected to differ across gender groups. The differing effects of these two-way interactions would be more difficult to detect in a model run across gender, which would capture these effects in three-way interactions;<sup>3</sup> specifically, any significance of three-way interactions would be harder to detect due to diminished power and the removal of variance explained by the multiple two-way component terms (Keith 2006). Given the benefits of greater flexibility, power, and parsimony, we present results of the more nuanced, fully interacted models run separately by gender.

**Quantile regression models**—Last, to examine whether any effects of the violence norms, particularly the hypothesized effects of girls' violence norms on the violence levels

<sup>3</sup>As a statistical note, three-way interactions are more difficult to detect because the unreliability of interaction terms is a product of the unreliability of its component terms. Three-way interactions are thus laden with measurement error, reducing the statistical power to detect a significant interaction (Aiken & West 1991). Further, research has suggested that when the assumption of homogeneity of error variances across groups is violated (as may be the case if our regression model fit better for one gender than the other), the power to detect significant interactions varies considerably (Keith 2006). In fact, we did run preliminary models across gender groups, including all possible two-way and three-way interaction terms, and found that none of these interactions were significant. However, because of the reasons stated here, we present in our text the results of the more powerful, flexible, and nuanced models run in each gender group.

of boys, held for the most at-risk groups of boys (those in the middle and upper portions of the boys' violence distribution), we ran a series of quantile regression models, which focus on effects for unique portions of the  $Y$  (dependent variable) distribution. A full explanation of quantile regression is elsewhere (e.g., Chen 2005), but briefly, it is a method particularly useful when a researcher hypothesizes that the relationship between the  $X$  covariates and  $Y$  may depend on the quantile of  $Y$ . "Quantile" is a more encompassing term than "percentile," and can refer to any number of divisions in a distribution of scores.

Whereas ordinary least squares (OLS) regression models the relationship between a set of  $X$  covariates and the conditional *mean* for a response variable  $Y$  given  $X = x$ , quantile regression models the relationship between the set of  $X$  covariates and the conditional *quantile* for the response variable  $Y$  given  $X = x$ . In OLS, beta weights are determined to minimize the sum of squared residuals about the regression line; in the most straightforward application of quantile regression, median regression (a quantile regression estimated at the 50<sup>th</sup> quantile), beta weights are determined to minimize the sum of *absolute* residuals about the regression line. Adjustments to these calculations are made to estimate the beta weights at other quantiles.

Quantile regression is useful for our question of whether uncovered effects of the violence norms hold for select portions of the boys' distribution because we are interested in those boys who are most at-risk. In our quantile regression models, the independent variables ( $X$  variables or predictors) of interest are the 20<sup>th</sup>, 50<sup>th</sup>, and 80<sup>th</sup> percentile normative scores. These predictors may have differential impact for boys in the middle and upper portions of the distribution for boys' individual violence scores (the  $Y$  outcome variable), as reflected in results of quantile regressions specified to minimize residuals as stated above, for the 50<sup>th</sup> and 80<sup>th</sup> quantiles of  $Y$ , respectively. Specifically, if social comparison theory's "similarity of other" schema holds true, then we may expect the 80<sup>th</sup> percentile normative score to have a stronger effect on those in the right tail of the distribution (those at the 80<sup>th</sup> quantile of  $Y$ ), relative to those in the middle (those at the 50<sup>th</sup> quantile), because of similarity on this characteristic. On the other hand, effects may manifest in ways that are contrary to theory. We ran these quantile regressions separately by grade because quantile regression is typically a cross-sectional model. This is also appropriate for our analyses because a middle school student's violence percentile changes by year. These cross-sectional models are hence fully interacted not only by gender but by grade, such that no interactions with time dummy variables are needed.

## Results

### *t*-tests

Table 1 shows means and standard deviations for the Violence total scores among individual students, and for the normative Violence scores among schools. These are shown by grade and gender. Boys' individual violence total scores were consistently higher than those for girls,  $t(4231) = 4.72, p < .001$  at Grade 6;  $t(3769) = 2.87, p < .01$  at Grade 7; and  $t(3791) = 2.68, p < .01$  at Grade 8. This provides support for our first hypothesis that boys would show higher violence scores on average, relative to girls, at all three grades. Normative scores for



the 50<sup>th</sup> and 80<sup>th</sup> percentiles were also higher for boys than for girls at all grades, and were higher for the 20<sup>th</sup> percentile at Grades 6 and 7 only.

For both boys and girls, Violence scores increased between Grades 6 and 7, paired  $t(1525) = 8.74, p < .001$  for boys; and paired  $t(1477) = 10.93, p < .001$  for girls. However, Violence scores did not significantly increase between Grades 7 and 8, paired  $t(1594) = 1.86, p = .06$  for boys; and paired  $t(1563) = 1.01, p = .31$  for girls. Pooled across both genders, however, both transitions were marked by significant increase in Violence total scores, paired  $t(3003) = 13.84, p = .001$  for Grade 6 to Grade 7; and paired  $t(1563) = 2.06, p < .05$  for Grade 7 to Grade 8. Overall, these trends in means suggest that in the current sample, greater growth in violence occurred toward the beginning of the middle school years than toward the end.

### Fixed Effects Panel Regression Models

Table 2 shows results for Models 1 and 2 of our fixed effects panel models, in which social multiplier effects from the same gender, then from the opposite gender, were added in unique blocks. Model 3 interaction terms involving the Seventh and Eighth grade dummy variables were never significant, reflecting no moderation of effects by grade (time), and are not presented here.

**Model 1: Within-gender effects**—Considering effects only from one's own gender group, higher 80<sup>th</sup> percentile terms were associated with higher individual Violence total scores among both boys and girls,  $b = .18, p < .01$  for boys; and  $b = .10, p < .05$  for girls. Higher 50<sup>th</sup> percentile terms were also associated with higher individual Violence total scores among girls only,  $b = .14, p < .01$ . However, within-gender effects of the 20<sup>th</sup> percentile terms were not significant for either group. This provides only partial support for our second hypothesis, in which we expected significant effects of both high and low violence norms. The significant, positive value for the Seventh grade term for both boys and girls indicated growth in both groups' Violence total scores between Grade 6 and Grade 7 (both  $ps < .001$ ). The Eighth grade term was not significant above and beyond the effect of the Seventh grade term for boys ( $p = .26$ ) or girls ( $p = .66$ ). This is in accord with the trends seen in Table 1, which indicated significant growth between Grade 6 and Grade 7, but no significant growth between Grade 7 and Grade 8, in analyses conducted separately by gender.

**Model 2: Cross-gender effects**—When cross-gender effects were added in Model 2, the effect of the 80<sup>th</sup> percentile term for boys on other boys was reduced in significance to  $b = .13, p < .05$ , though this was not a significant drop in the beta weight,  $t = .59, p = .56$ . However, Model 2 revealed that boys' Violence scores were also significantly influenced by the 20<sup>th</sup> percentile term for girls,  $b = .14, p < .05$ . The positive direction of this effect means that in schools in which the best-behaved or low-violence girls are relatively higher in violence compared to other schools, boys' individual Violence scores also tend to be higher (or that when these norms are lower, boys' individual scores will be lower). Moreover, this effect was equal in impact to the effect seen from high-violence boys,  $b = .13, p < .05$ . Note that the other two girl violence percentile terms (50<sup>th</sup> and 80<sup>th</sup> percentile terms) did not significantly influence the Violence scores of boys. This means that the effect of girls on

boys is nuanced rather than generalized (i.e., it is due to the behavior of best-behaved girls only). No cross-gender effects emerged for girls, and the impact of the same-gender 50<sup>th</sup> and 80<sup>th</sup> percentile terms remained similar in size. The same trends for the time dummies were found as in Model 1. These results provide support for our third hypothesis, in which we expected boys' levels of violence to be significantly improved in school contexts where girls' levels of violence were lower; specifically, this effect occurred through the best-behaved girls, or when the "best-behaved" girls had even better behavior than the "best-behaved" girls in other schools.

**Sensitivity analyses**—Our sensitivity analyses for these models revealed that these effects were robust to the weighting of the violence norm variables by either number or proportion of boys/girls in the grade and school. Specifically, in the full model run weighting the violence norm variables by number of boys or girls used in calculating the norm, 20<sup>th</sup> percentile girls showed the same positive effect on boys' individual violence scores ( $p = .06$ ), along with the continued effect of the 80<sup>th</sup> percentile norm among boys on their own group ( $p = .09$ ), though both effects were marginally significant. Using this specification of weights, there continued to be no similar cross-gender effect of any the boy norms scores on girls' individual violence (all  $ps > .34$ ), but only the continued effect of the 50<sup>th</sup> and 80<sup>th</sup> percentile norms among girls on their own group ( $p < .05$  and  $p = .08$ , respectively). In weighting the norms by proportions, similar effects were found ( $p < .05$  for the effect of 20<sup>th</sup> percentile norm among girls on boys' scores; no similar effect of boy norms on girls' scores, all  $p > .17$ ).

### Quantile Regression Models

**Effects among boys**—Table 3 shows the effects of 20<sup>th</sup>, 50<sup>th</sup>, and 80<sup>th</sup> percentile terms on scores among boys in the middle and upper portions of the overall boys' distribution at each grade level, revealing whether effects uncovered by previous models held for the most at-risk portions of the violence distribution. Trends across the grades of middle school reveal a shift from boys being influenced by their *own* gender group at Grade 6 (with higher boy normative scores associated with higher levels of violence) to being influenced by the *opposite* gender group at Grades 7 and 8 (again seen in positive associations). As seen for the fixed effects models, these effects came mostly from the best-behaved (20<sup>th</sup> percentile) girls. While this effect was marked for both middle- and extreme-violence boys at Grade 7, it diminished by Grade 8 for the most extremely violent boys, who appear to be "unreachable" from social influence by *any* school-based norms.

**Effects among girls**—Table 4 shows parallel results among girls. Most often, social influence from their own gender came from the scores of girls at the 50<sup>th</sup> percentile. Girls were not influenced by the behavior of the best-behaved (20<sup>th</sup> percentile) boys, but they were also influenced by boys with median and extreme levels of violence in their schools. All effects were in a positive direction, meaning that when these normative scores were higher, this was associated with higher violence levels for the indicated portion of girls. Similar to boys, the most extremely violent girls were unreachable by social normative influence by Grade 8.

For girls, there was also a consistent, negative effect of speaking Spanish or another language other than English at home on the violence scores of girls in both the middle and upper tail of the girl violence distribution, suggesting a harmful effect of acculturation (or a protective effect of lack of acculturation) on girls' levels of violence. These effects were not found for boys (see Table 3), and were not found for the Spanish term in the fixed effects model (see Table 2). Overall, results of these quantile models bolster the findings of our fixed effects models in that they show that the beneficial effect of attending a school with well-behaved girls is associated with lower violence scores among both median and high-risk boys—though this effect disappears for the most extremely violent boys at Grade 8.

## Discussion

This article focused on violence among youth, specifically violence seen in the middle school years, given that this is a sensitive period in the development of violent behaviors and for the processes of social influence that propagate the spread of violence among youth. This is an important problem to tackle because juvenile violence is currently of increasing public health concern (CDC 2012). We offered a novel link with regard to this public health issue, suggesting that an opportunity for improved intervention design lies in the connection between findings of positive social influence of girls on boys (e.g., Lavy & Schlosser 2011; Simons-Morton et al. 2005; McKenna et al. 1998) and the increased interest in the recent literature on social multiplier effects (e.g., Christakis & Fowler 2007; Fletcher 2011).

In the current study, we replicated prior studies' findings that boys exhibit higher levels of violence, relative to girls. We also found that, pooled across gender groups, violence levels increased from year to year. These findings supported our first hypothesis and highlighted that this age group, and boys particularly, are "at-risk" for increased levels of violence. Our results also suggested with some consistency that in addition to intuitive effects seen of boys and girls on others in their *own* gender group, there is evidence for a cross-gender effect of well-behaved girls on boys. That we have uncovered an overlooked component of school-based strategies for reducing violence is a statement that should be made tentatively, as this study was considered to be exploratory. However, given the magnitude of this public health problem, we feel that these results are promising and worthy of attention in follow-up studies that replicate or further disentangle the nuances of positive girl-to-boy social multiplier effects in the domain of youth violence. The hope in introducing this strategic "girl-to-boy" component to school-based violence prevention programs is that levels of violence in schools will be lowered, particularly among boys who are the most at risk, before violence escalates at later ages.

Our approach to studying this problem was quite nuanced. We focused on middle schools as the social area in which such social multiplier effects for lowering violence might be leveraged. In addition to focusing on both same-gender and cross-gender social multiplier effects in these schools, we considered whether these effects originated from various subpopulations (representing prototypes of behavior) within each gender group: low, average, and high violence. Simultaneous consideration of these effects of subgroups of students on other students acknowledged that these various social influences may operate in conjunction, or even in competition, with each other (e.g., simultaneous effects from both

boys and girls, and from both well-behaved and violent girls, in the same grade and school). Yet, our finding of a positive effect specifically from *well-behaved* (20<sup>th</sup> percentile) girls on the individual violence levels of boys emerged across models. This is precisely the social multiplier effect that we believe can be leveraged in improved school-based intervention efforts. Results of our models and implications (including appropriateness) of this improved design for school-based interventions are discussed here.

### Social Influence from Same Gender Group

In our second hypothesis, we stated an expectation to find social multiplier effects from those of the same gender, particularly from those who were extreme for violence (at the 80<sup>th</sup> percentile for each gender, grade and school) and from those who were low-violence (at the 20<sup>th</sup> percentile). We expected these effects to emerge for different reasons; while high levels of violence are the most directly observable, the behavior of low-violence peers might be noticeable because of the social rewards these students may receive in terms of praise from teachers, being more liked by classmates, etc. Effects from one's own gender group are also intuitive because they are in accordance with the social comparison theory's "similarity of other" schema (which posits stronger social influence from similar others). We found only partial support for this hypothesis for both boys and girls, finding effects from 80<sup>th</sup> percentile, but not 20<sup>th</sup> percentile, same-gender peers. However, girls at the 50<sup>th</sup> percentile for violence also influenced the levels of violence among other girls. The positive direction of these effects suggests that lowering the normative levels of violence among the extremely violent boys, and among both average and extremely violent girls, will lower the individual levels of violence of same-gender peers. Note that these results build upon those demonstrated by Lavy and Schlosser (2011) in that they are demonstrated for *individual* violence scores in the fixed effects models, not merely aggregate (grade-level) violence scores.

These effects may suggest that boys and girls compare themselves with those in their grade who are average to extreme in levels of violence. In addition to self-reflective processes, these effects may also occur because these social multiplier agents actively demand or pressure this behavior from others in their gender group. For instance, if a peer of the same gender acts in violent ways, one may need to escalate one's own behavior, even if only situationally, for protection or for instrumental reasons (i.e., to be able to obtain a desired result). However, this is still a case of comparing one's own behavior to that of a peer, and adjusting oneself to be more similar. Yet, not all youth will respond to bullying or threats in the same way (Dishion & Tipsord 2011), particularly if alternative strategies for responding are known, such that a youth's response need not mirror the behavior of an aggressor.

The consistent effect of 80<sup>th</sup> percentile youth on same-gender peers is notable because some literature suggests that aggressive children, boys particularly, are often socially rejected by classmates (e.g., Cairns & Cairns 1984; Cairns, Neckerman, & Cairns 1989; Coie & Kupersmidt 1983; Dodge 1983); but that this rejection depends on the overall level of aggression in the school (Stormshak, Bierman, Bruschi, Dodge, & Coie 1999; see Dishion & Tipsord 2011). It is possible that youth in middle schools who are very violent may be socially shunned or unpopular, but still affect others by setting an upper limit for

acceptability of aggressive behavior, or by necessitating that others act similarly, as mentioned above. It is likely that attitudes toward violent behavior among middle school students lie on a continuum, or multiple continuums reflecting ambivalence.

The nonsignificant interaction effects examined in the fixed effects models suggested that these same-gender effects were not moderated by grade, or were, in other words, similar in magnitude at each grade of middle school. However, results from quantile regressions suggested that the most extreme boys and girls were “unreachable” by social influence from their peers by Grade 8, even from one’s own gender group (while these effects were significant at Grade 7). Together, these findings suggest no moderation by grade in the *sample as a whole*, but evidence for moderation by grade for the very *upper portions* of the gender-based violence distributions. These findings are not discrepant, but paint a very detailed picture of which groups experience moderation of the social multiplier effects. Together, these findings suggest that leveraging same-gender social multiplier effects should be timely, occurring in the beginning or middle of the middle school years, when both boys and girls—even the most violent—can be reached by peer influence.

### Social Influence from Opposite Gender Group

In our third (and most novel) hypothesis, we stated an expectation to find cross-gender (girl-to-boy) social multiplier effects, with lower normative levels of violence among girls in a given school associated with lower individual levels of violence among boys. This hypothesis was based on findings in the literature of girls’ beneficial social influence on boys, with regard to violent, disruptive, or risky behavior (e.g., Simons-Morton et al. 2005; McKenna et al. 1998; White & Caird 2010; Lavy & Schlosser 2011), even if this basis was tentative or exploratory. Notably, this hypothesis sets the expected effect in contrast with traditional social comparison theory, suggesting that social influence will operate counter to the “similarity of other” schema (Festinger 1954a, 1954b; Stotland & Canon 1972). We found support for this hypothesis in both our fixed effects and quantile regression models, specifically, that levels of violence among the best-behaved (lowest violence) girls had a relatively consistent influence on boys. The direction of these effects was always positive, suggesting that in lowering the violence levels of the best-behaved girls, the levels of violence of individual boys will be lowered as well. Notably, the quantile models showed this effect to be strongest at Grade 7, and to also hold for boys in the middle of the violence distribution at Grade 8; but to *not* hold for the most extremely violent boys at Grade 8, who appeared to be unreachable by any social influence.

Importantly, similar effects were *not* found from boys to girls in the fixed effects models—though influence from average and extremely violent boys *was* found in the quantile models. The latter is intuitive because, with their higher levels of violence (technically, more *frequent* display of violent behavior, as measured in this study), there is more opportunity for violent boys’ behaviors to be observed. Similar to boys, the most extremely violent girls at Grade 8 were unreachable from social influence, whether from other girls or from boys. Again, this suggests that interventions leveraging social multiplier effects must be timely, occurring prior to the end of the middle school years, in order that the most at-risk subgroups may benefit.

That this positive social benefit was found despite any dissimilarity in the domains in which similar beneficial effects have previously been found suggests that the positive influence of girls on boys may be broader than has been recognized. It is important to note these prior studies all focused on preadolescent or adolescent populations, including elementary and high school students. Future work is needed to investigate at what age the social influence of girls or women may be leveraged in preventing higher levels of violence among boys and young men. However, balance is needed between recognition of these positive effects and the very real gender-based violence on women that also emerges in the middle school years as youth begin to date and engage sexually (Loeber & Hay 1997). Yet, we argue that the school is a relatively safe social arena for such social multiplier intervention efforts to be pursued because it is structured and monitored by teachers and administration. These adults play a vital role in the creation and execution of school-based prevention programs for youth (Nation et al. 2003; Bradshaw, Mitchell, & Leaf 2010), including how these programs may be specialized for their particular school, with its unique student population, as we next discuss. In addition, the nature of an intervention such as this can address the potential for some iatrogenic effects, for example, by having training, supervision, and monitoring of programs as they are first evaluated.

### **Practical and Theoretical Considerations for School-based Interventions**

Our findings suggest that interventions designed to leverage social multiplier effects in middle schools to decrease violence in this population may take a two-pronged approach. A first focus should be on boys and girls who are already exhibiting higher levels of violence (which has indeed been attempted and supported with findings of violence reduction; see, e.g., NRC & IOM, 2009; Matjasko et al. 2013; Multisite Violence Prevention Project 2008, 2009, 2012), but a second focus should incorporate the novel approach of utilizing girls in their positive effect on boys. Importantly, these strategies must be timely, given evidence that the most extreme boys and girls are unreachable by social influence by Grade 8. This timing is also apt because it may reduce levels of violence among boys before they escalate.

Our suggestions for the creation of a two-pronged school-based program incorporating this novel girl-to-boy social multiplier effect would be as follow. First, for students already exhibiting higher levels of violence during middle school, a tiered approach to prevention is warranted combining universal, selective and indicated preventive interventions (NRC & IOM, 2009). Second, leveraging the best-behaved girls may be done by introducing programs in intact clubs of girls such as Girl Scouts, girls' sports teams, or reading clubs to utilize these girls as peer leaders. These girls might, for example, present positive conflict resolution strategies to their peers in the format of role plays or dramatic presentations, as a "service" component of their club (e.g., a "service day" activity for the girls' basketball team). Of course, any intact girls' club may have a range of girls in terms of violent behavior. However, given promising findings of girls' social influence on boys, their influence may be an as of yet overlooked component of such school-based programs, worthy of testing. Notably, this strategy would also support the creation of opportunities for girls to succeed through these leadership efforts. These ideas can be incorporated into not only into classroom activities, but into various media that reaches all students, including social media, in efforts to carry any positive effects within schools into positive out-of-class experiences.



These efforts would in theory encourage even better behavior among these groups of girls, and create avenues for the encouragement of similar behavior among others, including boys.

Interventions incorporating this strategy should be careful to acknowledge the sensitive nature of dating and sexual violence that emerges in the middle school years as youth mature sexually and explore dating and romantic relationships (Loeber & Hay 1997). However, for this very reason, we emphasize that the school is one social arena that is relatively safe for this positive girl-to-boy social influence to be explored, given that it is structured and monitored by teachers and school administrators. This is not to say that boy-on-girl violence or harassment does not occur in schools; but it is to say that teachers and school administrators play a vital role in creating, monitoring, supervising, evaluating, and adjusting any school-based intervention initiative to be safe and effective in the particular school at hand (Nation et al. 2003; Bradshaw et al. 2010). Feedback from students, teachers, and administrators would certainly be a vital component in tracking the initial success of intervention programs introducing the component strategy of using girls as social multiplier agents. We also acknowledge that while the school may be a “safe” arena for investigating this component, any uncovered effects may not carry over to other social arenas outside of the school, such as the social arenas where boys and girls may convene or interact at this age or in the very near future (e.g., parties, dance clubs). Yet, this is not to say that they will not; carryover effects into other social arenas from intervention efforts conducted in schools is one area future research.

In addition to this sensitivity, other aspects of the practicality of such an intervention strategy must be considered. For one, in light of the results of our statistical models, it is important to consider whether it is possible for the best-behaved girls (those that most consistently delivered the cross-gender effect) to lower their levels of violence even further, in order to carry these beneficial effects to others. However, this is not unreasonable because it is equivalent to encouraging these girls to exert positive behaviors such as not calling someone a name or not pushing others (both represented in the items we used). Even girls in the 20<sup>th</sup> percentile for violence exhibit these behaviors to some degree (technically, more frequently than 20% of the other girls in the grade). There is also heterogeneity to what “20<sup>th</sup> percentile” or “well-behaved” means in each school. For instance, the level of violence seen among girls at the 20<sup>th</sup> percentile ranged from 5 to 12 points on the 15-point scale across the schools in this study. Hence, lowering the levels of violence in this group may be more practical in some schools than in others. Yet, the most well-behaved (20<sup>th</sup> percentile) girls may be less resistant to moderating their behavior than boys or more violent youth, who, if selected as social multipliers, would be asked to more dramatically change their ways. Utilizing girls, including those at the 20<sup>th</sup> percentile who are already relatively well-behaved, as social multiplier agents may in fact be a better strategy than aggregating high-risk students as recipients of interventions because research on the *iatrogenic effect* (Dishion & Tipsord 2011) of such interventions shows a negative (though inadvertent) effect on these youth. That is, the bringing together of high-risk youth may reinforce, or introduce, additional problematic behavior through their being singled out in aggregate form for special treatment. Well-behaved girls may also be less likely to engage in deviant talk, an antisocial behavior involving the use of sarcasm, jokes or other tactics in order to evoke response or

gain approval from peers, which may be particularly harmful in school-based social networks if exercised by those receiving treatment (Zakrisky, Wright, & Cardoos 2011).

The practicality of introducing this girl-to-boy social multiplier effect to the design of school-based interventions for lowering violence must also be assessed from the perspective of at-risk boys, who are ultimately the real “targets” of the intervention. A higher level of aggressiveness may be partly “normative” for boys because it is biologically based on their sex (Loeber & Hay 1997); but it is also likely a social manifestation of their male *gender role* (Stoltz 2005). It must be considered whether it is reasonable, socially acceptable, or even safe to expect boys to take on conflict resolution behaviors that are more akin to those of well-behaved girls within the school context, particularly if these behaviors are as situational responses that may be necessary for self-protection. Yet, *assertive* conflict resolution behavior may be promoted in lieu of aggressive or violent behavior in this group, to provide alternative methods for resolving conflicts, protecting oneself, and reasonably securing one’s own wants and needs in ways that are effective as well as respectful to both self and others. Teachers and school administrators must work with researchers to understand the nuances of gender identity, sexual identity, and safety versus danger in each school, with its unique student population (including in urban vs. rural schools, and among ethnic groups).

### Limitations and Future Directions

Several methodological and conceptual limitations are worth mentioning. First, in terms of measurement, our items captured the frequency, not intensity, of violence. Thus, our results suggest that boys’ “levels” of violence may be reduced by improving behaviors among the best-behaved girls in terms of *frequency* of engaging in the violent behaviors measured here, but not necessarily the type, nature, or intensity of the behaviors. Theory on desistance from aggressive and violent behavior suggests that the correlation between the frequency and intensity of these acts is complex, depending on the severity of the act as well as external sanctions for the act (e.g., parental discipline, placement in a detention center), social sanctions versus ties, the ability to self-regulate certain behaviors, and a number of other factors (Loeber & Hay 1997). Given this varying correlation between frequency and intensity, our results should thus not be interpreted to mean that reducing the *intensity* of girls’ normative violent behaviors in schools will lower the intensity of violence among individual boys. Some of our items were in fact more intense or extreme in terms of physical or tangible outcomes than others (e.g., “called someone a name to their face” vs. “kicked, hit, or beat someone”), and future research may incorporate additional analysis at the item level. However, even verbal aggressiveness has been shown to have marked effects on youth (Nansel et al. 2001; Nishina et al. 2005) and is highly correlated with other violent behaviors as evidenced by the high alpha coefficient for our violence scale. Also with regard to measurement, because the data were collected via self-report, scores may be biased in the negative direction due to social desirability effects or a desire to avoid getting in trouble. However, participants were informed that responses would be kept confidential; and observational data, such as reports from teachers, administrators, or parents may be even less accurate, or even biased against certain social or ethnic groups. Future research might compare the effects seen in models when violence is measured in each of these ways.

Second, in terms of modeling, it is a limitation that the fixed effects models parse out or “difference out” effects of time-invariant characteristics (Baum 2006; Rodríguez & Elo 2003), but the quantile models do not. However, note that the influence of the best-behaved (20<sup>th</sup> percentile) girls was robust, appearing whether time-invariant characteristics were differenced out or not. Additionally, our findings represent just the beginning of a potential line of research on the influence of girls on boys for the outcome of violence. Statistical models investigated in future research can consider the potential moderating role of any one time-invariant characteristic of interest. Similarly, our models did not investigate potential mediation paths that may reveal *how* these effects take place, such as through boys’ attraction to girls, the popularity of these girls, or other theoretically sound explanations. Considering the mediation pathways in future research will illuminate theory and proper design of interventions. Further, other weighting factors than the ones we employed in our sensitivity analyses (number and proportion of each gender in the school and grade) can be examined in follow-up studies, including weights for social status or connectedness of the social multiplier agent, which may impact the strength of their ability to influence others, as seen in some research to date (Cohen & Prinstein 2006; Prinstein 2007).

Last, our models were limited in their ability to explain all significant effects that were found. Namely, a strong and consistent (negative) effect of speaking Spanish or another language at home was found in the results of the quantile regression models among girls, although this finding was unanticipated. There is some existing research linking acculturation with increased levels of aggression (e.g., Smokowski & Bacallao, 2006; Smokowski, Rose & Bacallao, 2009). However, the current study was not designed to test this hypothesis with due care, and we do not wish to overstep the limitations of our study’s current design in interpreting these effects. For instance, language spoken at home is only one aspect of acculturation, and even our language items were categorical response items, with multiple responses not an option. A portion of the participants in this study likely spoke multiple languages at home, and more recent studies are beginning to acknowledge the existence of truly bilingual families and the use of blended language. Future studies properly designed to examine the role of acculturation should consider its potentially modifying role, and measure it more completely. These studies should, additionally, focus on whether acculturation may have different effects on these processes for boys and girls, as may be suggested by our data.

Finally, regarding general interpretations, our sample consisted of urban, mostly ethnic minority youth, many of whom came from low-income families. Hence, results may not generalize to suburban middle schools or schools with a predominantly White/Caucasian student population. The types of violence that occur in these schools may be different in quality or frequency. For example, suburban schools may be more likely than urban schools to face infrequent but larger-scale acts of violence, such as mass shootings (NRC, 2003). Similarly, results may not generalize to an older adolescent (high school) sample, though future research should examine whether it does. Last, while positive effects are seen in boys’ behavior at each grade level (except for the most violent boys at Grade 8) due to social influence by girls, these resulting improvements in behavior may not be constant or lasting, but only short-lived, or limited to the school context, and not extend to other social arenas.

Further research should consider whether boys undergo longer-term change in behavior (perhaps due to inward reflection or internalization of the examples set by well-behaved girls) or whether these modifications exemplify very short-term modifications in behavior in the school environment.

## Conclusion

This study presented initial evidence for a novel social multiplier effect for lower violence in middle schools. Our findings suggest that the violent behavior of boys in schools covaries with the level of normative violence behavior seen among well-behaved girls, and that these girls may be leveraged in social multiplier intervention strategies to improve levels of violence seen among at-risk boys, before these levels increase with age. Carefully designed intervention studies examining this potential effect should explore whether this component may be feasibly added into existing intervention methods, and whether sizable effects on boys are found. Utilizing girls as the social multiplier agents in these strategies may be more effective than other strategies, and create further opportunities for leadership development among girls. Our hope is that this represents a new line of research on a novel and effective method for lowering levels of school-based violence among youth, particularly boys who are at greater risk.

## Biographies

**Lisa M. Yarnell, Ph.D.**, is a Postdoctoral Research Associate with joint postdoctoral appointment at the University of Southern California (Psychology) and the Michael & Susan Dell Center for Advancement of Healthy Living, University of Texas at Austin Campus (Public Health). She received her doctorate in Human Development and Applied Statistical Modeling from the University of Texas at Austin. Her interest is the creative and intelligent use of statistics and research methods to address problems of health and human development, with major research interests in structural equation modeling, the connections between socioeconomic status and health, and the role of perception in health and human development.

**Keryn E. Pasch, Ph.D., MPH**, is an Assistant Professor in Health Behavior and Health Education in the Department of Kinesiology and Health Education in the College of Education at the University of Texas, Austin. She received her M.P.H. in Health Behavior and Health Education from the University of North Carolina School of Public Health and her doctorate in Behavioral Epidemiology, with a minor in Interpersonal Relationships Research, from the University of Minnesota School of Public Health. Her research interests include the co-occurrence of risk behaviors in adolescence and early adulthood and the influence of media on adolescent health behavior.

**H. Shelton Brown, III, Ph.D.**, is an Associate Professor in Health Economics at the University of Texas Health Science Center at Houston, School of Public Health, Austin Regional Campus. He received his doctorate in Health Economics from Vanderbilt University. His major research interests include health economics, public economics, urban

economics, social norms and social contagion of health behaviors, and the use of econometrics to model health behaviors.

**Cheryl L. Perry, Ph.D.**, is Professor and Regional Dean at the University of Texas Health Science Center at Houston, School of Public Health, Austin Regional Campus. She received her doctorate in Education from Stanford University. Her major research interests include the design, development and evaluation of multi-component behavioral interventions for youth in communities, including smoking and alcohol use prevention, and health promotion programs on healthy eating, physical activity and obesity. She also has focused on more comprehensively on tobacco use among youth and young adults, including research in tobacco regulatory science.

**Kelli A. Komro, Ph.D., MPH**, is Professor of Health Outcomes and Policy within the College of Medicine, and the Associate Director of the Institute for Child Health Policy at the University of Florida. She received her M.P.H. and doctorate in Epidemiology from the University of Minnesota School of Public Health. Her major research interests include the social determinants of health among children and adolescents; design and evaluation of community-wide strategies to promote health among children and adolescents; group-randomized controlled trials; comprehensive preventive interventions; preventing alcohol, tobacco and marijuana use; violence; HIV among youth; and health disparities.

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**Table 1**  
Means and Standard Deviations for Individual Total Scores and School-based Percentile Scores for Violence, by Grade and Gender

Score	6 <sup>th</sup> Grade		7 <sup>th</sup> Grade		8 <sup>th</sup> Grade	
	Boys	Girls	Boys	Girls	Boys	Girls
Violence Total	9.49 (3.11)	9.05 (3.07)	9.87 (2.98)	9.60 (2.96)	9.90 (3.04)	9.64 (3.01)
Individual Violence						
School-based Violence						
20 <sup>th</sup> percentile	6.58 (1.25)	6.34 (1.29)	7.19 (1.53)	7.06 (1.55)	7.16 (1.31)	7.16 (1.56)
50 <sup>th</sup> percentile	9.54 (1.59)	8.78 (1.72)	10.12 (1.52)	9.62 (1.46)	10.09 (1.47)	9.78 (1.70)
80 <sup>th</sup> percentile	12.44 (1.41)	11.72 (1.87)	12.56 (1.16)	12.30 (1.30)	12.73 (1.08)	12.43 (1.32)
Total <i>n</i>	2143	2090	1928	1843	1901	1892

*Note.* Range of possible individual total scores was 5–15.

**Table 2**

Results of Fixed Effects Models Assessing Effects of School-Level Violence Norms and Time-Varying Individual Characteristics on Individual Levels of Violent Behavior, by Gender

Effect	Boys ( <i>n</i> = 2774)		Girls ( <i>n</i> = 2697)	
	Model 1	Model 2	Model 1	Model 2
Unstandardized Regression Coefficients <i>b</i> ( <i>SE</i> )				
20 <sup>th</sup> percentile boys	.00 (.05)	.00 (.05)	-	-.01 (.04)
50 <sup>th</sup> percentile boys	.05 (.06)	.04 (.06)	-	.02 (.05)
80 <sup>th</sup> percentile boys	<b>.18**</b> (.06)	<b>.13*</b> (.06)	-	.08 (.06)
20 <sup>th</sup> percentile girls	-	<b>.14*</b> (.06)	.08 <sup>†</sup> (.05)	.07 (.05)
50 <sup>th</sup> percentile girls	-	.02 (.06)	<b>.14**</b> (.05)	<b>.14**</b> (.05)
80 <sup>th</sup> percentile girls	-	.07 (.05)	<b>.10*</b> (.04)	.08 <sup>†</sup> (.04)
Spanish (1=yes)	.28 (.24)	.26 (.24)	-.13 (.22)	-.12 (.23)
Other (1=yes)	.51 <sup>†</sup> (.27)	.48 <sup>†</sup> (.27)	.65* (.28)	.67* (.28)
Seventh (1=yes)	<b>.50***</b> (.08)	<b>.36***</b> (.09)	<b>.48***</b> (.08)	<b>.48***</b> (.08)
Eighth (1=yes)	.08 (.07)	.07 (.07)	.03 (.07)	.01 (.07)
Constant	6.56*** (.62)	5.44*** (.73)	6.01*** (.52)	5.25*** (.66)
Variance Explained ( <i>R</i> <sup>2</sup> )				
Within-person <i>R</i> <sup>2</sup>	.037	.040	.059	.061
Between-person <i>R</i> <sup>2</sup>	.016	.047	.070	.080
Overall <i>R</i> <sup>2</sup>	.029	.057	.081	.089

Note. Spanish and Other reflect language spoken in the home (English as omitted category).

<sup>†</sup> *p* < .10.

\* *p* < .05.

\*\* *p* < .01.

\*\*\* *p* < .001.



Table 3

Results of Cross-sectional Quantile Regressions Assessing Effects of School-level Violence Norms and Time-Varying Individual Characteristics on Levels of Violence among Average and Extreme Portions of the Boy Violence Distribution Across All Schools, by Year

Effect	Grade 6 (n = 2137)		Grade 7 (n = 1921)		Grade 8 (n = 1892)	
	Average	Extreme	Average	Extreme	Average	Extreme
Spanish (1=yes)	-.20 (.32)	.24 (.38)	.09 (.23)	.11 (.23)	-.26 (.31)	-.17 (.28)
Other (1=yes)	-.19 (.39)	-.60 (.41)	-.13 (.38)	-.59 (.37)	-.16 (.40)	.46 <sup>†</sup> (.26)
20 <sup>th</sup> percentile boys	-.22 (.16)	-.12 (.11)	.15 (.16)	-.03 (.06)	.28 (.19)	-.02 (.16)
50 <sup>th</sup> percentile boys	<b>.36*</b> (.15)	.24 <sup>†</sup> (.13)	-.16 (.16)	<b>.22*</b> (.09)	-.08 (.14)	.08 (.19)
80 <sup>th</sup> percentile boys	<b>.38**</b> (.13)	<b>.34*</b> (.15)	.26 (.18)	.07 (.15)	.17 (.13)	.20 (.19)
20 <sup>th</sup> percentile girls	.15 (.15)	-.13 (.12)	<b>.42**</b> (.16)	<b>.28**</b> (.11)	<b>.45*</b> (.22)	.18 (.15)
50 <sup>th</sup> percentile girls	.09 (.16)	.06 (.09)	.23 <sup>†</sup> (.12)	.07 (.14)	.14 (.14)	.07 (.11)
80 <sup>th</sup> percentile girls	.12 (.12)	<b>.27**</b> (.10)	.09 (.14)	.04 (.13)	-.16 (.12)	.16 (.12)
Constant	-.31 (1.26)	3.91*** (1.14)	1.08 (1.49)	6.63*** (1.19)	4.24** (1.62)	5.76** (1.51)
R <sup>2</sup>	.056	.058	.045	.041	.039	.033

Note. Average and Extreme portions of the violence distribution represent the 50<sup>th</sup> and 80<sup>th</sup> quantiles of boys' violence distribution, by grade, and indicate the moment of the violence distribution to which the regression effects were estimated. Spanish and Other reflect language spoken in the home (English as omitted category).

<sup>†</sup> p < .10.

\* p < .05.

\*\* p < .01.

\*\*\* p < .001.

**Table 4**

Results of Cross-sectional Quantile Regressions Assessing Effects of School-level Violence Norms and Time-Varying Individual Characteristics on Levels of Violence among Average and Extreme Portions of the Girl Violence Distribution Across All Schools, by Year

Effect	Grade 6 (n = 2082)		Grade 7 (n = 1831)		Grade 8 (n = 1882)	
	Average	Extreme	Average	Extreme	Average	Extreme
Spanish (1=yes)	-1.44*** (.26)	-1.47*** (.30)	-1.21** (.40)	-.85** (.28)	-1.33*** (.29)	-1.46*** (.38)
Other (1=yes)	-1.66*** (.32)	-2.27*** (.60)	-2.00*** (.49)	-0.962	-2.21*** (.39)	-2.37*** (.65)
20 <sup>th</sup> percentile boys	-.02 (.11)	.18 (.11)	.09 (.11)	-.02 (.10)	-.06 (.12)	-.10 (.17)
50 <sup>th</sup> percentile boys	<b>.23* (.10)</b>	.09 (.17)	.12 (.18)	-.02 (.14)	.07 (.14)	.07 (.16)
80 <sup>th</sup> percentile boys	.08 (.13)	.18 (.19)	.35 (.25)	<b>.35** (.11)</b>	.16 (.20)	.24 <sup>†</sup> (.13)
20 <sup>th</sup> percentile girls	-.20 (.14)	-.03 (.12)	-.03 (.19)	.11 (.11)	<b>.47* (.22)</b>	.11 (.16)
50 <sup>th</sup> percentile girls	<b>.53*** (.13)</b>	<b>.33*** (.10)</b>	<b>.41* (.17)</b>	.22 (.14)	-.04 (.19)	-.04 (.12)
80 <sup>th</sup> percentile girls	.00 (.10)	.08 (.09)	-.21 (.15)	.00 (.16)	.22 <sup>†</sup> (.13)	.30 <sup>†</sup> (.17)
Constant	2.72** (.99)	4.20*** (1.24)	2.53 (1.88)	5.65*** (17)	2.09 (1.81)	5.63*** (1.29)
R <sup>2</sup>	.105	.087	.084	.072	.113	.070

*Note.* Average and Extreme portions of the violence distribution represent the 50<sup>th</sup> and 80 quantiles of girls' violence distribution, by grade, and indicate the moment of the violence distribution to which the regression effects were estimated. Spanish and Other reflect language spoken in the home (English as omitted category).

<sup>†</sup> < .10.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .