School Size and Youth Violence: The Mediating Role of School Connectedness

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Youth violence continues to be considered a public health concern in the United States. This study utilized longitudinal data to test the possible mediating and moderating effects of school connectedness between school size and youth violence. The participants were obtained from Waves I and II of the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative ongoing survey of 7th through 12th grade students in the United States. A series of multilevel models using Hierarchical Linear Modeling (HLM6) procedures were compared. Results did not support school connectedness as a moderator; however, results did support school connectedness as a mediator between school size and youth violence. These findings highlight the importance of how the quality of individual student-school personnel relationships can play a role in preventing violence both within and outside of the school setting.

Violence in some form has always existed in our schools and communities, but highly publicized shootings in the 1990s, such as Littleton, Colorado, Jonesboro, Arkansas, and Paducah, Kentucky have led to increased public awareness and concern (Modzeleski et al., 2008). In 2001, the Surgeon General concluded that youth violence is a public health concern in the United States (U. S. Department of Health and Human Services, 2001). Interestingly, although school and community violent crimes committed by juveniles have declined over the past decade (Federal Bureau of Investigation, 2013), compared to all other age groups, children and adolescents are most likely to be crime victims (Furlong & Morrison, 2000), and youth violence is the second leading cause of fatal injuries for adolescents (Centers for Disease Control and Prevention, 2014).

In addition to consequences like injury or death, violence exposure and victimization are associated with a wide range of psychological risk factors (e.g., posttraumatic stress disorder [PTSD], depression, high-risk sexual behaviors) and serious physical health conditions (e.g., heart disease; Hammond, Haegerich, & Saul, 2009; Kia-Keating & Ellis, 2007; Ludwig & Warren, 2009). An additional concern of youth exposure to violence tends to be a consequent cycle of violence where victims

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become the perpetrators (Osofsky, Werers, Hann, & Fick, 1993). Brookmeyer, Fanti, and Henrich (2006) found that simply being exposed to violence is a significant predictor of subsequent increases in violent behavior.

Research on school violence has tended to examine characteristics of youth who exhibit violent or high rates of aggressive behavior. In reviewing the extant research, Furlong and Morrison (2000) asserted that research on youth violence should expand the focus to examine the context and precursors that may influence violent behaviors. In this regard, social and environmental factors (e.g., social settings, social networks, school characteristics) may be particularly important (Hoagwood, 2000). More specifically, relationships between students and adults may have a significant impact on the occurrence of youth violence (Vossekuil, Fein, Reddy, Borum, & Modzeleski, 2002), and there is growing literature that specifically addresses enhancing students' relationships with school personnel (e.g., Chapman, Buckley, Sheehan, & Shochet, 2013; Lapan, Wells, Petersen, & McCann, 2014). The impact of students' relationships with adults in school settings has been studied as "school connectedness."

Youth Violence and School Connectedness

School connectedness has been defined in different ways, but a common theme emphasizes the quality of relationships between students and school personnel (faculty, staff, and administrators). A commonly accepted definition of school connectedness is students' perception of quality relationships with students and school personnel, feeling supported by school personnel, and feeling safe while in school (McNeely & Falci, 2004; Resnick et al., 1997).

Researchers have found that adolescents who tend to feel nurtured, supported, and accepted within such contexts as peers, school, and community are more likely to attend school, experience improved academic performance, and graduate (Hawkins et al., 2000; Kearney, 2008; Resnick et al., 1997; Shochet, Dadds, Ham, & Montague, 2006; Thompson, Iachan, Overpeck, Ross, & Gross, 2006). Studies have also indicated that students who feel connected to their teachers and peers are more likely to seek help with interpersonal issues (McNeely, Nonnemaker, & Blum, 2002; Townsend & McWhirter, 2005). Furthermore, students' trusting relationships with school personnel may have a positive impact on academic achievement, well-being, and resiliency (Catalano, Haggerty, Oesterle, Fleming, & Hawkins, 2004; Joyce & Early, 2014; Shochet et al., 2006; Smith & Sandhu, 2004).

Several studies also indicated that students who feel more connected within their school are less likely to engage in disruptive or antisocial

behaviors (Brookmeyer et al., 2006; Miller, Breham, & Whitehouse, 1998; O'Donnell, Hawkins, & Abbott, 1995; Ozer, 2005). More specifically**,** Resnick, Harris, and Blum (1993) found that high school students who reported high levels of school connectedness had significantly lower rates of emotional distress, suicidal ideation/behavior, and risky/delinquent behaviors than students with low levels of school connectedness. Resnick et al. (1997) obtained similar results based upon a cross-sectional analysis of interview data from over 12,000 adolescents (grades 7-12) who participated in the National Longitudinal Study on Adolescent Health (Add Health). Also using Add Health data, Franke (2000) found school attachment (a variation of school connectedness) to play a role in preventing violence against both property and people. In comparison to students with low levels of school connectedness, students with high levels of school connectedness are less likely to be perpetrators, or victims, of violence (Chapman, Buckley, Sheehan, Shochet, & Romaniuk, 2011; Resnick, Ireland, & Borokowski, 2004; Wilson, 2004). Finally, in one of the few studies to look at school connectedness as a mediator, Loukas, Suzuki, and Horton (2006) found school connectedness to mediate the relationship between three school climate variables (e.g., perceived friction, perceived cohesion, and overall class satisfaction) and future conduct problems one year later.

Youth Violence and School Size

There appears to be a relationship between school connectedness and youth violence, but few studies have examined the complexities of this relationship. It is likely that other variables influence the relationship of school connectedness and youth violence. One area of interest is a growing body of literature focusing on school size. More specifically, in the past 30 years, there has been growing empirical support that as school size increases, students tend to have less participation in school activities, higher absenteeism, and higher dropout rates (Cotton, 1996; Fowler & Walberg, 1991; Jones, Toma, & Zimmer, 2008; Kearney, 2008; Lindsay, 1982; Pittman & Haughwout, 1987). Students in larger schools also tend to have lower levels of academic achievement and lower rates of attending college (Cotton, 1996; Galletti, 1999; Pittman & Haughwout, 1987; Ready, Lee, & Welner, 2004). Many studies show these domains of functioning to be superior in smaller schools, with a few studies indicating that larger schools are "equally" effective at best (Lindsay, 1982).

With respect to the development of meaningful relationships between students and school personnel, some evidence favors small schools. For example, research has shown that as school size increases, students tend to report lower levels of school satisfaction and poorer interpersonal

relationships with teachers (Bowen, Bowen, & Richman, 2000; Cotton, 1996; Fowler & Walberg, 1991; Lindsay, 1982; Resnick et al., 1997). Similar to school connectedness, research has shown that increasing school size is associated with higher rates of youth violence, including homicides (Brookmeyer et al., 2006; Ferris & West, 2004; Kaiser, 2005; Leung & Ferris, 2008). Although there are no clear reasons for such outcomes, one common explanation is that as school populations increase it becomes increasingly difficult for students to establish meaningful relationships with school personnel. In fact, some studies have found school connectedness to be inversely related to school size (Crosnoe, Johnson, & Elder, 2004; Kearney, 2008; McNeely et al., 2002; Thompson et al., 2006). Therefore, increasing school size may inhibit school connectedness, possibly leading to higher frequency of youth violence.

Although some studies have included both school connectedness and school size variables, no study has examined both variables together as predictors of youth violence. Instead, many studies that examined these variables used cross-sectional data or failed to include all three simultaneously (i.e., school connectedness, school size, and youth violence) in the analyses. Additionally, it seems important to examine whether school connectedness is a mediator and/or moderator of the relationship between school size and youth violence. For example, Hoagwood (2000) encouraged researchers to consider possible mechanisms that contribute to the development of aggressive behavior and associated youth violence. More specifically, Blum, McNeely, and Rinehart (2002) recommended considering possible school characteristics that may predict school connectedness (e.g., school size), which in turn may help prevent youth violence. Few studies have directly tested school connectedness as a mediator or moderator between other school variables (Loukas et al., 2006).

In sum, school connectedness may be a significant factor linking school size and youth violence. Thus, it appears important to examine the relationship between school size and youth violence within the context of school connectedness. As noted by Hawkins et al. (2000), longitudinal research is especially informative when examining this relationship.

The present study addressed two questions. First, does school connectedness partially mediate the effects of school size on youth violence? Four hypotheses were examined: (1) School size will be positively associated with youth violence; (2) School size will be inversely associated with school connectedness; (3) H_{3a}: School connectedness will be inversely associated with youth violence. H_{3b}: School connectedness will be inversely associated with youth violence, while controlling for the effects of school size; and (4) School

connectedness will partially mediate the effects of school size on youth violence (See Figure1). The second question was: Does school connectedness moderate the effects of school size on youth violence? It was predicted that student connectedness will moderate the effect of school size on youth violence (See Figure 2).

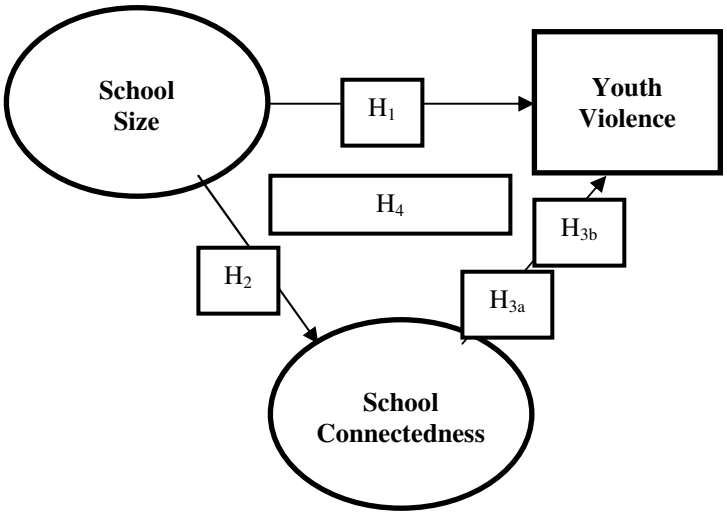

FIGURE 1 Predicted Mediating Effect of School Connectedness Between School Size & Youth Violence

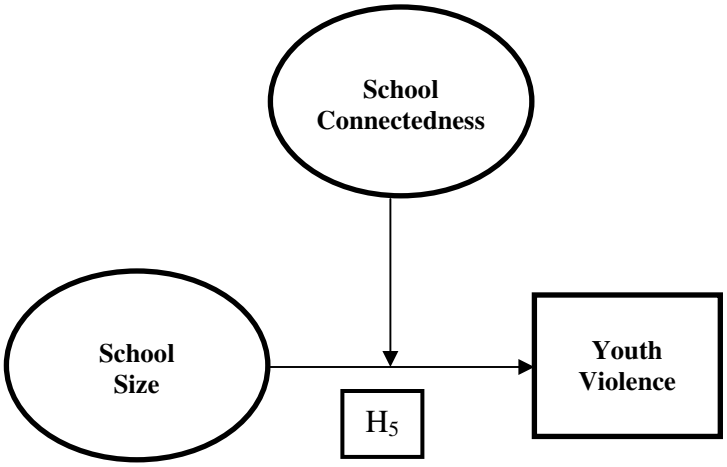

FIGURE 2 Predicted Moderating Effect of School Connectedness Between School Size & Youth Violence

METHOD

Participants & Procedure

The participants (nested within schools) came from Waves I and II of the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative ongoing survey of 7th through 12th grade students in the United States beginning during the 1994-95 school year (Harris et al., 2009). The Add Health study provides an extensive examination of health-related behaviors among adolescents. Add Health takes into account characteristics of the individual, family, peer group, school, and community as having an important impact on adolescents' health status. This dataset was chosen for its longitudinal nature and inclusion of individual and organizational characteristics. Harris et al. (2009) describes the study design and participants for this study. The Indiana University Review Board approved all study protocols.

Student Variables. The sample for Wave I consisted of 20,745 students and Wave II consisted of 14,738 students. Analyses for this study included only students who answered key construct questions (e.g., school connectedness, violent behavior) at both Waves I and II, and were given sampling weights at both waves (N = 11,777). This sample included 5724 males (48.6%) and 6053 females (51.4%). The number of students in grades 7 – 12 was as follows: 7th (15.2%; n = 1790), 8th (15.4%; n = 1814), 9th (20.0%; n = 2355), 10th (22.6%; n = 2662), 11th (22.2%; n = 2614), 12th (4.2%; n = 495), and grade not given (0.4%; n = 47). The reason for a low number of participants in 12th grade is because students in 12th grade at time 1 were able to participate in time 2 only if they had to repeat the grade (i.e., those in 12th grade who graduated at time 1 were not part of time 2). With respect to ethnic background, the sample included 7478 Caucasian (63.5%), 2591 African-American (22.0%), 1967 Hispanic (16.7%), 883 Asian (7.5%), and 412 Native American (3.5%) students. These percentages exceed 100% because some students identified themselves as more than one race/ethnicity.

School Variables. A school administrator for each school (typically the principal) completed a questionnaire of key school demographics during Waves I and II. A total of 132 schools completed the questionnaires. The present study included only schools that answered key demographic questions (e.g., school size, race/ethnicity of students) and were given sample weights (N = 115). Mean class size was 25.61 students (SD = 5.40) and the mean number of full-time teachers per school was 55.05 (SD = 32.26). Almost all schools were public schools (90.8%; n = 104). The remainder were private (9.2%; n = 11). Most schools (53.8%; n = 62) were located in suburban communities. The remainder were in urban (31.5%; n = 36) or rural (14.6%; n = 17) communities.

Measures

Youth violence. Youth violence was measured using a 7-item scale from the Add Health data that assessed a wide range of violent behaviors. Resnick et al. (1997), Dornbusch, Erickson, Laird, and Wong (2001), and Resnick et al. (2004) reported high internal consistency (alphas = .82 or 83) for this scale. The following 7 questions were used to measure youth violence (based on in the past 12 months "how often did you"): (1) "Pull a knife or gun on someone?" (2) "Shoot or stab someone?" (3) "Get into a serious physical fight?" (4) "Use a weapon in a fight?" (5) "Hurt someone badly enough to need bandages or care from a doctor or nurse?" (6) "Use or threaten to use a weapon to get something from someone?" (7) "Take part in a fight where a group of your friends was against another group?" The first two questions were answered using a scale of *never* (0), *once* (1), and *more than once* (2). Questions 3 through 7 were answered using a scale of *never* (0), *1 or 2 times* (1), *3 or 4 times* (2), and *5 or more times* (3). Because of the relative low frequencies of violence, the violent data were recoded as *no violent acts* (0) and *one or more violent acts* (1) (see Dornbusch et al., 2001; Resnick et al., 2004). Each question was treated as a dichotomous variable, and the number of violent acts was summed, with scores ranging from 0-7. In this dataset, 71.7% of students reported zero incidents of violence while 28.3% reported one or more incidents of violence. Following procedures used by Dornbusch et al. (2001) and Resnick et al. (2004), a log-log transformation was performed before analysis because of the highly skewed distribution for this variable (pre log-log transformation skewness = 4.592; post log-log transformation skewness = 1.544).

School size. Based on information reported by school administrators, the Add Health dataset categorized school size as small (1-400 students), medium (401-1000 students), or large (1001-4000 students). Of the total school sample (N=115), 22.3% (n=26) were small schools, 46.9% (n=54) were medium schools, and 30.8% (n=35) were large schools. Thus, this predictor variable was coded categorically. Number of teachers was not reported for all schools, preventing the calculation of teacher-student ratio.

School connectedness. School connectedness was measured using Resnick et al.'s (1997) 8-item scale. Resnick et al.'s definition includes adolescents' need to feel respected and cared for, having a perception of belonging, and a sense of safety and fairness. In one of the first published studies examining school connectedness with Add Health data Resnick et al. used an 8-item scale (alpha = .75) that included feelings of teacher support and respect, sense of safety, perception of belonging, perception of being treated fairly, and difficulty getting along with teachers and other students. Other studies have measured school

connectedness with the same Add Health data with a range of 5-8 questions (Bonny, Britto, Klostermann, Hornung, & Slap, 2000; Brookmeyer et al., 2006; Henrich, Brookmeyer, & Shahar, 2005; McNeely et al., 2002; McNeely & Falci, 2004). Resnick et al.'s 8-item scale was selected because of its theoretical foundation, widely cited definition of school connectedness, and other studies citing similar internal consistency (Henrich et al., 2005; McNeely & Falci, 2004). The following 8 questions were used to measure school connectedness: (1) "You feel close to people at your school?" (2) "You feel like you are part of your school?" (3) "You are happy to be at your school?" (4) "The teachers at your school treat students fairly?" (5) "You feel safe in your school?" (6) Since the start of the school year, how often have you had trouble "getting along with your teachers?" (7) Since the start of the school year, how often have you had trouble "getting along with other students?" (8) "How much do you feel that your teachers care about you?" Questions 1-5 were answered using a scale of strongly agree (1) to strongly disagree (5). These responses were reverse-coded with higher scores reflecting greater school connectedness. Questions 6 and 7 were answered using a scale of never (0) to everyday (3). These responses were also reverse-coded to have a higher score reflect greater school connectedness. Finally, question 8 was answered on a scale of *not at all* (1) to *very much* (5). The eight questions were transformed to z-scores and summed for each student due to varying scales of the items (e.g., 0-3; 1-5). Thus, higher scores reflect greater school connectedness.

Data Analysis

All analyses in this study utilized sampling weights to adjust for stratification and oversampling of underrepresented groups. The use of sampling weights allows for the sample to be regarded as nationally representative of adolescents in grades 7 through 12.

Hierarchical linear models (HLM) with HLM 6 (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) were used to estimate the effects of school connectedness and school size on youth violence over time. This statistical technique is appropriate for the multi-level nature of the research questions, and the school-based clustering (i.e., nested data) of Add Health, in which observations within schools are not independent. All multilevel model analyses in this study used the default setting of restricted maximum likelihood (REML) estimation. REML is the appropriate estimation for analyzing data output for HLM as it simultaneously estimates random and fixed effects. In other words, REML adjusts for the uncertainty about the fixed effects, which provides for more conservative hypothesis testing (Raudenbush & Bryk, 2002).

Furthermore, all fixed effect estimates are based on final estimation with robust standard errors.

Within-school (individual-level) and between-school (school-level) models were estimated simultaneously. This study employed a two-level hierarchical linear model with school connectedness (time 1) and youth violence (time 2) on the first level nested within schools and school size (time 1) on the second level. In order to test any possible mediation/moderation of school connectedness on the effects of school size on youth violence a logical stepwise process for testing the five hypotheses was implemented.

The following is the primary two-level model for which analyses were used to test this study's hypotheses:

Level 1: $Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + r_{ij}$
Level 2: $\beta_{oj} = Y_{00} + Y_{01}W_j + u_{0j}$ $\beta_{1j} = Y_{10} + Y_{11}W_j + u_{1j}$
Where: i = student (i = 1…11,777) level 1 units nested with j = school (j = 1…115) level 2 units

Y_{ij} = level-1 outcome (youth violence)
β_{0j} = level-1 intercept in level-2 unit j
β_{1j} = level-1 slope in level-2 unit j
X_{ij} = level-1 predictor (school connectedness)
r_{ij} = level-1 random effect
Y_{00} = mean value of level-1 outcome (youth violence), controlling for level-2 predictor (school size) [fixed effect]
Y_{01} = effect (slope) of level-2 predictor (school size) [fixed effect]
W_j = level-2 predictor (school size)
u_{0j} = level-2 random effect
Y_{10} = mean value of level-1 slope (school connectedness), controlling for the level-2 predictor (school size) [fixed effect]
Y_{11} = effect (slope) of level-2 predictor (school size) [fixed effect]
u_{1j} = level-2 random effect

This primary model included the three key constructs of the study and was used to develop alternative, secondary models to test each hypothesis. The primary model was also able to include key available demographic variables that could be included in the secondary models. Level 1 demographic variables included gender, race/ethnicity, socioeconomic status. Level 2 demographic variables included urbanicity (i.e., rural, suburban, urban) and school type (public, private).

This study focuses on issues of mediation and moderation. Baron and Kenny's (1986) standard four step procedure for mediation relationships for regression was followed. This procedure is cited as an appropriate method for testing mediation with HLM (Baron & Kenny, 1986; Krull & MacKinnon, 2001; Zhang, Zyphur, & Preacher, 2009). It should also be noted that the steps are not in terms of statistical significance (Baron &

Kenny, 1986). Rather, the steps are stated in terms of zero and nonzero coefficients. A comparison of models is required. Ultimately, the appropriate manner to determine mediation is to consider the degree to which the relationship between the predictor variable and outcome variable decreases when the proposed mediator is controlled (Frazier, Barron, & Tix, 2004).

Another common technique to statistically test significance with mediation is the Sobel test, which was originally developed to test mediation significance in multiple regression (Krull & MacKinnon, 2001). The Sobel test is also occasionally used to test mediation in HLM (Krull & MacKinnon, 1999; 2001). However, some authors caution about potential greater error variance with HLM, which can ultimately result in increased rates of Type I errors (Krull & MacKinnon, 1999; 2001; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). In this case, although no suggested *p*-value is provided as an ideal cutoff to curtail the confounding error variance effect, the smaller the *p*-value, the more desirable.

In HLM, the moderator is the interaction term assigned to the selected slope in any given model (Davison, Kwak, Seo, Choi, 2002; Raudenbush & Bryk, 2002; Raudenbush et al., 2004). This is referred to as a cross-level interaction. In this study, a cross level interaction exists between student level variable X (school connectedness) and school variable W (school size) if the effect Y_{11}Wj is nonzero (i.e., statistically significant; Davison et al., 2002).

RESULTS

Level 1 and Level 2 Correlations

Table 1 shows the correlations among all the Level 1 variables. Youth violence was significantly correlated with gender, school connectedness, income, and all ethnicity variables. Findings indicate that males were more likely to report engaging in violent behaviors than females.

TABLE 1 Correlations Between Level-1 Variables

	Sex	YV	Conect	Hisp.	White	AA	AI	Asian
Youth Violence	-0.178**							
Connectedness	0.021*	-0.209**						
Hispanic	-0.010	0.067**	-0.002					
White	-0.010	-0.071**	0.021*	n/a				
African American	0.011	0.051**	-0.051**	n/a	n/a			
American Indian	0.013	0.060**	-0.053**	n/a	n/a	n/a		
Asian	-0.016	-0.020*	0.032**	n/a	n/a	n/a	n/a	
Income	-0.004	-0.058**	0.052**	-0.089**	0.124**	-0.103**	-0.029**	0.021*

*p<.05, **p<.01

Moreover, students reporting higher levels of school connectedness and students from families with reported higher levels of income also reported lower rates of violence. Hispanics, African Americans, and Native Americans reported higher rates of violence, whereas Caucasians and Asians reported lower rates of violence.

School connectedness was significantly correlated with gender, income, and all ethnic groups, with the exception of Hispanics. Females were more likely to report higher levels of feeling connected to school than males. Furthermore, students from families with reported higher levels of income reported higher levels of school connectedness. African Americans and Native Americans reported lower levels of feeling connected to school, whereas Caucasians and Asians reported higher levels of feeling connected to school.

Finally, Hispanics, African Americans, and Native Americans reported lower levels of income, whereas Caucasians and Asians reported higher levels of income. Overall, it should be noted that the absolute magnitude of the correlations for all Level 1 variables was relatively small in size.

School type was positively related with school size ($r = .255$, $p < .01$) and urbanicity ($r = .171$, $p < .05$). Thus, public schools were more likely to have a larger school size and be in urban communities. School size was not significantly associated with urbanicity ($r = .133$).

Hypothesis Models

Separate models corresponding to hypotheses 1-4 (see Figure 1) are necessary in order to test for the proposed mediation effect (Baron & Kenny, 1986).

Hypothesis 1: School size will be positively associated with youth violence.

TABLE 2 Hypothesis Model Equations (A-E)

Model A: Youth Violence and School Size
Level 1: $Yij[\text{youth violence}] = \beta_{0j} + r_{ij}$
Level 2: $\beta_{oj} = \Upsilon_{00} + \Upsilon_{01}[\text{school size}] + u_{0j}$

Model B: School Connectedness and School Size
Level 1: $Yij[\text{school connectedness}] = \beta_{0j} + r_{ij}$
Level 2: $\beta_{oj} = \Upsilon_{00} + \Upsilon_{01}[\text{school size}] + u_{0j}$

Model C: Youth Violence and School Connectedness
Level 1: $Y_{ij}[\text{youth violence}] = \beta_{0j} + \beta_{1j}[\text{school connectedness}] + r_{ij}$
Level 2: $\beta_{oj} = \Upsilon_{00} + u_{0j} \quad \beta_{1j} = \Upsilon_{10}$

Model D: Youth Violence and School Connectedness (School Size Controlled)
Level 1: Y_{ij}[youth violence] = $\beta_{0j} + \beta_{1j}$[school connectedness] + r_{ij}
Level 2: $\beta_{oj} = \Upsilon_{00} + \Upsilon_{01}$[school size]+ u_{0j} $\beta_{1j} = \Upsilon_{10}$

Model E: Youth Violence and School Connectedness (Interaction)
Level 1: Y_{ij}[youth violence] = $\beta_{0j} + \beta_{1j}$[school connectedness] + r_{ij}
Level 2: $\beta_{oj} = \Upsilon_{00} + \Upsilon_{01}$[school size]+ u_{0j} $\beta_{1j} = \Upsilon_{10} + \Upsilon_{11}$[school size]

Consistent with Baron and Kenny (1986), Model A (see Table 2) includes youth violence as a level 1 outcome and school size as a level 2 predictor. The fixed effect for school size on youth violence (Υ_{01}) was not statistically significant t (113) = 0.913, p = .363. (See Table 3 for Model A parameter estimates.) Therefore, the hypothesis (H_1) that school size is positively associated with youth violence was not supported. The variance component of the random intercept (u_{0j}), also referred to as the random effect on the youth violence variable from each school, had a significant p-value of <.001 (u_{0j} = 0.034). This indicates

TABLE 3 Hypothesis Models (A-E) Final Estimation of Fixed Effects

		Coefficient	SE	T-ratio	df	p-value
Fixed Effects Model A						
Youth Violence (Int.)[a]	Υ_{00}	0.568	0.037	15.232	113	.000***
School Size	Υ_{01}	0.050	0.054	0.913	113	.363
Fixed Effects Model B						
School Connect (Int.)[a]	Υ_{00}	0.474	0.157	3.017	113	.004**
School Size	Υ_{01}	-0.796	0.231	-3.448	113	.001**
Fixed Effects Model C						
Youth Violence (Int.)[a]	Υ_{00}	0.593	0.031	19.159	114	.000***
School Connect (Slope)	Υ_{10}	-0.052	0.005	-11.178	11775	.000***
Fixed Effects Model D						
Youth Violence (Int.)[a]	Υ_{00}	0.591	0.035	16.831	113	.000***
School Size	Υ_{01}	0.007	0.050	0.150	113	.882
School Connect (Slope)	Υ_{10}	-0.050	0.050	-9.764	11774	.000***
Fixed Effects Model E						
Youth Violence (Int.)[a]	Υ_{00}	0.572	0.033	16.004	113	.000***
School Size	Υ_{01}	0.007	0.048	0.146	113	.884
School Connect (Slope)	Υ_{10}	-0.046	0.051	-6.876	11773	.000***
School Size	Υ_{11}	0.001	0.014	-0.715	11773	.475

Note. Output generated by HLM6 with REML. Run-time deletion reduced number of level-1 units to 8981
[a] Intercept *p<.05, **p<.01, ***p<.001

that there was variability in the youth violence intercept (β_{0j}) among schools (i.e., un-modeled variability). In other words, there were other school-level factors associated with violent behaviors that were not accounted for in this model. It should be noted that the random effects of the outcome variables in all models showed significant variability.

Hypothesis 2: School size will be inversely associated with school connectedness.

The second step is to test the predictor variable (school size) by treating the mediator (school connectedness) as an outcome variable. The intent is to examine whether there is an effect between school size and school connectedness. Thus, Model B (see Table 2) includes school connectedness as a level 1 outcome and school size as a level 2 predictor.

The fixed effect for school size on school connectedness (γ_{01}) was statistically significant $t(113)= -3.448$, $p<.001$. (See Table 3 for Model B parameter estimates.) Therefore, the hypothesis (H_2) that school size is inversely associated with school connectedness was supported.

Hypothesis 3: H_{3a}: School connectedness will be inversely associated with youth violence. H_{3b}: School connectedness will be inversely associated with youth violence, while controlling for the effects of school size.

The third step in testing this research question was broken down into two separate hypotheses (H_{3a} and H_{3b}) and models (C and D; see Table 2). The primary purpose for these models is to test the mediator (school connectedness – also a predictor variable) with the outcome variable (youth violence). Thus, Model C includes youth violence as a level 1 outcome and school connectedness as a level 1 predictor. Model D includes youth violence as a level 1 outcome, school connectedness as a level 1 predictor, and school size as a level 2 predictor. However, in this model, school size is not included as a slope/predictor for school connectedness (i.e., no interaction); only as a slope/predictor for youth violence in order to control for school size. Both models were tested because Model C provides information about the relationship between school connectedness and youth violence and Model D is part of the process for testing the mediation effects of school connectedness between school size and youth violence. For Model C, the fixed effect for school connectedness on youth violence (γ_{10}) was statistically significant t (11,775) = -11.178, $p < .001$. (See Table 3 for Model C parameter estimates.) Therefore, the hypothesis (H_{3a}) that school connectedness is inversely associated with youth violence was supported.

For Model D, the fixed effect for school connectedness on youth violence (γ_{10}) was statistically significant t (11774) = -9.764, $p < .001$. (See Table 3 for Model D parameter estimates.) Therefore, the

hypothesis (H_{3b}) that school connectedness is inversely associated with youth violence, while controlling for school size, was supported.

Hypothesis 4: School connectedness will partially mediate the effects of school size on youth violence.

Models H_{3b} (Model D) of step 3 and H_1 (Model A) of step 1 were used together for the fourth step in determining any possible mediating relationship of school connectedness between school size and youth violence. The effect of the predictor (school size) on the outcome (youth violence), controlling for the mediator (school connectedness), should be zero or close to zero. This effect was essentially obtained in Model D (Y_{01}) of step 3 as demonstrated by a parameter (i.e., coefficient) for school size at 0.007 t (113) = 0.150, p = .882. Additionally, the results from Model A (Y_{01}) of step 1 show that the parameter for school size (school connectedness not controlled as a mediator) was 0.049, t (113) = 0.913, p = .363. What is observed here is that the parameter estimate for school size was reduced when school connectedness was added (controlled) to Model D. Thus, school size had almost no effect by itself, but any effect that it did have was in conjunction with school connectedness. Furthermore, it should be recalled that Model B of step 2 showed a significant inverse relationship between school size and school connectedness.

The most important indicator of a possible mediation is when steps 2 and 3 are met. Moreover, step 4 does not have to be fully met unless the desired outcome is a complete mediation. A Sobel Test was performed to confirm the mediation relationship of school connectedness on school size and youth violence. Baron and Kenny (1996) and MacKinnon et al. (2002) state that the t-test statistic from the relationship between the independent variable (school size) and mediator (school connectedness; Model B) and the t-test statistic from the relationship between the mediator (school connectedness) and outcome (youth violence; Model D), while controlling for the independent variable (school size), are required to determine possible statistical significance. (It should also be noted that the use of these two t-test statistics corresponds with the above stated steps 2 and 3 for mediation.) Thus, the required t-test statistics from Model B (t = -3.448) and Model D (t = -9.764) provided a Sobel Test statistic of 3.251 (p = .001). As stated earlier, some authors caution on potential increased rates of Type I errors using the Sobel Test with HLM (Krull & MacKinnon, 1999; 2001; MacKinnon et al., 2002). However, the statistically significant small p-value provides greater confidence for avoiding Type I error concerns. Therefore, the results of this study suggest that school connectedness partially mediates the effects of school size on youth violence.

Hypothesis 5: Student connectedness would moderate the effect of school size on youth violence. (See Figures 1 and 2.)

The analysis for this hypothesis is to test both predictor variables (school size and school connectedness) with the outcome variable (youth violence). Of most interest is the interaction of school size on the slope of school connectedness. Thus, Model E (see Table 2) included youth violence as a level 1 outcome, school connectedness as a level 1 predictor, and school size as a level 2 predictor. The fixed effect for school size (slope) on school connectedness (Y_{11}) was not statistically significant t (11773)= -0.715, p = .475, indicating no interaction between school size and school connectedness (See Table 3 for Model E parameter estimates.) Therefore, the hypothesis (H_5) that student connectedness moderates the effect of school size on youth violence was not supported.

It should also be noted that the mediation and moderation findings remained consistent while also controlling for the covariates of biological sex, race/ethnicity, income, school type, and urbanicity. Results of these analyses are available from the author.

DISCUSSION

The present study was a multivariable, longitudinal examination of the mediating role of school connectedness on youth violence. The research questions for the present study emerged as an unexplored area within the larger ecological context of research related to youth violence, school connectedness, and school size. Although there is a growing body of literature on the relationship between school connectedness and youth violence, few studies have considered school size, and no study has examined school connectedness as a mediator or moderator. The findings from this study support a partial mediation effect of school connectedness between school size and youth violence. The prediction of a moderation effect of school connectedness between school size and youth violence was not supported.

Mediation and Moderation of School Connectedness

The first hypothesis (H_1) that school size would be positively associated with youth violence was not supported. This finding contradicts previous research and was unexpected because earlier literature linked increasing student population to acts of violence (Brookmeyer et al., 2006; Ferris & West, 2004; Kaiser, 2005; Leung & Ferris, 2008). However, close examination of these studies (Ferris & West, 2004; Kaiser, 2005; Leung & Ferris, 2008) revealed that they measured slightly different constructs from this study. For example, Ferris and West examined “serious violent incidents” (e.g., from physical

altercations to use of guns/knives) and Kaiser's conclusions were largely based on 17 school shootings. Differences in how violence was measured may account for the inconsistent findings.

The second hypothesis (H_2) that school size would be inversely associated with school connectedness was supported. This finding suggests that it is increasingly difficult for students to establish quality relationships with teachers and other school personnel as the size of the school increases. This finding was consistent with previous research examining relationships of students with school personnel, including studies examining Add Health data. Although many studies have examined the effects of school size on a variety of outcomes, few have specifically examined the relationship between school size and school connectedness. Before the term "school connectedness" received wide attention in the literature, Bowen et al. (2000) and Fowler and Walberg (1991) both reported school size to be an inverse predictor of what they called "school satisfaction," which was used as a more broad term beyond student-school personnel relationships. Other studies have found the construct of school connectedness to be inversely related to school size (Kearney, 2008; Thompson et al., 2006). Furthermore, two Add Health studies have also found inverse relationships between school connectedness and school size (Crosnoe et al., 2004; McNeely et al., 2002).

The third hypothesis (H_{3a}, H_{3b}) that school connectedness would be inversely associated with youth violence, when controlling for the effects of school size, was supported. It appears that the stronger the relationships students form with teachers and school personnel, the less likely they are to engage in negative, disruptive, aggressive behaviors. This finding was consistent with previous research examining school connectedness and a variety of violence outcomes. When compared to students who are low on school connectedness, students with high levels of school connectedness were less likely to be perpetrators or victims of violence (Smith & Sandhu, 2004; Wilson, 2004). Resnick et al.'s (1997) seminal study of a cross-sectional examination of Add Health data found that students with high levels of school connectedness had an inverse relationship with aggressive behaviors. Other Add Health studies have also found that high levels of school connectedness have a role in preventing youth violence (Brookmeyer et al., 2006; Dornbusch et al., 2001; Franke, 2000; Henrich et al., 2005). Resnick et al.' s (2004) Add Health study found that students reporting high levels of school connectedness at Wave 1, reported lower reports of violent behavior at Wave 2 (one year later). Resnick et al.' study is similar to this study in that it explicitly used longitudinal data to examine school connectedness as a predictor of violence over time. However, the Resnick et al.'s study

used multiple linear regression to analyze the data whereas the present study incorporated hierarchical linear modeling to account for student data being nested within schools.

The hypothesis that school connectedness would partially mediate the effects of school size on youth violence was supported (H_4). Baron and Kenny's (1986) mediation four step process was followed and the necessary fixed effects from the models to determine the first three hypotheses were obtained. Overall, there was no relationship between school size and youth violence (H_1), but there was a relationship between school connectedness and youth violence (H_3), and school size and school connectedness (H_2). Furthermore, the relationship between school size and youth violence decreased to almost no effect when school connectedness was controlled. The only connection school size had with youth violence was *through* school connectedness – a mediator. A Sobel Test was also conducted to provide statistical support of a mediation relationship. Therefore, given the results, one can cautiously conclude that school connectedness appears to partially mediate the effects of school size on youth violence.

The hypothesis that school connectedness would moderate the effects of school size on youth violence was not supported (H_5). The fixed interaction effect between school size and school connectedness was not significant. Therefore, school connectedness did not influence the relationship between school size and youth violence.

Overall, the present results indicate that school connectedness is a mediator between school size and youth violence, but does not act as a moderator between these variables. Multiple researchers have called for further examination of school connectedness as a possible mediator/moderator between youth violence and other school variables, including school size (Blum et al., 2002; Crosnoe et al., 2004; Hoagwood, 2000). In one of the few studies to look at school connectedness as a mediator, Loukas et al. (2006) found school connectedness to mediate the relationship between three school climate variables (i.e., perceived friction, perceived cohesion, and overall class satisfaction) and future conduct problems one year later. The findings from Loukas et al. and this current study support the important role of school connectedness "bridging" relationships between other school variables and disruptive/violent behaviors. More specifically, this study demonstrates that school size does not have a direct relationship to youth violence, but school size may have an impact on youth violence through school connectedness.

Study Limitations

The use of an existing database like Add Health has many advantages, including use of a nationally representative sample of adolescent students, large sample size, and longitudinal data collection. This study built upon previous research with this database through the use of hierarchical linear modeling [HLM], appropriate weights, and examination of the potential mediating and moderating role of school connectedness. Despite these strengths, this study has some limitations that should be considered when interpreting the results.

One limitation, albeit out of control of the author, is the relatively low frequencies of violence (i.e., 71.7% of students reported zero incidents of violence). Thus, although the questions that assessed violent behavior were rated on a 4-point scale, because of the low occurrence of these behaviors, for the present study these measures were recoded as "*no violent acts* (0) or *one or more violent acts (1)*" (see Dornbusch et al., 2001; Resnick et al., 2004). However, a log-log transformation was performed to adjust for the highly skewed distribution for this variable.

Another limitation relates to the way school size was measured. The Add Health data set categorized school size as small (1-400), medium (401-1000), or large (1001-4000). It is possible that a continuous measure of school size would produce different findings. An alternative measure of school size would have been student-teacher ratio. However, the categorical nature of school size precluded any possible option to transform number of students and number of teachers for each school into a student-teacher ratio construct.

Finally, it is important to note that some students did not participate in the Add Health study. It is possible that there may be differences in perceptions of school connectedness between those students who did not participate to those who did participate. Thus, a student who does not have a positive perception of school may not only have an increased proclivity to avoid attending school, but also not participate in a study that asks about their thoughts and feelings of school and related relationships.

Implications for Practice

The present findings indicate that students' sense of school connectedness, rather than school size, are associated with the occurrence of violence. That is, violent behavior is less likely to occur when youth feel more connected to their school. Students' sense of school connectedness can be influenced by school personnel and policies, which offers opportunities for initiatives to prevent or reduce violence at school and in the community.

Overall, school connectedness appears to be an important domain that can be changed and improved upon through systemic efforts by school counselors and administrators. As alluded to earlier, some researchers believe that the field of violence prevention is evolving toward an ecological perspective (e.g., Centers for Disease Control and Prevention, 2014; Resnick et al., 2004), which will include more concerted efforts to instill programs that foster and facilitate school connectedness.

The findings from this study and other studies (e.g., Brookmeyer et al., 2006; Dornbusch et al., 2001; Franke, 2000; Henrich et al., 2005; Resnick et al., 2004) indicate that improving school personnel's interactions with students may have an effect on increasing levels of students' perceptions of school connectedness and preventing youth violence. Catalano et al. (2004) found that prevention/early intervention efforts that focused on classroom instruction and management and child skill development showed an increase in self-reports of positive school climate and reducing school behavioral problems, six and nine years after the intervention. School counselors and administrators can have a role in improving relationships between students and school personnel through teacher education and basic relational skill development. In fact, specific school-based programs that target increasing school connectedness are now being successfully implemented (e.g., Chapman, et al., 2013; Lapan, et al., 2014). Fostering strengths, providing hope, responding to bullying, and instilling personal insight are some recommended avenues to foster student connectedness between students and teachers. (e.g., Bonny et al., 2000; Ericson, 2001; Ozer, 2005; Shochet et al., 2006). One avenue that is gaining increasing attention as a vital component of student-teacher relationships is student self-reports of being treated with dignity and respect by their teachers (Daniels et al., 2010). These approaches seem to cultivate a sense of fitting in, or belonging, rather than feeling rejected.

Recommendations for Future Research

To date, many of the studies cited in this paper used multiple regression, or other variations, when examining relationships of students nested within a school setting. However, hierarchical linear modeling (HLM) is most appropriate for multi-level research questions, including school-based clustering (i.e., nested data) of Add Health data where observations within schools are not independent. In fact, Add Heath specifically recommends the use of HLM for such analyses in order to account for effects on estimates of totals, estimates of ratios, and estimates of variances, standard errors, and confidence intervals (Harris et al., 2009). Simply stated, not using HLM analyses with nested data can result in inaccurate hypothesis testing.

Some of the previous studies in this literature domain using Add Health data either neglected to incorporate sampling weights, or did not explicitly mention the use of weights. It is important to use the appropriate weight to the corresponding research design and included Waves in order to assure a nationally representative sample with unbiased population estimates and standard errors. Not using weights when necessary limits the generalizability of the findings.

In the current study, school connectedness was measured as a global relationship between students and teachers/school personnel, and sometimes peers. Although this approach has shown to be effective in measuring school connectedness and determining relationships with other variables, measuring levels of connectedness more specifically may provide clearer outcomes. For example, preventative efforts may be given clearer direction by distinguishing from connectedness with teachers, peers, and even learning (McNeely & Falci, 2004). An overarching level of school connectedness can still be measured, but also include different levels of connectedness subtypes. Research on specific identification of connectedness subtypes could provide insight to mental health professionals as to the target areas in need of more development and consultation.

As this present study demonstrated, the role of school size and school connectedness are interconnected, which has provided added insight into further areas of research and expanded practice options for school counselors and other professionals within school settings. However, testing of this study's mediational and moderator models is by no means exhaustive. There certainly is room for future research to consider alternative mediator/moderator models, including variables beside school connectedness and alternative social ecologies (e.g., neighborhood risk factors). Overall, further examination of such contextual relationships appears to have promise in further expanding effective preventative approaches to youth violence both in schools and the community.

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