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Emotional Desensitization to Violence Contributes to Adolescents' Violent Behavior

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Abstract Many adolescents are exposed to violence in their schools, communities and homes. Exposure to violence at high levels or across multiple contexts has been linked with emotional desensitization, indicated by low levels of internalizing symptoms. However, the long-term consequences of such desensitization are unknown. This study examined emotional desensitization to violence, together with externalizing problems, as mediators of the relationship between exposure to violence in pre-adolescence and violent behavior in late adolescence. A community sample of youth (N=704; 48 % female; 76 % African American, 22 % Caucasian) reported on their exposure to violence in multiple settings at ages 11, 13 and 18. Internalizing and externalizing problems were assessed at ages 11 and 13; violent behavior was measured at age 18. Structural Equation Modeling showed that exposure to high levels of violence at age 11 was associated with lower levels of internalizing problems (quadratic effect) at age 13, as was exposure to violence across multiple contexts (linear effect). In turn, fewer internalizing problems and more externalizing problems at age 13 predicted more violent behavior at age 18. The results suggest that emotional desensitization to violence in early adolescence contributes to serious violence in late adolescence.

Keywords Exposure to violence · Desensitization · Internalizing problems · Externalizing problems

Many U.S. adolescents are exposed to violence in their schools, communities and homes. In a nationally representative sample, 43 % of adolescents witnessed violence in the last year and 40 % were directly victimized (Finkelhor et al. 2013). Exposure to violence is especially ubiquitous in poor urban areas, where as many as 80–90 % of children and adolescents witness violence in their schools and communities (Flannery et al. 2004; Mrug and Windle 2010). Across all income levels, however, African American youth are disproportionately more affected by exposure to violence compared to Caucasian adolescents (Crouch et al. 2000). The high prevalence of violence exposure in the lives of American youth has raised many concerns about its negative influences, particularly on antisocial behavior (Fowler et al. 2009; Wilson et al. 2009). One mechanism through which exposure to violence may increase violent behavior is emotional desensitization, defined as diminished emotional responsiveness in response to repeated encounters with violence (Funk et al. 2004). This study examines whether emotional desensitization to violence in early adolescence contributes to violent behavior 5 years later, in late adolescence.

Emotional Desensitization

Theoretically, desensitization to violence represents a form of habituation, a well-established type of non-associative learning that results in diminished response to a stimulus after repeated exposure (Rankin et al. 2009). Thus, for instance, witnessing community violence would initially elicit strong negative emotional reactions, but after repeated exposure to

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community violence these emotional reactions would be dampened, resulting in less emotional distress. Habituation typically extends to similar stimuli and across contexts through the process of stimulus generalization (Rankin et al. 2009). Thus, for example, witnessing a fight in the community may produce desensitization to other types of violence in the same context (e.g., threats, shootings), as well as violence observed in other settings (e.g., home or school).

Desensitization to violence has been primarily studied in lab-based experimental studies that exposed college students to violent movies and video games. For instance, viewing of violent movies led to increased depressive and anxiety symptoms that diminished with repeated exposure (Linz et al. 1988), as well as less empathy and sympathy for the depicted victims (Fanti et al. 2009; Mullin and Linz 1995). Behavioral measures of desensitization also showed slower helping responses in children, college students, and adults after exposure to violent videos or videogames (Bushman and Anderson 2009; Molitor and Hirsch 1994). In a meta-analysis of 136 studies, Anderson et al. (2010) concluded that exposure to violent video games contributes to decreased empathy and prosocial behavior, consistent with greater emotional desensitization.

Despite the evidence for emotional desensitization to media violence, it is not clear if desensitization would occur to the same degree for real-life violence. Real-life violence is likely more intense than fictitious violence in the media, and habituation is less likely to occur for more intense stimuli (Rankin et al. 2009). Also, many studies have linked exposure to real-life violence with elevated internalizing problems, including depression, anxiety, and trauma symptoms (Cooley-Quille et al. 2001; Kilpatrick et al. 2003; McCart et al. 2007), which seems inconsistent with emotional desensitization. Despite the well-established links between exposure to real-life violence and internalizing problems, however, the effect sizes for general internalizing distress tend to be weaker and less consistent across studies compared to externalizing and trauma symptoms; this is particularly evident for exposure to community violence (Fowler et al. 2009).

Emotional desensitization has been offered as a possible explanation for these weaker and more inconsistent effects (Farrell and Bruce 1997). Ng-Mak et al. (2002) were the first to operationalize emotional desensitization for youth exposure to community violence, speculating that at high levels of exposure some youth may show a pattern of *pathologic adaptation* characterized by high levels of aggression combined with low levels of internalizing distress. This pattern was thought to arise from a combination of a positive linear relationship between violence exposure and aggression and a quadratic, reverse U-shaped relationship between violence exposure and internalizing distress. As a result, youth exposed to moderate levels of violence would show higher aggression and distress compared to those exposed to low levels of violence, and those exposed to high levels of violence would demonstrate still higher aggression but lower distress than those with moderate levels of exposure.

A handful of studies have tested this pattern of 'pathologic adaptation' empirically, yielding identical results. Specifically, three studies from different urban locations have confirmed that externalizing problems are positively and linearly related to adolescents' violence exposure in the community or across multiple settings, whereas emotional distress follows the inverse U pattern of highest values at moderate levels of violence exposure and lower values at low and high levels of exposure (Gaylord-Harden et al. 2011; Mrug et al. 2008; Ng-Mak et al. 2004). It is important to note that these findings are not inconsistent with the larger literature on elevated internalizing distress among youth exposed to violence: when the quadratic effect of violence exposure was not included in the models, these studies replicated the well-established fact that youth exposed to more violence experience more internalizing symptoms (i.e., a positive linear effect of violence exposure). However, the studies clearly demonstrated that the relationship between violence exposure and internalizing problems does not follow the typically assumed linear pattern.

A major limitation of these studies was their cross-sectional design. Because violence exposure, internalizing distress and externalizing problems were assessed at the same time in all three investigations, it is not clear whether exposure to violence leads to greater emotional desensitization over time. Alternative explanations of the results are equally plausible, such as adolescents with high levels of antisocial behaviors and few internalizing problems seeking out or contributing to incidents of violence, resulting in greater violence exposure. Examining the relationships prospectively would provide stronger support for the causal hypothesis that exposure to high levels of violence leads to elevated externalizing problems but lower internalizing problems, a pattern indicative of emotional desensitization.

Emotional Desensitization as a Risk Factor for More Violent Behavior

Desensitization to violence, including the pattern of 'pathologic adaptation' to violence, has been proposed to increase the risk for subsequent violent behavior (Mrug et al. 2008; Ng-Mak et al. 2002; Sams and Truscott 2004). Specifically, the strong negative reactions that exposure to violence normally elicits, such as emotional distress, physiological arousal, and cognitive disapproval, should inhibit the enactment of violent behavior (Fanti and Avraamides 2011). With repeated exposure to violence, however, these negative reactions diminish through habituation (i.e., desensitization), resulting in less inhibition of violent behavior. At the same time, violence exposure increases the likelihood of violent behavior through

other social-cognitive and behavioral mechanisms, such as observational learning and priming of aggressive behavior (Bradshaw et al. 2009; Huesmann 2007). Thus, repeated exposure to violence should increase violent behavior both directly through increasing aggressive behavior and indirectly through diminished negative emotional, cognitive and physiological reactions to violence that would otherwise inhibit aggression (i.e., through desensitization).

Several studies have tested desensitization to violence as a mediator of increased aggression among youth exposed to violence, but they have focused primarily on cognitive aspects of desensitization. In studies of real-life violence exposure, greater acceptance of violence or more normative beliefs about violence mediated concurrent and short-term effects of exposure to community, home and peer violence on aggressive behavior (Allwood and Bell 2008; Boxer et al. 2008; Guerra et al. 2003; Schwartz and Proctor 2000; Su et al. 2010). In lab-based studies with college students, less aversive brain reactions to violent pictures mediated the effects of violent video game playing on lab measures of aggressive behavior (Bartholow et al. 2006; Engelhardt et al. 2011), suggesting a mediating role of emotional desensitization. However, no studies have tested whether emotional desensitization to real-life violence contributes to more violent behavior over time.

Multiple Contexts of Violence

Many children and adolescents experience multiple types of violence in more than one setting, including their homes, schools, and communities (Finkelhor et al. 2007). Although the cumulative amount of violence exposure is a stronger predictor of poorer adjustment compared to single types or settings with violence (Finkelhor et al. 2007; Mrug et al. 2008), some evidence suggests that experiencing violence in multiple contexts may contribute to emotional desensitization. Specifically, early adolescents who encountered violence in their community, as well as in their home, reported less anxiety and/or depression than those who only experienced violence in the home (Mrug et al. 2008; Mrug and Windle 2010). Similarly, exposure to violence in the community attenuated the relationship between children's exposure to interparental violence and internalizing problems (Rosenfield et al. 2014). These studies suggest that exposure to violence in multiple contexts makes desensitization more likely through promoting stimulus generalization. If violence is experienced at home, in the community, and at school, negative reactions to further violence are more likely to be dampened and desensitization is more likely to occur. Indeed, children exposed to community violence viewed interparental violence as less threatening, which helped explain the emotional desensitization effect (Rosenfield et al. 2014). Thus, the number of different contexts in which violence exposure took place may contribute to emotional desensitization over and above the total amount of violence experienced by youth.

Present Study

In summary, many U.S. adolescents are exposed to violence in their communities, schools and homes, with low-income and African American youth being at the greatest risk. There is evidence that exposure to community or cross-context violence in early adolescence is associated with emotional desensitization, indicated by a pattern of lower emotional distress at high levels of exposure resulting from a quadratic relationship between violence exposure and distress. Additionally, emotional desensitization is more likely to occur when youth are exposed to violence in multiple settings. However, the evidence for emotional desensitization to real-life violence is based mostly on cross-sectional research; longitudinal studies are needed to provide stronger support for the causal hypothesis that exposure to violence leads to more emotional desensitization. In addition, it is unknown whether emotional desensitization contributes to more violent behavior over time, as frequently hypothesized in the literature. Thus, this study used longitudinal design to examine emotional desensitization in early adolescence as a mediator of the relationship between pre-adolescent violence exposure and late-adolescent violent behavior. Because violence exposure is most prevalent among low-income and African American youth, these adolescents comprise the majority of the sample used in this study. Because both violence exposure and psychosocial adjustment vary as a function of age, sex, ethnicity and family SES (Aber et al. 2003; Finkelhor et al. 2013; Stein et al. 2003), these variables were included as covariates in the analyses.

We hypothesized that violence exposure in pre-adolescence would predict more externalizing and internalizing problems in early adolescence, but that internalizing problems would be lower than predicted at high levels of violence exposure due to a negative quadratic relationship between these variables. In addition, exposure to violence in more contexts should predict fewer internalizing problems due to greater emotional desensitization. In turn, we expected that more externalizing problems in early adolescence would contribute to more violent behavior in late adolescence, whereas greater internalizing distress in early adolescence would inhibit later violent behavior. The central hypothesis related to emotional desensitization is that higher levels of violence (through a negative quadratic effect) and more contexts with violence would lead to lower internalizing distress, which would be linked with more violent behavior.

Methods

Participants included 704 adolescents (48 % female; 76 % African American, 22 % Caucasian, 2 % other ethnicities) who took part in the Birmingham Youth Violence Study (BYVS). Children were initially recruited from 5th grade classrooms in 17 schools in the Birmingham, Alabama area, selected through a two-stage probability sampling process designed to yield a representative sample of the local population. Child participants completed individual interviews at average ages 11.8 (Wave 1), 13.2 (Wave 2), and 18.1 (Wave 3) between 2003 and 2014. Primary caregivers also completed individual interviews at Waves 1 and 2. Of the 704 youth participating in Wave 1 (42 % of those invited), 603 (86 %) returned at Wave 2 and 491 (70 %) were interviewed at Wave 3. Compared to those lost to follow up, retained participants were more likely to be females (51 % vs. 41 %, $\chi^2_{(1)}$= 6.63, p<0.05) and African American (82 % vs. 67 %, $\chi^2_{(1)}$= 21.85, p<0.001) and reported higher exposure to violence at Wave 1 (M=2.54 vs. 2.14, t=2.43, p<0.05), but the two groups did not differ on family income and externalizing or internalizing problems at Wave 1 (all p>0.05).

Although the sample was heterogeneous in terms of socioeconomic characteristics, there was an over-representation of families from lower socioeconomic background (72 % of families were recruited from inner city schools; 28 % from suburban areas). Primary caregiver's highest education level ranged from less than 9th grade to graduate degree (16 % with no high school diploma, 24 % graduated high school, 30 % had some college, and 29 % earned a technical, associate or higher degree). Family income ranged from below $5000 to over $90,000, with median in the $25,000–$30,000 range. The sample SES reflected the neighborhoods in which the families resided, representing 96 census tracts with median household income (U.S. Census Bureau 2004) ranging from $10,919 to $81,288 (median of $30,966). In terms of neighborhood safety, 20 % of parents reported that physical fighting was a problem in their neighborhood, 32 % reported that gunshots were a problem, and 31 % felt unsafe alone on their block at night.

The study was approved by the Institutional Review Board at the University of Alabama at Birmingham. At each wave, parents and children were given detailed information about the study and provided written informed consent (parents or adult participants) and assent (children). All interviews were conducted in private spaces by trained interviewers using Computer-Assisted-Personal-Interviews, with sensitive questions completed by participants privately through Audio-Computer-Assisted-Self-Interview (ACASI). Participants received monetary compensation for their time ($20 in Waves 1 and 2, $50 in Wave 3).

Measures

Violence exposure Exposure to violence was assessed at each wave with the Birmingham Youth Violence Study Violence Exposure measure (Mrug et al. 2008). Using the last 12 months as a reference period, adolescents reported whether they witnessed 1) a threat of physical violence, 2) actual physical violence, and 3) a threat or actual violence involving a weapon; and whether they were a victim of 4) a threat of physical violence, 5) actual physical violence, and 6) threat or actual violence involving a weapon. At Waves 1 and 2, endorsement of any of these 6 items was followed by three contextual probes, asking whether this occurred at school, in the neighborhood, or at home; response options were *Yes* (1) or *No* (0). These questions yielded 18 dichotomous variables for each combination of type of violence (witness or victim of threat, actual violence and weapon violence) and the three contexts (school, neighborhood, home), scored 1 for exposure to that combination or 0 for no such exposure (e.g., witnessed a threat at school, victim of weapon violence at home, etc.). These 18 indicators were summed for a total exposure to violence at each time point, with a possible range of 0–18.

At Wave 3, the same questions were asked, but one additional context probe was added for exposure to violence in the workplace, and the response format was changed from *Yes*/*No* to a 4-point frequency scale from *No* (0) to *Many times* (3). This scale yielded 24 frequency items (coded 0–3) for each combination of the six types of violence and four contexts (home, school, neighborhood and work). These 24 items were summed for a composite score of violence exposure, with a possible range of 0–72. At each time point, higher scores indicating greater extent of violence exposure across all contexts.

Contexts with violence Because the composite violence exposure scores reflected both the extent of violence in each context as well as across contexts, we also calculated the number of contexts in which youth reported any exposure to violence at Wave 1 to be able to examine its effects over and above total exposure to violence. Any endorsement of violence in each context was coded as 1 and summed across school, home, and neighborhood for a range from 0 to 3.

Externalizing problems At Waves 1 and 2, externalizing problems were measured with parent reports of conduct problems, adolescent reports of conduct problems, and adolescent reports of overt (physical) aggression. Conduct problems were measured with 15 dichotomous questions about the adolescent's oppositional/defiant behavior and more serious conduct problems. These questions were adapted from the Diagnostic Interview Schedule for Children Predictive Scales (DPS; Lucas et al. 2001) and included defying adults, being spiteful

and vindictive, blaming others, cursing and getting even with people by hurting them or telling lies about them, aggression, theft/deceit, destruction of property, and expulsion from school for misbehavior. Youth and parents indicated whether the adolescent engaged in each of these behaviors in the last 12 months, *No* (0) or *Yes* (1). The responses were summed (youth: α=0.75 and 0.73 at Waves 1 and 2; parents: α=0.84 at each wave). See Table 1 for a summary of all measures of externalizing and internalizing problems.

Overt aggression was assessed with adolescent self-report on the Forms and Functions of Aggression measure (Little et al. 2003). At Wave 1, only the 6-item instrumental overt aggression subscale was used (α=0.86). At Wave 2, the 18-item overt aggression scale was utilized, which includes instrumental, as well as pure and reactive overt aggression (e.g., "You are the kind of person who often fights with others" for pure). The items were rated on a 4-point scale ranging from *Not at all true* (0) to *Completely true* (3). Responses to all items were averaged, with higher scores indicating greater endorsement of overt aggression (α=0.86 at Wave 1 and 0.88 at Wave 2).

Internalizing problems At Wave 2, internalizing problems were assessed with adolescents' reports of anxiety and depressive symptoms. Anxiety was measured with the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds and Richmond 1997). The 28 items (e.g., "You worry a lot of the time.") were endorsed as *True* (1) or *False* (0) and summed (α=0.89). For depression, six items adapted from the Major Depressive Disorder (MDD) scale of the Diagnostic Interview Schedule for Children Predictive Scales (DPS; Lucas et al. 2001) were used. Items included loss of pleasure and interest in activities, low energy level, low self-worth, suicidal ideation, fatigue, and concentration difficulties in the past 12 months, with response options *Yes* (1) or *No* (0) that were summed (α=0.68).

At Wave 1, depressive and anxiety symptoms were not measured. The only measures of internalizing problems that were available at this wave were hopelessness and suicidal behavior. Hopelessness was assessed with adolescent report on 4 dichotomous items from the Hopelessness Scale for Children (Kazdin et al. 1986). The items were rated *No* (0) or *Yes* (1) and summed (α=0.53). Suicidal behavior was measured as the sum of three dichotomous items asking youth about having suicidal thoughts, plan and attempt over the past 12 months (α=0.58).

Violent behavior At Wave 3, youth were asked about the frequency with which they engaged in 7 violent behaviors in the last 12 months. The items were adapted from Elliott et al. (1985) and included individual and group fighting, attacking others to hurt them, using force to obtain money or things from others, cutting or stabbing someone, and shooting at someone. The items were rated on a 7-point scale from *Never* (0) to *11 or more times* (6) and summed (α=0.80). Validity of self-reported antisocial behavior is supported by strong correlations with objective measures of delinquency, and is enhanced by using the ACASI and assurances of confidentiality as was done in this study (Thornberry and Krohn 2000).

Table 1 Measures of externalizing and internalizing problems

	Reporter	W1	W2	Items	Reliability	W1 Factor loading	W2 Factor loading
Externalizing							
Conduct problems (DISC Predictive Scales)	Parent	X	X	Sum of 15 items rated 0/1	$.84^{W1}$ $.84^{W2}$	0.26	0.30
Conduct Problems (DISC Predictive Scales)	Child	X	X	Sum of 15 items rated 0/1	$.75^{W1}$ $.73^{W2}$	0.80	0.83
Physical aggression (Forms and Functions of Agg.)	Child	X		Mean of 6 items rated 0–3	0.86	0.36	
Physical aggression (Forms and Functions of Agg.)	Child		X	Mean of 18 items rated 0–3	0.88		0.73
Internalizing							
Hopelessness (Hopelessness Scale for Children)	Child	X		Sum of 4 items rated 0/1	0.53	–	
Suicidal behavior	Child	X		Sum of 3 items rated 0/1	0.58	–	
Depression (DISC Predictive Scales)	Child		X	Sum of 6 items rated 0/1	0.68		0.79
Anxiety (RCMAS)	Child		X	Sum of 28 items rated 0/1	0.89		0.84

Agg Aggression, *W1* Wave 1, *W2* Wave 2, *DISC* Diagnostic Interview Schedule for Children. Wave 1 internalizing measures were standardized and averaged. For additional information on measures, please see the Measures section under Methods

Covariates Based on parent report at Waves 1 and 2, adolescent sex, ethnicity (Caucasian vs. minority) and family income (rated on a 13-point scale) were used as covariates.

Data Analysis

Univariate distributions and bivariate associations among variables were examined. Because multiple measures of externalizing and internalizing problems were used at Waves 1 and 2, latent factors for externalizing and internalizing problems at each time point were estimated as a part of the main Structural Equation Model described below. This approach was feasible for externalizing problems at each time point and internalizing problems at Wave 2 due to significant positive correlations among the groups of measures (externalizing: r=0.12 to 0.27 at Wave 1 and r=0.24 to 0.61 at Wave 2; internalizing at Wave 2 r=0.67). However, the lack of correlation (r=0.01) between the two Wave 1 measures of internalizing problems (suicidal behavior and hopelessness) caused problems with model convergence. Thus, these two variables were combined prior to the main analysis by standardizing them and computing their average to give each measure equal weight. Although uncorrelated with each other, both Wave 1 internalizing variables were positively associated with Wave 2 depression and anxiety symptoms, and using their combination resulted in stronger stability of internalizing problems over time than using either measure alone.

The main analysis was conducted with Structural Equation Modeling (SEM) in Mplus 7. The model simultaneously estimated the loadings for measured externalizing and internalizing variables on their respective latent factors, as well as structural paths among the latent factors and other measured variables in the model. The measurement part of the model (linking externalizing and internalizing variables with latent factors) estimated paths (loadings) from each latent factor to its indicators and residuals for each indicator; variance of each latent factor was fixed to 1 to standardize the factors. As shown in Fig. 1, the overall SEM model included Wave 1 exposure to violence centered at 0, its square to assess quadratic effects, the number of contexts with violence, and internalizing and externalizing problems predicting Wave 2 internalizing and externalizing problems which in turn predicted Wave 3 violent behavior (see Fig. 1). The model also accounted for continuity in violence exposure over time, with Wave 1 violence exposure predicting Wave 2 exposure, and Wave 2 exposure predicting Wave 3 violence exposure. In addition, Wave 2 exposure to violence was included as a predictor of Wave 3 violent behavior. All variables measured at the same time were allowed to correlate with one another. All structural paths were adjusted for adolescent sex, ethnicity, family income, and age at the time of the predicted variable to ensure that the obtained relationships were not spurious due to demographic differences. Because some of the variables

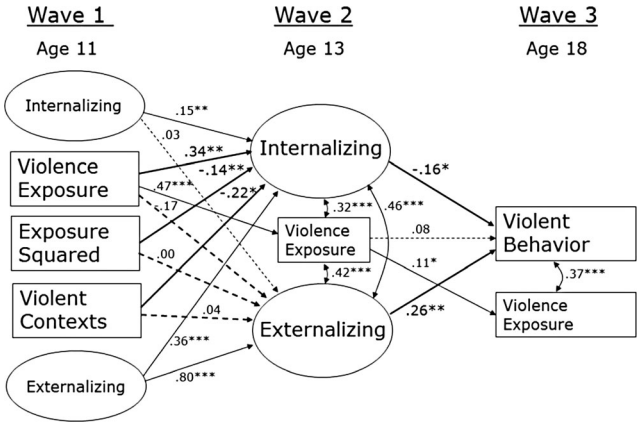

Fig. 1 Structural Equation Model linking early adolescent violence exposure with internalizing and externalizing problems and late adolescent violent behavior. *Note*: Standardized path coefficients are shown. Solid lines represent significant paths and covariances; dashed lines represent nonsignificant paths. *p<0.05; **p<0.01; ***p<0.001

were not normally distributed, maximum likelihood estimation with robust standard errors (MLR) was used; this method produces valid results even with non-normally distributed variables or violations of independence. Ten percent of all data values were missing; missing data were handled with Full-Information Maximum Likelihood (FIML) which preserves the overall sample size and minimizes bias (Wothke 2000). The significance of all indirect effects was tested simultaneously with bootstrapping using 10,000 bootstrap samples (Preacher and Hayes 2008).

Results

Preliminary Analyses

A summary of individual measures of externalizing and internalizing problems, including factor loadings from the main model (or the PCA for Wave 1 internalizing), is provided in Table 1. Descriptive statistics and correlations of all variables are presented in Table 2. In this sample, 81 % of youth reported some exposure to violence at Wave 1, 86 % at Wave 2, and 77 % at Wave 3. At Wave 1, 46 % reported exposure in one setting, 27 % in two settings, and 7 % in all three settings. On average, participants experienced the equivalent of two to three types of violence in one context in early adolescence (Waves 1 and 2) and two types of violence several times in late adolescence (Wave 3). At Wave 3, the mean of violent behavior corresponded to engaging in two violent behaviors once or one violent behavior twice. Most correlations between violence exposure, externalizing problems, internalizing problems and violent behavior were positive and significant within and across time, but fewer correlations reached significance between Wave 1 and Wave 3 variables and between internalizing and externalizing problems, particularly over time. At

Table 2 Descriptives and correlations

	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Violence exposure, W1	2.40 (2.15)	–													
2. Contexts with violence, W1	1.23 (0.84)	0.83*	–												
3. Hopelessness, W1	2.31 (1.21)	0.09*	0.12*	–											
4. Suicidal behavior, W1	0.12 (0.42)	0.25*	0.19*	0.01	–										
5. Conduct problems (P), W1	4.39 (3.61)	0.12*	0.12*	0.05	0.10*	–									
6. Conduct problems (C), W1	3.51 (3.35)	0.46*	0.41*	0.09*	0.34*	0.25*	–								
7. Physical aggression, W1	0.21 (0.39)	0.21*	0.21*	0.09*	0.03	0.12*	0.27*	–							
8. Depression, W2	2.60 (1.71)	0.24*	0.19*	0.12*	0.19*	0.06	0.30*	0.06	–						
9. Anxiety, W2	10.19 (6.47)	0.27*	0.22*	0.15*	0.22*	0.08	0.29*	0.08	0.67*	–					
10. Conduct problems (P), W2	4.17 (3.52)	0.16*	0.16*	0.05	0.12*	0.69*	0.24*	0.12*	0.08	0.12*	–				
11. Conduct problems (C), W2	2.79 (2.36)	0.26*	0.25*	0.13*	0.23*	0.17*	0.49*	0.21*	0.47*	0.42*	0.24*	–			
12. Physical aggression, W2	0.44 (0.40)	0.32*	0.33*	0.14*	0.22*	0.17*	0.43*	0.29*	0.28*	0.31*	0.25*	0.61*	–		
13. Violence exposure, W2	2.37 (1.91)	0.48*	0.41*	0.11*	0.21*	0.09*	0.32*	0.14*	0.37*	0.39*	0.17*	0.44*	0.38*	–	
14. Violent behavior, W3	1.94 (3.99)	0.08	0.09*	0.07	0.09	0.21*	0.09	0.09*	−0.02	0.03	0.22*	0.14*	0.23*	0.17*	–
15. Violence exposure, W3	5.30 (5.45)	0.25*	0.26*	0.08	0.18*	0.20*	0.19*	0.07	0.18*	0.22*	0.25*	0.25*	0.30*	0.31*	0.44*

P parent report, *C* child report

*$p<0.05$ or lower

Wave 1, exposure to more violence and across more contexts was also associated with older age, male gender, being a racial minority, and lower family income (*r*'s from 0.10 to 0.23, all $p<0.01$).

Main Analyses

The SEM model had good fit to the data: $\chi^2_{(94)}=186.61$, $p<0.001$; CFI=0.95; RMSEA=0.04; SRMR=0.04. After adjusting for Wave 1 externalizing and internalizing problems and demographic covariates, more extensive exposure to violence at Wave 1 predicted more internalizing problems at Wave 2 (see Fig. 1). A negative effect of squared violence exposure on internalizing problems indicated that internalizing distress was lower at high levels of violence exposure than would be expected based on a linear relationship (see Fig. 2). Additionally, violence exposure in more contexts predicted lower levels of subsequent internalizing problems. No violence exposure variables predicted Wave 2 externalizing problems after accounting for the strong continuity in externalizing between Waves 1 and 2. In turn, more externalizing and fewer internalizing problems at Wave 2 predicted more violent behavior 5 years later, at Wave 3. Figure 2 presents predicted Wave 2 internalizing scores from both the linear and quadratic effects of violence exposure, as well as the predicted scores for Wave 3 violent behavior based on predicted Wave 2 internalizing scores and other variables in the model. This figure shows that estimated internalizing scores peak around 1.2 SD above the mean on exposure to violence, corresponding to a score of 5 (10 % of the sample scored above this threshold). Past this point, predicted internalizing scores are lower at higher levels of exposure to violence. In turn, lower predicted internalizing distress at higher levels of violence exposure is associated with higher estimates of violent behavior 5 years later.

Testing of indirect effects with bootstrapping indicated that higher internalizing problems at Wave 2 mediated the relationship between greater extent of violence exposure at Wave 1 (linear effect) and less violent behavior at Wave 3; $b=-0.10$, $p<0.05$; 95 % CI [−0.25, −0.01]. Additionally, lower levels of internalizing problems mediated the positive effect between squared Wave 1 violence exposure and more Wave 3 violent

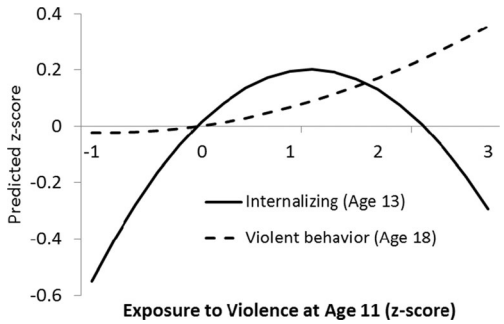

Fig. 2 Model-based estimates depicting the relationships between exposure to violence at Wave 1 (Age 11) and internalizing problems at Wave 2 (Age 13), and between internalizing problems at Wave 2 and violent behavior at Wave 3 (Age 18). All variables are standardized

behavior; b=0.01, p<0.05; 95 % CI [0.001, 0.025], indicating that high levels of violence exposure are related to more violent behavior through lower internalizing distress. Finally, lower internalizing problems at Wave 2 mediated the positive link between exposure to violence in more contexts in Wave 1 and more violent behavior at Wave 3; b=0.16, p<0.05; 95 % CI [0.02, 0.45]. Together, the results indicate that youth exposed to moderate levels of violence experience more internalizing distress than those exposed to little or no violence, and in turn engage in less violent behavior several years later. However, a small subset of youth (about 10 % in this sample) who have been exposed to high levels of violence as early adolescents, experience lower internalizing distress and in turn commit more violence 5 years later. Finally, youth who have been exposed to violence across more contexts also develop fewer internalizing problems, and in turn engage in more violent behavior.

Other paths in the model revealed continuity in violence exposure, internalizing problems, and externalizing problems across subsequent waves. Wave 1 externalizing problems also predicted more internalizing problems at Wave 2, although the opposite relationship (internalizing to externalizing) was not significant. In addition, all Wave 1 variables were significantly intercorrelated (r's ranging from 0.17 to 0.83, p<0.05). Similarly, Wave 2 violence exposure, internalizing and externalizing problems showed moderate positive correlations with one another, and Wave 3 violent behavior was associated with more concurrent violence exposure (Fig. 1).

Discussion

Prior studies showed that exposure to community and cross-context violence in early adolescence is associated with elevated internalizing problems, but that internalizing distress is lower than expected at high levels of violence exposure or when violence exposure occurs across multiple contexts, consistent with the hypothesis of emotional desensitization. The present study extended this research in two ways. First, we demonstrated that high levels of violence exposure and violence exposure across multiple contexts in pre-adolescence predicted lower levels of internalizing distress 2 years later, even after adjusting for previous internalizing and externalizing problems. Compared to previous cross-sectional studies (Gaylord-Harden et al. 2011; Mrug et al. 2008; Ng-Mak et al. 2004; Rosenfield et al. 2014), these longitudinal results provide stronger support for the hypothesis that exposure to high levels of violence and violence experienced in multiple contexts lead to emotional desensitization. Second, we linked lower levels of early adolescent internalizing problems, a marker of emotional desensitization, with more violent behavior 5 years later in late adolescence. Together, the findings support the hypothesis that violence experienced at high levels or across multiple contexts contributes to more violent behavior over time through lower levels of internalizing problems, or emotional desensitization; this hypothesis was also supported by significant tests of these mediating relationships.

The percentages of participants reporting any exposure to violence (77 to 86 % across the three waves) were substantially higher than estimates from nationally representative studies (e.g., 40–50 % in Finkelhor et al. 2013), consistent with sampling families from schools serving primarily low income and African American youth who are disproportionately affected by violence (Stein et al. 2003). Over a third of the sample reported exposure to violence in more than one context in pre-adolescence, further attesting to the extent of violence experienced by these youth. Consistent with previously reported patterns of violence exposure (Finkelhor et al. 2013; Stein et al. 2003), male, African American youth, and those from lower income families reported exposure to more violence and across more contexts. Exposure to violence also was fairly stable over time, with correlations ranging from 0.48 across 2 years to 0.25 across 7 years. The high levels of violence experienced by the participating youth made the sample well-suited to study emotional desensitization, which should only occur after repeated exposure to violence. Indeed, model estimates indicated that emotional desensitization was experienced by about 10 % of the youth.

The results supported the hypothesis that youth exposed to high levels of violence experience less emotional distress than those exposed to moderate levels of violence, with the latter group also reporting more internalizing problems than those exposed to less violence. These longitudinal results extend previous cross-sectional studies reporting such curvilinear relationships (Gaylord-Harden et al. 2011; Mrug et al. 2008; Ng-Mak et al. 2004), but are also consistent with a wealth of studies showing associations of violence exposure with elevated internalizing problems (Cooley-Quille et al. 2001; Fowler et al. 2009; Kilpatrick et al. 2003). Our results suggest that at moderate levels of violence exposure, youth experience more internalizing problems that over time inhibit violent behavior, as indicated by the significant indirect effect linking violence exposure with higher internalizing problems and lower violent behavior. However, youth exposed to high levels of violence experience fewer cognitive, emotional and somatic symptoms of internalizing distress than those exposed to moderate levels of violence, likely due to habituation to the distressing nature of violence. In our sample, approximately 10 % of youth fell into this category, attesting to the presence of a sizeable minority of urban youth who may be experiencing emotional desensitization to real-life violence. Although the emotional numbing that characterizes emotional desensitization may be adaptive, allowing these youth to function and survive in dangerous environments, our results also suggest

that, over time, emotional desensitization contributes to more violent behavior and thus may bring about maladaptive developmental outcomes.

Indeed, youth who experienced less internalizing distress in early adolescence reported higher levels of violent behavior 5 years later, perhaps because internalizing distress reduces the energy, willingness or opportunities (e.g., through peer involvement) to aggress against others. The prospective link between internalizing problems and lower antisocial behavior several years later has been previously reported from early to late adolescence (Leadbeater et al. 1999; Masten et al. 2005), but studies utilizing shorter time intervals (6 months) yielded less consistent results (Wiesner 2003). In fact, concurrent associations between internalizing and externalizing problems are typically positive, as shown here and by others (Beyers and Loeber 2003; Wiesner 2003), underscoring the potential for substantial biases when inferring longitudinal relationships from cross-sectional data. Together, these studies suggest that although internalizing problems often co-occur with externalizing problems, over time they inhibit externalizing behaviors.

The emotional numbing that accompanies emotional desensitization to violence may contribute to the development of psychopathic traits, defined by emotional callousness and lack of remorse and empathy toward others (Frick 2006). Although our study only measured diminished internalizing distress as a marker of emotional desensitization, others have found decreased empathy at high levels of exposure to community violence, suggesting that low empathy may serve as another marker of emotional desensitization (Mrug et al. 2014). Psychopathic traits have been consistently associated with more aggressive and violent behavior, particularly with instrumental aggression (Frick and Dickens 2006), which is also consistent with the link between emotional desensitization and greater violent delinquency found in this study. Interestingly, psychopathic traits also have been associated with higher exposure to community violence among urban youth and male juvenile delinquents (Davis et al. 2015; Howard et al. 2012), although neither study had the data to link violence exposure with an increase in psychopathy over time. More longitudinal research is needed to clarify the relationships between violence exposure, emotional desensitization, psychopathic traits, and violent behavior.

As expected, the number of contexts in which youth experienced violence also contributed to emotional desensitization, over and above the effects of cumulative violence exposure. These results suggest that exposure to violence in multiple settings may be more detrimental to youth functioning than comparable amount of exposure that is concentrated in a single developmental context. Encountering violence in multiple settings may make violence seem ubiquitous and unescapable, thereby promoting desensitization. These results extend previous cross-sectional findings (Mrug et al. 2008; Rosenfield et al. 2014) and point to the need to assess adolescents' exposure to violence more broadly, with particular attention to the social contexts in which violence has been experienced.

Contrary to predictions, violence exposure in preadolescence did not predict higher externalizing problems 2 years later after accounting for continuity in externalizing behaviors. Although violence exposure is consistently related to concurrent externalizing problems with moderate effect size (e.g., Fowler et al. 2009), prospective effects of violence exposure on changes in externalizing problems tend to be of much smaller magnitude, nonsignificant, or only present for some types of violence exposure (e.g., Guerra et al. 2003; Margolin et al. 2010; Mrug and Windle 2010). Studies addressing bidirectional effects also indicate that externalizing problems contribute to higher levels of violence exposure as much, or more, than violence exposure contributes to externalizing problems (Mrug and Windle 2009). Thus, the evidence for violence exposure leading to increased externalizing problems over time is limited, particularly in samples that show high stability of externalizing problems over time, as was the case in this study. However, the high continuity in externalizing behavior in this study is consistent with previous reports of antisocial behavior being stable throughout adolescence and into adulthood (Beyers and Loeber 2003; Brook et al. 2011). We should note that the latent externalizing factors in this study were driven primarily by the youth self-report, with loadings of parent-reported conduct problems having much smaller magnitude. Since these loadings were estimated within the overall SEM model that linked the latent factors with other self-reported variables, it is not surprising that youth self-report of externalizing problems was given greater weight.

Implications, Limitations, and Future Directions

The present results suggest that youth who had been exposed to violence in any setting should be screened for the presence of both externalizing and internalizing problems, which generally tend to co-occur. However, a subgroup of youth may be identified who have been exposed to high levels of violence or to violence across multiple contexts, and who also present with high levels of externalizing problems but little emotional distress. These youth are at the greatest risk for serious violence in the future. Violence prevention efforts may be more likely to prevent desensitization and associated negative outcomes if they aim to reduce violence across multiple settings (e.g., communities, as well as schools and homes). For youth who have experienced violence, interventions should focus on both externalizing and internalizing problems, as well as cognitive and emotional aspects of desensitization, such as normative beliefs and acceptance of violence and emotional numbing and callousness.

The implications for research include the importance of longitudinal studies addressing the relationships between

different facets of exposure to violence, emotional and behavioral functioning, and desensitization. As our and others' results suggest, different characteristics of violence exposure vary in their potential to promote desensitization; we are only now beginning to understand under what conditions exposure to violence may lead to desensitization and subsequent negative outcomes. In addition, the relationships between violence exposure and desensitization do not always follow a simple linear pattern; curvilinear relationships between violence exposure and various aspects of desensitization should be further explored in future research. In addition, other possible outcomes of desensitization should be addressed, including both positive and negative aspects of adaptation (e.g., quality of interpersonal relationships, academic and occupational outcomes).

The present results are limited by the relatively high attrition rate between early and late adolescence. Thus, the results may not generalize to youth who were more likely to drop out (Caucasian youth, males, and those exposed to lower levels of violence). As in other studies with urban youth, the levels of violence exposure were substantially higher compared to nationally representative samples. It is not clear whether similar patterns of results would emerge in studies of youth that are exposed to less violence (e.g., suburban or rural youth); thus, replication in different populations is needed. The measurement of internalizing problems at Wave 1 was limited to only two variables (hopelessness and suicidal behavior) that also had low internal consistencies. Unfortunately, the core constructs of depressive and anxiety symptoms were not measured during that wave. Although we deemed it preferable to include Wave 1 internalizing problems than not being able to control for Wave 1 emotional desensitization, the limited measurement likely attenuated relationships of Wave 1 internalizing problems with other variables. In particular, the stability of internalizing problems between Waves 1 and 2 was very low; this may have contributed to stronger predictive links between wave 1 variables and Wave 2 internalizing problems. In addition, differences in measurement of internalizing and externalizing problems between Waves 1 and 2 precluded the examination of longitudinal stability of the latent internalizing and externalizing variables. Using identical measures across time is recommended for future studies. Finally, the measurement of emotional desensitization only included internalizing problems, to the exclusion of other aspects of emotional desensitization (e.g., empathy, emotional reactivity to violent stimuli) or related aspects of the broader construct of desensitization (e.g., markers of cognitive or physiological desensitization to violence). More comprehensive measurement of desensitization would be useful in future studies.

Despite these limitations, this study provides new insights into the long-term effects of violence exposure on adolescents' functioning. The results point to emotional desensitization as a key mediating mechanism through which preadolescent exposure to high levels of violence across multiple contexts may translate into serious violence in late adolescence. The results point to the combination of high levels of violence exposure, violence exposure across multiple contexts, high externalizing problems, and low internalizing distress as representing the greatest risk for subsequent violence. Future research should address other long-term effects of emotional desensitization, as well as strategies to address internalizing problems and emotional desensitization within violence prevention programs for youth exposed to high levels of violence across multiple contexts.

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Conflict of Interest The authors declare that they have no conflict of interest.

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