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RECIPROCAL RELATIONS BETWEEN TRAUMATIC STRESS AND PHYSICAL
AGGRESSION DURING MIDDLE SCHOOL

A thesis defense submitted in partial fulfillment of the requirements for the degree of Master of
Science at Virginia Commonwealth University

By

Erin L. Thompson

M.P.P., Georgetown University, 2012

B.A., Washington and Lee University, 2008

Director: Albert. D. Farrell, Ph.D.

Commonwealth Professor, Department of Psychology

Virginia Commonwealth University

Richmond, VA

December, 2016

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Abstract

RECIPROCAL RELATIONS BETWEEN TRAUMATIC STRESS AND PHYSICAL AGGRESSION DURING MIDDLE SCHOOL

By Erin L. Thompson, M.P.P.

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science
at Virginia Commonwealth University

Virginia Commonwealth University, 2016

Major Director: Albert D. Farrell, Ph. D., Commonwealth Professor, Department of Psychology

There is convincing evidence that demonstrates traumatic stress and aggressive behavior are highly related among adolescents. The evidence is less clear regarding the direction of this relation. The purpose of this study was to examine the reciprocal longitudinal relations between physical aggression and traumatic stress among a predominantly African American sample of middle school students. Support was found for traumatic stress predicting increased levels of physical aggression across the winter to the spring of the sixth grade for boys and across all waves from the fall of the seventh grade to the fall of the eighth grade for both boys and girls. Conversely, physical aggression during the winter of the sixth grade predicted a decrease in traumatic stress in the spring of the sixth grade for both boys and girls. These findings suggest that interventions may need to incorporate skills that are aligned with trauma-informed care practices in order to reduce traumatic stress and physical aggression among adolescents.

Reciprocal Relations Between Traumatic Stress and Physical Aggression During Middle School

Although the majority of research examining the effects of traumatic stress has focused on adults, particularly war veterans, traumatic stress symptomology among children and adolescents is receiving increasing attention. Studies investigating the impact of traumatic experiences among adolescents indicate that the development of traumatic stress occurs at higher rates than previously believed (e.g., see Gabbay, Oatis, Silva, & Hirsch, 2004 for a review). There has also been an increasing recognition that traumatic stress is not only a symptom of maladjustment, but may itself be a risk factor for future problem behaviors including physical aggression (e.g., Wolfe, Wekerle, Scott, Straatman, & Grasley, 2004). Additional work is needed to disentangle the specific pathways to further our understanding of the causes and consequences of traumatic symptoms among adolescents.

Research has shown that traumatic stress is associated with a variety of negative outcomes, including aggressive behavior (Byrne & Riggs, 1996; Samuelson, Krueger, Burnett, & Wilson, 2010; Wolfe et al., 2004). Deficits in self-regulation provide one potential mechanism to account for the relation between traumatic stress and aggressive behavior (Brewin & Holmes, 2003; Crick & Dodge, 1994). According to social information processing theories, traumatized children often view the world as a hostile place and become hypervigilant to potential threats, leading to a tendency to misinterpret social situations and respond aggressively (Crick & Dodge, 1994; Crittenden & Ainsworth, 1989; Milner, 2000). Moreover, the ecological-transactional model suggests that the relation between traumatic exposure and aggression is bidirectional (Farrell, Mehari, Kramer-Kuhn, & Goncy, 2014; Lynch & Cicchetti, 1998). This suggests that traumatic stress may not only increase the risk of aggression, but that aggression may further

increase an adolescent's risk of developing traumatic stress by putting youth in more dangerous situations. The social information processing and ecological-transactional models may thus be complementary, such that both serve to explain the bidirectional and possibly cyclical nature of traumatic stress and aggression. Although previous research has demonstrated an association between traumatic stress and aggression, much of the research has used cross-sectional designs that do not establish the direction of this association. This underscores the need for longitudinal studies to investigate the causal pathways that account for the relation between traumatic stress and aggression. The purpose of the current study was to test the bidirectional relations between traumatic stress and aggression among adolescents using longitudinal data to provide a stronger test of the direction of effects.

Literature Review

A clinical diagnosis of Posttraumatic Stress Disorder (PTSD) requires meeting specific criteria listed in the Diagnostic and Statistical Manual of the American Psychiatric Association (APA, 2013). However, children and adolescents who have experienced a traumatic event often experience a range of traumatic stress, including sub-threshold levels of PTSD. Many youth experiencing traumatic stress re-experience the traumatic event through intrusive thoughts and images, which are often accompanied by increased physiological distress and hyperarousal (APA, 2013; Southwick, Rasmusson, Barron, & Arnsten, 2005). These symptoms can create an altered view of one's self and the environment around them (Motta, 2015).

Many early social-cognitive theorists, including Horowitz, Becker, and Malone (1973) and Janoff-Bulman (1989), emphasized the massive readjustments needed to integrate traumatic experience into an individual's preexisting views of the world, also known as human nature's completion tendency (Brewin, Dalgleish, & Joseph, 1996). Horowitz argued that after trauma,

our completion tendency maintains the trauma-related information in active memory, which can emerge as flashbacks, nightmares, and unwanted thoughts. However, he also argued that our psyche puts forth psychological defense mechanisms of numbing and denial, resulting in tension between our completion tendency and defense mechanisms. This tension can create oscillation between denial or numbing and intrusion until the traumatic material fully integrates itself into our long-term schemas. However, if information processing fails, the partially processed traumatic information remains in active memory, leading to traumatic symptomatology (Brewin et al., 1996). Studies have shown that even sub-threshold levels of PTSD affect adjustment and daily functioning (Marshall, Olfson, Hellman, Blanco, Guardino, & Struening, 2001; Stein, Walker, Hazen, & Forde, 1997).

Traumatic Stress Among Adolescents

Adolescents are at a high risk for traumatic stress because of their increased exposure to stressful and dangerous situations. Some of the more well known stressors that increase risk for traumatic stress include emotional, physical, and sexual violence (e.g., Copeland, Keeler, Angold, & Costello, 2007; Hedtke, Ruggiero, Fitzgerald, Zinzow, Saunders, Resnick, & Kilpatrick, 2008). However, research has also shown that other experiences such as parental incarceration, family aggression, learning about traumatic events occurring to a loved one, and experiencing a car accident or natural disaster can lead to traumatic stress as well (e.g., Copeland et al., 2007; Ford, Chapman, Connor, & Cruise, 2012; Fowler, Tompsett, Braciszewski, Jacques-Tiura, & Baltes, 2009). There is also some preliminary research that indicates racial discrimination among adolescents can lead to trauma-related stress, suggesting that a wide variety of events may lead to stress-related symptoms (Kang & Burton, 2014).

An overwhelming number of children and adolescents in the United States experience traumatic events each year (e.g., Finkelhor, Turner, Ormrod, & Hamby, 2009; Fitzpatrick & Boldizar, 1993). Youth are more likely to be exposed to violence and crime than are adults (Finkelhor et al., 2009). Adolescents aged 12 to 17, for example, are the most common victims of a violent crime in America, and are five times more likely than adults to be raped, robbed, or assaulted (Clark & Kirisci, 1996). Among children and adolescents more broadly, research has suggested that approximately 41% have been physically assaulted within the past year and 22% have witnessed some form of violence in their family or community (Finkelhor, Turner, Shattuck, & Hamby, 2013). Exposure to violence and victimization is particularly common among lower income children and adolescents (Fitzpatrick & Boldizar, 1993; Gorman-Smith, Henry, & Tolan, 2004; Turner, Finkelhor, & Ormrod, 2006). These exposure rates constitute a significant public health concern.

Early adolescence is a particularly salient time to study the relation between traumatic stress and adjustment. Research has shown that adolescents are more likely to develop traumatic stress than are children (Whitbeck, Hoyt, Johnson, & Chen, 2007). In addition, traumatic stress may have a stronger negative biological impact on adolescents compared to adults (McCormick & Mathews, 2007; McCormick, Mathews, Thomas, & Waters, 2010). This includes the increased likelihood of re-developing traumatic stress after a new traumatic experience occurs later in life (Brady, Acierno, Resnick, Kilpatrick, & Saunders, 2004; Breslau, Kessler, Chilcoat, Schultz, Davis, & Andreski, 1998). Traumatic stress is also associated with a low quality of life, emphasizing the need to improve the understanding of the causes and consequences of traumatic stress (Olatunji, Cisler, & Tolin, 2007).

Prevalence rates of traumatic stress among adolescents are quite high. For example, Gabbay, Oatis, Silva, and Hirsch (2004) reviewed a series of studies investigating a formal diagnosis of PTSD and found prevalence rates ranging from 2% to 9% among adolescents in the general population. Much higher prevalence rates of PTSD have been found among youth who have experienced a specific trauma, although these rates have varied substantially depending upon the sample. Gabbay and colleagues (2004) reported rates of PTSD that ranged from 20% to 63% for children who have been maltreated; 14% to 65% among those exposed to violence (i.e., witnessing or victimization); 14% to 35% for those involved in automobile accidents; 12% to 53% for children with medical problems (e.g., cancer, burn victims); and 3% to 50% for natural disaster victims. Cumulative exposure to traumatic events, such as repeated exposure to interpersonal violence, has been shown to be one of the strongest predictors of PTSD (Cisler et al., 2012).

Consistent with exposure to violence rates within low-income communities, Fitzpatrick and Boldizar (1993) found that 27% of their urban sample of youth met criteria for PTSD according to the DSM-III-R criteria. Wood, Foy, Layne, Pynoos, and James (2002) compared incarcerated youth with a matched sample based on age, gender, ethnicity from a large urban high school district and found significant PTSD symptomology among both groups. Specifically, 40% of the incarcerated youth reported PTSD symptoms; however, a significant portion of their urban high school sample also reported symptoms of PTSD (23%). Steiner, Garcia, and Matthews (1997) found that 32% of a sample of violent juvenile offenders met full PTSD criteria. Research has also shown that female gender is a risk factor for traumatic stress (Kaur & Kearney, 2015; Kilpatrick, Ruggiero, Acierno, Saunders, Resnick, & Best, 2003). These prevalence rates of traumatic stress indicate a clear need for additional prevention and

intervention efforts for American youth who are at a high risk of developing traumatic stress, particularly for those living in violent communities.

Aggression Among Adolescents

Early adolescence is a critical period during which many individuals begin to engage in aggressive behavior (Bettencourt, Farrell, Liu, & Sullivan, 2013; Huizinga, 1995; Moffitt, 1993). The transition from elementary to middle school creates new social contexts and increases in autonomy that put adolescents at an increased risk for problem behavior (Crockett & Crouter, 1995; Dishion & Andrews, 1995; Seidman, Allen, Aber, Mitchell, & Feinman, 1994). Furthermore, social status is established during this transition (Stoltz, Cillessen, van den Berg, & Gommans, 2016), and previous studies have shown that aggression can increase adolescents' social status (Sentse, Kretschmer, & Salmivalli, 2015). Investigating some of the causes and consequences of aggression during this critical period may provide insight into the developmental pathways toward maladjustment.

Although violence-related crimes in the United States have steadily declined since the late 1990's (Dahlberg & Mercy, 2009), physical aggression among adolescents still persists at unacceptably high rates (Huesmann, Dubow, & Boxer, 2009). For example, in a nationally representative sample, 21% of students between sixth and tenth grade were involved in physical aggression as either perpetrator or victim (Wang, Iannotti, Nansel, & 2009). As many as 90% of inner-city high school youth report witnessing physical aggression among their peers (O'Keefe, 1997). In a predominantly African-American sample of adolescents attending three public middle schools in the Southeastern United States, 45% of youth reported engaging in aggression in the past 30 days, including 33% who were non-victimized aggressors and an additional 12% of youth who were both aggressive and victims (Bettencourt & Farrell, 2013).

The consequences of engaging in aggressive behavior during adolescence are quite serious. The link between aggressive behavior in adolescence and adult aggression and violence is well established (e.g., Huesmann, 1988; Piquero, Carriaga, Diamond, Kazemian, & Farrington, 2012). Aggressive behavior during adolescence is associated with a variety of detrimental outcomes later in life and exacts considerable social and economic costs. Research has shown that aggressive adolescents are more likely to experience other co-occurring risk factors, including other forms of delinquency, substance use, dating violence, teenage pregnancy, peer victimization, and depression than their non-aggressive peers (Bardone, Moffitt, Caspi, Dickson, Stanton, & Silva, 1998; Catalano, Hawkins, Berglund, Pollard, & Arthur, 2002; Crick & Grotpeter, 1995; Reyes, Foshee, Bauer, & Ennett, 2012). Studies have shown that these adjustment problems persist regardless of whether delinquent and aggressive behavior declines over the course of adolescence (Moffitt, Caspi, Harrington, & Milne, 2002). Preventing and reducing aggression among adolescents could have a significant impact on an adolescent's developmental trajectory of adjustment.

Relation between Traumatic Stress and Aggression

Much of the current research regarding traumatic stress and aggressive behavior has focused on adult populations, often linking traumatic stress with anger and aggression (e.g., Jakupcak et al., 2007; Taft, Watkins, Stafford, Street, & Monson, 2011). The majority of these studies have been cross-sectional, and thus have not established whether traumatic stress leads to the development of aggression or whether aggressive tendencies expose individuals to dangerous environments that lead to the development of traumatic stress. One study investigating the temporal relation between traumatic stress and aggression among veterans found that reductions in traumatic stress severity were significantly associated with decreases in aggression after

treatment (Makin-Byrd, Bonn-Miller, Drescher, & Timko, 2012). These findings point to the potentially causal role traumatic stress has on problem behavior. The importance of investigating the impact of traumatic stress on externalizing behavior was supported by a meta-analysis by Taft and colleagues (2011) who found a medium-sized association between traumatic stress and perpetration of physical and psychological aggression among adults. Their meta-analysis also revealed that the strength of the association between traumatic stress and physical aggression was stronger for men and for more severe violence (vs. a broader measure). It is currently unclear whether these findings can be replicated among adolescents.

Strong associations have also been found between traumatic stress and antisocial behavior among adolescents based on research comparing offending and non-offending youth. For example, Steiner, Garcia, and Matthews (1997) found that 32% of their sample of violent juvenile offenders met full criteria for PTSD. In addition, Wood, Foy, Layne, Pynoos and James (2002) found that incarcerated youth, and thus those who have engaged in delinquent behavior, are significantly more likely to experience traumatic stress than their counterparts still in high school. These studies do not establish a causal relation between traumatic stress and problem behavior. It is thus not clear whether youth who engage in a risky and aggressive lifestyle are at greater risk for developing traumatic stress or whether initial traumatic stress leads to increased aggressive behavior. Furthermore, these studies do not differentiate which specific types of problem behavior (i.e., aggression versus delinquent behavior) are related to traumatic stress.

There have been few studies that specifically investigated the relation between traumatic stress and aggression as opposed to broader measures of antisocial behavior among youth. For example, Marsee (2008) found a positive association between the development of traumatic stress within high school students after Hurricane Katrina and reactive aggression (i.e.,

aggression when angry or provoked), which was mediated by emotional dysregulation. This association was also stronger for minority youth than for Caucasians. These results are consistent with the idea that individuals experiencing traumatic stress are engendered by heightened emotional reactivity and are consequently unable to restrict aggressive responses when feeling provoked by others. In addition, Moretti, Obsuth, Odgers, and Reebye (2006) found that the relation between exposure to inter-parental violence and adolescent physical aggression was stronger for individuals who met criteria for PTSD. Research has also indicated that traumatic stress from childhood trauma can have lasting effects into adulthood. For example, Swopes, Simonet, Jafffe, Tett, and Davis (2013) used a retrospective cross-sectional design that identified PTSD as a mediator between adverse childhood experiences and partner aggression as an adult (defined as physical and verbal aggression, anger, and hostility towards their partner), underscoring the need to identify traumatic symptomatology early in order to prevent additional adjustment problems. Unfortunately, the aforementioned studies all used cross-sectional data, making it difficult to ascertain the causal pathways between traumatic symptoms and aggression. Additional research is therefore needed to clarify whether traumatic stress is a cause or consequence of aggressive behavior among youth.

Further evidence in support of a possible link between traumatic stress and later aggression among adolescents is provided by at least one longitudinal study. Wolfe and colleagues (2004) used a longitudinal design to investigate possible mediators of the relation between maltreatment and dating violence (e.g., physical, verbal, and relational aggression towards a dating partner) among a diverse sample of high school students. The authors found that traumatic stress was the only significant mediator of the relationship between childhood maltreatment and mid-adolescence dating violence across both genders from Time 1 to Time 2

spaced one year apart. This provides additional evidence of the impact traumatic stress can have on later externalizing symptoms. The authors did not however investigate the relation between aggression at Time 1 and traumatic stress at Time 2. Thus, they did not explore whether there was a bidirectional relation between traumatic stress and aggression. In addition, there is evidence to suggest that dating violence is a distinct construct of aggression (Goncy, Farrell, Sullivan, & Taylor, 2015), indicating the need to investigate the relation between traumatic stress and externalizing behavior across different forms of aggression.

The notion that traumatic stress leads to increases in aggression is also supported by research showing that traumatic stress may alter social-information processing factors that have been implicated in the development of aggression. Longitudinal studies have revealed that symptoms of traumatic stress predict changes in social information processing (e.g., Bryant & Harvey, 1997; El Khoury-Malhame et al., 2011; Foa, Feske, Murdock, Kozak, & McCarthy; 1991). These same factors have been shown to affect aggressive behavior (e.g., Calvete & Orue, 2010; Dodge & Coie, 1987). These negative social information processing patterns include inadequate decoding of relevant social cues and hostile attribution biases, which can cause youth to function in survival mode (Brewin & Holmes, 2003; Crick & Dodge, 1994; Crittenden & Ainsworth, 1989). A person's ability to encode and interpret their own and others' emotions are key components of the model. Among combat veterans for example, traumatic stress has been linked to heightened perceptions of threat in ambiguous situations (Taft, Schumm, Marshall, Panuzio, Holtzworth-Munroe, 2008). Additionally, as with adults, youth experiencing traumatic stress often demonstrate impairment in executive functioning, emotion regulation, attention, and impulse control (Beers & De Bellis, 2002; Marsee, 2008; Samuelson, Krueger, Burnett, & Wilson, 2010). The aforementioned work suggests that individuals with traumatic stress are

using more of their attentional resources to ascertain threats in their environment and interpret others' behavior as threatening. This provides a framework for understanding the association between traumatic stress and aggression. However, the current literature has yet to provide clear evidence for causation between traumatic stress and later aggressive behavior among adolescents. It is important to consider other theories that might inform the study of relations between youth's aggressive behavior and later traumatic symptoms.

Bidirectional Nature of Traumatic Stress Symptoms and Aggression

There is theoretical and some empirical evidence to support the notion that the relation between traumatic stress and aggression among youth is bidirectional. According to the ecological-transactional model, children's behavior and their environment mutually influence one another (Cicchetti & Lynch, 1993). There is an abundance of research that indicates violent events, which lead to traumatic stress, predict antisocial behavior in high-risk youth, either directly or indirectly (Farrell & Bruce, 1997; Gorman-Smith & Tolan, 1998; Overstreet & Braun, 2000; Schwab-Stone, Chen, Greenberger, Silver, Lichtman, & Voyce, 1999). There is also evidence to suggest that aggression influences an adolescent's likelihood of exposure to traumatic events. For example, delinquent and aggressive youth report greater exposure to physical violence than their non-delinquent peers (Breslau, Davis, Andreski, & Peterson, 1991). Similarly, Lynch and Cicchetti (1998) found that greater externalizing behavior predicted higher levels of exposure to violence one year later.

Traumatic events, such as exposure to violence, and aggression have been found to have bidirectional longitudinal effects (Farrell et al., 2014; Salzinger, Ng-Mak, Feldman, Kam, & Rosario, 2006). For example, Farrell and colleagues (2014) found support for a reciprocal relation between witnessing community violence and physical aggression among 1,156

adolescents who completed measures in the fall and spring of the sixth grade. Because of the close link between trauma exposure and traumatic stress, this research suggests that initial aggression levels could put adolescents at an increased risk for the development of trauma symptomatology. This highlights the need to investigate bidirectional relations between traumatic stress and aggressive behavior among adolescents.

Some researchers have hypothesized that youth from low-income and violent neighborhoods gravitate towards risky lifestyles to cope with feelings of negativity and stress, which then puts them at risk for traumatization (Begle, Moreland, Dumas, & Hanson, 2010). This theory has been supported by research examining the relations between aggression and exposure to violence. For example, research has shown that gang members' aggressive and violent lifestyles put these youth at an increased risk for victimization and traumatic stress compared to non-gang members (Li, Stanton, Pack, Harris, Cottrell, & Burns, 2002; Pyrooz, Moule, & Decker, 2014). Providing further clarification regarding the link between aggressive behavior and later traumatic stress, van der Molen and colleagues (2015) examined nine waves of data from the Pittsburgh Girls Study and found that early onset of disruptive behavior during childhood was associated with adjustment problems in early adolescence, including PTSD symptoms. Their study provides a clear link between early aggressive behavior and later trauma symptomatology, underscoring the need to test the bidirectionality of this relation.

The possibility of bidirectional relations between traumatic stress and aggression is supported by theories purporting the cyclical nature of violence and victimization. For example, a growing body of research has demonstrated that individuals experiencing traumatic stress after victimization are less likely to engage in self-protective behaviors that protect against further victimization (Cisler et al., 2011; Cisler et al., 2014; Messman-Moore & Brown, 2006; Orcutt,

Erikson, & Wolfe, 2002). These findings might initially appear somewhat incongruous with previous research that suggests individuals experiencing traumatic stress are more hypervigilant to threat (e.g., El Khoury-Malhame et al., 2011). However, individuals experiencing traumatic stress not only identify threats more easily, but they are more likely to react aggressively to threats that increase their risk of re-victimization. Their aggressive reactions put individuals experiencing traumatic stress at greater risk for re-victimization. This hypothesis is supported by theories that promote the cyclical nature of violence and victimization through traumatic stress (Maxfield & Widom, 1996).

Similar deficits in social information processing associated with both aggression and traumatic stress support the possibility of a bidirectional association between these two constructs among adolescents. There is evidence that a subset of youth who are both victims and aggressors display a unique pattern of maladjustment consistent with social information processing theory (Bettencourt et al., 2013; Pyrooz et al., 2014; Schwartz, Proctor, & Chien, 2001). There is also preliminary evidence to suggest that peer victimization (i.e., experiencing aggression from others) is a form of trauma and a significant predictor of traumatic stress (Nielsen, Tangen, Idsoe, Matthiessen, & Mageroy, 2015). This empirical evidence supports the hypothesis that traumatic stress and aggression can be bidirectional in nature, as many of the outcomes for aggressor-victims are similar to the patterns displayed by individuals with traumatic stress. Specifically, Schwartz and colleagues (2001) reviewed the literature regarding aggressor-victims and found them to be characterized by an unorganized response style. In particular, they display emotional dysregulation, poor concentration, impulsivity, anxiety, and attribute hostile intent in ambiguous situations. Bettencourt and Farrell (2013) found similar maladjustment patterns within their aggressor-victims sample, revealing higher rates of emotion

dysregulation and depression among aggressor-victims than those who were neither aggressive nor victimized. Therefore, additional research is needed to understand the possible reciprocal relation between aggression and traumatic stress in adolescents more generally.

Statement of the Problem

There is convincing evidence demonstrating that traumatic stress and aggressive behavior are highly related among adolescents. The evidence is less clear, however, regarding the direction of this relation. One reason for the lack of clarity is the preponderance of cross-sectional studies. A review of the published literature did not identify any studies that simultaneously investigated whether initial levels of aggression raised the risk of experiencing traumatic stress while at the same time investigating whether initial levels of traumatic stress increased the likelihood of later aggression among adolescents. Clarifying these relations among a sample of adolescents who live in violent neighborhoods could highlight the cyclical nature of traumatic stress and aggression in high-risk populations.

The purpose of the present study was to examine bidirectional longitudinal relations between traumatic stress and physical aggression among early adolescents. One limitation of previous work investigating the effects of traumatic stress on later aggression has been the use of broad measures of aggression that do not differentiate between different forms of aggression (i.e., physical, verbal, and relational aggression). This is not consistent with previous research that has indicated that these forms of aggression represent distinct constructs that have unique relations with adolescent adjustment (Card, Stucky, Sawalani, & Little, 2008; Farrell, Sullivan, Goncy, & Le, 2015). Broad measures of aggression could thus obscure the relations between each form of aggression and other measures of adjustment, including traumatic stress. A primary goal of the current study was to isolate the relations between traumatic stress and physical

aggression, as there is strong empirical support to suggest physical aggression puts adolescents at an increased risk for trauma (Farrell et al., 2014; Lynch & Cicchetti, 1988; Salzinger et al., 2006). Consistent with the ecological-transactional and social information processing models, I hypothesized reciprocal relations between traumatic stress and physical aggression.

Early adolescence is a time of rapid change (Eccles, Midgley, Wigfield, & Buchanan, 1993), yet few studies have investigated change within and across all three grades of middle school. Because researchers typically conduct school-based studies in which they measure traumatic stress and physical aggression in the fall and/or spring, there is limited knowledge on how these constructs covary across different seasons. There is some evidence to suggest that symptoms of externalizing behavior problems decrease in August and September (Kovalenko, Hoven, Wicks, Moore, & Mandell, 2000) and are higher during May and June (van de Looji-Jansen, de Wilde, Mieloo, Donker, Verhulst, 2009). Other research has shown that the greatest proportion of children's calls to violence help lines occurred in February (van Dolen, Weinberg, & Ma, 2013). This suggests that rates of victimization among youth may peak at different times compared to rates of aggression among youth and that victimization encompasses more than peer aggression. Seasonal factors, such as the transition back to school that occurs each fall, changes within peer groups throughout the school year, the potential for greater unsupervised time during the summer months, or conversely, the lack of transportation to see friends during school breaks, all have the potential to influence adolescents' levels of risk for traumatic stress and physical aggression. Seasonal effects on the relation between traumatic stress and physical aggression were therefore examined, but were considered exploratory in that no specific hypotheses were proposed.

In addition to the limited work on intra-year changes in physical aggression and traumatic stress during early adolescence, it is unclear whether the relation between physical aggression and traumatic stress varies across middle school. There is currently no research that has investigated the extent to which this relation changes across middle school grades. Within a recent meta-analysis, younger adolescents were at a higher risk of developing PTSD (Trickey, Siddaway, Meiser-Stedman, Serpell, & Field, 2012). Although sixth graders may be at a higher risk of developing traumatic stress, this does not suggest that younger youth experiencing traumatic stress are also at an increased risk of physical aggression. Prior work has been mixed in regards to changes in the frequency of physical aggression across middle school. Some have found physical aggression to be stable across middle school (Ojanen & Kiefer, 2013; Romero, Richards, Harrison, Garbarino, & Mosley, 2015), whereas others have found increases in self-reported frequency of physical aggression during early adolescence (Karriker-Jaffe, Foshee, Ennett, & Suchindran, 2008). Therefore, analyses investigating grade differences among these relations were also exploratory.

Gender differences among the relations were also tested. As previously mentioned, girls have been shown to be at a higher risk for developing traumatic stress (Kaur & Kearney, 2015; Kilpatrick et al., 2003; Trickey et al., 2012). However, results have been mixed regarding gender differences in the frequency of physical aggression. Some researchers have found no differences (Bettencourt et al., 2013; Miller-Johnson, Moore, Underwood, & Coie, 2005; Sullivan, Farrell, & Kliewer, 2006), whereas others have found that boys exhibit more aggression than girls (Schwartz et al., 2001). Among adult samples, the association between traumatic stress and physical aggression has been stronger for men than women (Taft et al., 2011). Among adolescents, Wolfe and colleagues (2004) found traumatic stress mediated exposure to violence

and dating violence equally across both genders. As the existing literature has not produced consistent patterns to suggest specific hypotheses regarding gender differences among the relations between traumatic stress symptoms and physical aggression (see Foster & Brooks-Gunn, 2009 for a review), analyses examining gender differences were exploratory. Analyses also controlled for other demographic variables including age, ethnicity, and race.

Method

Participants and Procedure

This study made use of previously collected data from students at three urban public middle schools in Richmond, Virginia as part of a study using a multiple-baseline design to evaluate a universal school-based intervention (i.e., Olweus Bullying Prevention Program; Olweus & Limber, 2010) and a family intervention component for families of youth identified as high risk for problem behaviors. Violence among youth is a serious problem in Richmond. From 1999 to 2007, the homicide rate among 15 to 24 year olds in Richmond ranged from slightly more than five times to nearly eleven times the national average and disproportionately affected African American youth (Bishop & Masho, 2011). The three middle schools were selected for the larger study based on attendance zones in neighborhoods with high rates of violence-related crimes. Richmond also has some notable economic factors that impact youth development programs. For example, during the 2014 to 2015 school year, 98% of students attending the Richmond Public School System qualified for the federal free or reduced lunch program (Virginia Department of Education, 2015).

This study was based on data collected four times a year (i.e., 3 months apart) for five years (i.e., 2010 to 2015) from a random sample of English-speaking students in all three grades at each middle school. The intervention components were initiated in one of the schools

beginning in Year 2, in a second school in Year 3, and were not yet implemented in the third school prior to the last wave of data collection. A sample of students from all three grades in each school was recruited from a random sample of all students during the first project year (about 210 per grade). In subsequent years, a new cohort of approximately 210 incoming sixth graders was recruited from a random sample of students and additional seventh and eighth grade students were randomly selected to replace students who left the school. Active parental permission and student assent were obtained. Participation rates were fairly high. For example, during the first three years of the project 1,188 of the 1,300 eligible and consented students participated in the study (participation rate of 91%). To reduce participant fatigue and testing effects while still obtaining a large overall sample, each participant was randomly assigned to complete only two of the four assessment waves (i.e., October, January, April, and July) each year. Once recruited, students completed assessments each year until they left middle school or chose to discontinue participation. This study was approved by the IRB of the author's university.

Differences within and across middle school grades were examined by using two samples drawn from the same larger longitudinal dataset. The first sample was used to examine changes across five waves of data starting in the fall of the sixth grade through the fall of the seventh grade (i.e., 6A, 6B, 6C, 6D, 7A, where the number indicates the grade and A = Fall, B = Winter, C = Spring, and D = Summer). It included all 1,188 adolescents who participated in at least one of the five waves. The second sample included five waves of data from the fall of the seventh grade to the fall of the eighth grade (i.e., 7A, 7B, 7C, 7D, 8A). It included all 1,201 adolescents who participated in at least one wave of those five waves. There was some overlap across datasets in that participants who had data that fell into the waves required for both samples were

included in both samples. This non-independence precluded making any between group comparisons, but allowed for analyses of multiple time points within and across school years. The overall sample included 1,609 adolescents. Approximately half the participants (49%) provided data for the sixth grade into seventh grade and seventh grade into eighth grade models. Of the rest, 26% provided data only for the sixth grade into seventh grade analysis, and 25% for the seventh grade into eighth grade analysis. The overall sample had slightly more girls (53%), and ranged in age from 10 to 16 years old, with 69% of participants identifying as African American. An additional 12% of the sample endorsed being African American and one or more other races. Approximately 5% of the sample self-identified as White, with the remaining participants endorsing another race (i.e., Asian, American Indian or Alaska Native, or Pacific Islander or Native Hawaiian). Regarding ethnicity, 14% of the overall sample self-identified as Hispanic or Latino.

Measures

Data were collected in the three schools generally in small groups during the school year and individually in adolescents' homes during the summer using a computer-assisted self-administered interview. Analyses for this project were based on a de-identified data set using identification numbers that could not be linked to participants' names. Participants were compensated with a \$10 gift card for each assessment that they completed. The current study focused on the following measures administered as part of a larger battery.

Demographic Variables. Gender, age, race, and ethnicity were based on student report. Students were asked to indicate whether they were Hispanic or Latino, and asked how they described themselves by checking one or more of the following options: *White; Black or African*

American; American Indian or Alaska Native; Asian; or Native Hawaiian or Other Pacific Islander.

Physical Aggression. Physical aggression was measured by the Problem Behavior Frequency Scale – Revised, which assesses the frequency of different forms of problem behavior (PBFS-R; Farrell et al., 2015). Respondents reported how frequently they engaged in specific behaviors in the past 30 days using a 6-point anchored scale from *Never* to *20 or more times* (i.e., 1 = *Never*, 2 = *1-2 times*, 3 = *3-5 times*, 4 = *6-9 times*, 5 = *10-19 times*, and 6 = *20 or more times*). Physical aggression toward others (i.e., perpetration) was measured by five items. Sample items include “*hit or slapped someone,*” and “*shoved or pushed someone.*” The PBFS-R has been found to have high internal consistency and a well-established factor structure in previous studies with other middle school samples (e.g., Farrell et al., 2015). Previous research found support for strong measurement invariance across gender, sites, and time, as well as support for construct validity using measures of related teacher and student reported constructs (Farrell et al., 2015).

Traumatic Stress. Adolescents’ traumatic stress was assessed using the Checklist of Children’s Distress Symptoms (CCDS), which was designed to assess the type and extent of symptoms experienced by youth who live with long-term exposure to community violence (Richters & Martinez, 1990). The CCDS is a 28-item measure based on diagnostic criteria for PTSD described in the *Diagnostic and Statistical Manual of Mental Disorders*, third edition (*DSM-III-R*) (APA, 1987). Items represent clusters of traumatic stress including hyperarousal (difficulty with attention and sleep), re-experiencing the event (reenactment of the precipitating event, flashbacks, intrusive thoughts), and avoidance. Responses are rated on a 5-point scale, including 1 = *Never*, 2 = *Seldom*, 3 = *Once in a while*, 4 = *A lot of the time*, and 5 = *Most of the*

time. Previous research found that children's composite symptom scores on the CCDS were significantly related to trauma exposure (Dulmus & Wodarski, 2000; Overstreet & Braun, 2000) and exposure to violence (Mathews, Dempsey, & Overstreet, 2009; Overstreet, Dempsey, Graham & Moely, 1999). Although the nature of the CCDS does not allow for clinical diagnoses of PTSD, it does provide an index of posttraumatic stress symptoms (Mash & Barkley, 2007). As recommended by Mash and Barkley (2007), a total CCDS score was used in the analyses similar to previous studies (e.g., Mathews et al., 2009; Suglia, Staudenmayer, Cohen, & Wright, 2010). At least one prior study has found support for a single higher-order construct using the CCDS (Li, Howard, Stanton, Rachuba, & Cross, 1998). Higher scores corresponded to more adverse psychological traumatic stress within the current study.

Data Analysis

Descriptive statistics were calculated to examine the distribution properties of each scale. Exposure to the violence prevention programming was dummy-coded to control for its effects. Correlations between physical aggression, traumatic stress, and demographic variables were computed within each of the five waves of data for each sample. All analyses were conducted using MPlus Version 7.11 (Muthén & Muthén, 2015), which computes standard errors, and a chi-square test of model fit. Missing data were addressed using full information maximum likelihood estimation (FIML). FIML provides estimates of parameters based on all available data including cases with some missing responses. Standard errors were computed using a robust estimator to account for non-normality (i.e., MLR). Significance for all tests was established at a two-tailed alpha of .05.

The hypothesized reciprocal relations between traumatic stress and physical aggression were tested using cross-lagged autoregressive path models for each of the two samples. The

cross-lagged path models were used to determine the extent to which traumatic stress at each wave predicted subsequent changes in physical aggression at the following waves, while also examining the extent to which physical aggression at each wave predicted subsequent changes in traumatic stress. The models controlled for demographics, previous levels of traumatic stress and aggression, and included correlations between traumatic stress and aggression within each wave. The model (see Figure 1) consisted of five waves of data each collected three months apart.

Separate path models were run for each sample to examine relations for waves (a) spanning the fall wave of the sixth grade to the fall wave of the seventh grade and (b) spanning the fall of the seventh grade to the fall of the eighth grade. This made it possible to investigate differences across grades and across different times of the year by comparing models in which parameters were constrained across samples or waves to models in which parameters were allowed to vary. Gender differences were also explored, using a multiple group approach to compare coefficients representing relations between traumatic stress and aggression for boys and girls. Specifically, regression coefficients within the path models were constrained to the same values for boys and girls and compared to an unconstrained model that allowed for differences in estimates across gender. Constrained and unconstrained models were compared based on the overall fit indices and the Satorra-Bentler scaled chi-square difference test (Satorra & Bentler, 2010), which takes into account the scaling correction factor for the MLR estimator. A significant Satorra-Bentler scaled chi-square difference tests indicates that the less constrained model fit the data significantly better than the more constrained model. A non-significant Satorra-Bentler scaled chi-square difference test thus favors the more parsimonious constrained model. Additional fit indices used in the current study included the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI). RMSEA

values of .06 or smaller and CFI and TLI values of .95 or greater indicate a good fit (Hu & Bentler, 1999).

To examine the effect size of significant findings, the relative percentage of variance accounted for by the explanatory variables was examined (i.e., R^2 change). Specifically, R^2 change coefficients were calculated by comparing the R^2 from the final model with and without the cross-lagged paths. For example, to determine the unique contribution of traumatic stress on physical aggression in the spring of the sixth grade, traumatic stress in the fall and winter of the sixth grade were removed from the model. In this case, R^2 change represents the unique contribution of traumatic stress at all prior waves (i.e., Waves 6A and 6B) on physical aggression in the spring of the sixth grade (i.e., Wave 6C).

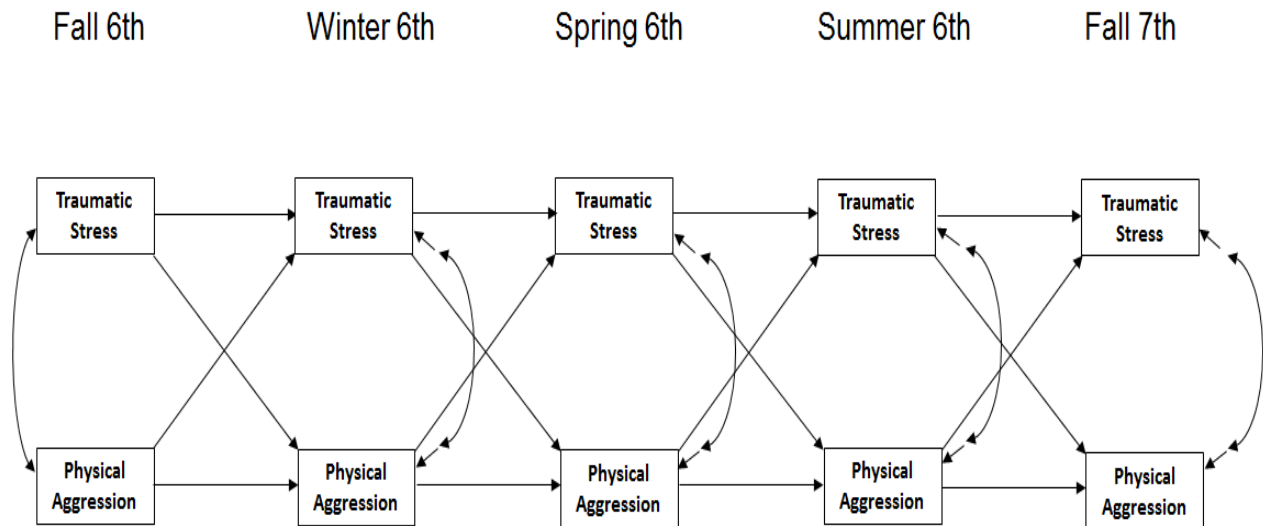


Figure 1. Autoregressive path model examining the reciprocal relation between traumatic stress and physical aggression from the fall of the sixth grade to the fall of the seventh grade. A similar model was used to test these relations from the fall of the seventh grade to the fall of the eighth grade. Demographic covariates within each wave were included in the model, but are not shown in the figure.

Results

Descriptive Statistics

Sample size, means, and standard deviations for demographic variables, physical aggression, and traumatic stress are reported separately by sample and gender in tables 1 and 2.

Table 1
Means and Standard Deviations for Physical Aggression and Traumatic Stress From Fall of the Sixth Grade to Fall of the Seventh Grade.

	<u>Girls (N=630)</u>		<u>Boys (N=558)</u>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<u>Physical Aggression</u>				
Fall 6th	1.40	0.64	1.46	0.76
Winter 6th	1.38	0.57	1.42	0.70
Spring 6th	1.39	0.56	1.51	0.75
Summer 6th	1.35	0.51	1.34	0.62
Fall 7th	1.44	0.67	1.42	0.69
<u>Traumatic Stress</u>				
Fall 6th	2.23	0.77	1.94	0.71
Winter 6th	2.13	0.81	1.87	0.73
Spring 6th	2.10	0.81	1.72	0.66
Summer 6th	2.05	0.73	1.79	0.70
Fall 7th	2.03	0.84	1.76	0.67

Table 2

Means and Standard Deviations for Physical Aggression and Traumatic Stress From Fall of the Seventh Grade to Fall of the Eighth Grade.

	<u>Girls (N=656)</u>		<u>Boys (N=545)</u>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<u>Physical Aggression</u>				
Fall 7th	1.47	0.67	1.43	0.67
Winter 7th	1.49	0.74	1.40	0.67
Spring 7th	1.60	0.83	1.40	0.60
Summer 7th	1.43	0.65	1.34	0.58
Fall 8th	1.55	0.79	1.37	0.66
<u>Traumatic Stress</u>				
Fall 7th	2.16	0.82	1.77	0.69
Winter 7th	2.08	0.80	1.70	0.64
Spring 7th	2.04	0.82	1.78	0.68
Summer 7th	1.96	0.76	1.70	0.60
Fall 8th	2.09	0.82	1.65	0.67

Correlations among variables. Pearson correlations among the study variables are reported in Table 3 for Waves 6A through 7A, and in Table 4 for Waves 7A through 8A. Male gender was negatively correlated with traumatic stress at every wave ($rs = -0.17$ to -0.27 , $ps < .001$), indicating that boys reported lower levels. Gender differences also emerged in regards to physically aggressive behavior, such that male gender was positively correlated with physical aggression at Waves 7C, 7D, and 8A ($rs = -.09$ to $-.12$, $ps < .05$), indicating that boys reported higher frequencies of aggression. African Americans reported lower levels of traumatic stress at three of the waves (i.e., 6B, 6D, and 7A ($rs = -.08$ to $-.12$, $ps < .05$)). Hispanic ethnicity was negatively correlated with physical aggression at three of the waves ($rs = -.09$ to $-.13$, $ps < .05$). Physical aggression was significantly correlated across all waves ($rs = .23$ to $.66$, $ps < .001$), particularly between adjacent waves ($rs = .46$ to $.66$). Traumatic stress was also significantly correlated across all waves ($rs = .46$ to $.69$, $ps < .001$). Physical aggression and traumatic stress

were significantly correlated within each wave ($r_s = .22$ to $.39$, $p_s < .01$). With two exceptions (i.e., Waves 6A and 6B), physical aggression was significantly correlated with traumatic stress at the following wave ($r_s .23$ to $.31$, $p_s < .01$). Conversely, traumatic stress was significantly correlated with physical aggression at every subsequent wave ($r_s .19$ to $.37$, $p_s < .01$).

Table 3

Correlations Among Project Variables Including Demographic Variables, Physical Aggression, and Traumatic Stress from the Fall of the Sixth Grade to the Fall of the Seventh Grade

	1	2	3	4	5	6	7	8	9	10	11	12
1. Male	-											
2. AA	.04	-										
3. Hispanic	-.01	-.62***	-									
4. 6A PA	.05	.06	-.13***	-								
5. 6B PA	.03	.08	-.12***	.57***	-							
6. 6C PA	.07	.09*	-.09*	.61***	.46***	-						
7. 6D PA	-.01	.07	-.08	.28**	.51***	.66***	-					
8. 7A PA	.00	.10	-.07*	.41***	.60***	.46***	.62***	-				
9. 6A TS	-.18***	-.09	.00	.22**	.23**	.20*	.28**	.22**	-			
10. 6B TS	-.17***	-.08*	.07	.12	.26***	.33***	.30***	.28***	.55***	-		
11. 6C TS	-.24***	-.08	.07	.19*	.02	.29***	.19**	.20**	.56***	.66***	-	
12. 6D TS	-.17***	-.12**	.08	.13	.05	.23**	.29***	.17**	.55***	.59***	.52***	-
13. 7A TS	-.19***	-.11*	.12**	.27***	.15*	.26***	.24**	.31***	.46***	.61***	.51***	.69***

Note. $N=1,188$. PA = Physical Aggression. TS = Traumatic Stress. AA = African American. 6A = first wave during the sixth grade, 6B = second wave in the sixth grade, etc.

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

Table 4

Correlations for Project Variables Including Demographic Variables, Physical Aggression, and Traumatic Stress from the Fall of the Seventh Grade to the Fall of the Eighth Grade

	1	2	3	4	5	6	7	8	9	10	11	12
1. Male	-											
2. AA	.06	-										
3. Hispanic	-.03	-.62***	-									
4. 7A PA	-.04	.11**	-.08*	-								
5. 7B PA	-.07	.00	-.01	.58***	-							
6. 7C PA	-.12**	.13***	-.13***	.45***	.56***	-						
7. 7D PA	-.09*	.12**	-.11**	.32**	.45***	.61***	-					
8. 8A PA	-.11**	.03	-.06	.23**	.32***	.41***	.59***	-				
9. 7A TS	-.23***	-.10**	.11**	.32***	.23*	.37***	.18**	.20**	-			
10. 7B TS	-.25***	-.06	.07	.23**	.32***	.37***	.33***	.28***	.60***	-		
11. 7C TS	-.17***	-.06	.04	.24**	.23***	.33***	.28***	.26**	.60***	.49***	-	
12. 7D TS	-.20***	.03	.01	.08	.24***	.31***	.34***	.26***	.62***	.51***	.68***	-
13. 8A TS	-.27***	-.02	.02	.18	.39***	.34***	.29***	.39***	.61***	.57***	.53***	.69***

Note. $N=1,201$. PA = Physical Aggression. TS = Traumatic Stress. AA = African American. 7A = first wave during the sixth grade, 7B = second wave in the seventh grade, etc.

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

Bidirectional Changes Across Waves for the Sixth into Seventh Grade Sample

Analyses of the longitudinal models were conducted to test bidirectional relations among physical aggression and traumatic stress across five waves between the fall of the sixth grade through the fall of the seventh grade (i.e., sixth into seventh grade; Waves 6A, 6B, 6C, 6D, 7A; Model 1) and between the fall of the seventh grade and fall of the eighth grade (i.e., seventh into eighth grade; Waves 7A, 7B, 7C, 7D, 8A; Model 3). Additional multiple group models were tested to determine whether gender moderated the bidirectional relations between physical aggression and traumatic stress (Models 2 and 4).

Model 1: Full sample. Table 5 reports the fit statistics for several variations of Model 1, which investigated the reciprocal relations between changes in physical aggression and traumatic stress across five waves within the sixth into seventh grade sample. The starting point was the model represented in Figure 1 in which physical aggression and traumatic stress at Waves 6B through 7A were regressed on the scores on these constructs at the preceding wave and the demographic variables (Model 1a). This model did not adequately fit the data (see Table 5). A second model (Model 1b) that added paths linking physical aggression at Wave 6A to physical aggression at every wave, and traumatic stress at Wave 6A to traumatic stress at every wave was tested to see if the initial levels of these constructs predicted subsequent changes across all waves. This significantly improved the overall fit compared to Model 1a (see Table 5).

Constraints were imposed on Model 1b to test differences in parameters across waves. More specifically, Model 1b was compared to models that constrained: (a) all autoregressive coefficients representing the impact of physical aggression across subsequent waves to the same value (Model 1c), (b) all autoregressive coefficients for traumatic stress across waves to the same value (Model 1d), and (c) both sets of constraints on autoregressive coefficients (Model 1e).

Results of the Satorra-Bentler scaled chi-square difference test indicated that constraining autoregressive coefficients for physical aggression and for traumatic stress did not result in a significant decrease in model fit compared to the unconstrained model (see Table 5). In other words, both constructs showed similar levels of stability across waves. All further analyses to compare the effect of additional constraints were therefore based on this model.

Additional models evaluated differences across waves in the relations between traumatic stress and changes in physical aggression (Model 1f) and the relations between physical aggression and changes in traumatic stress (Model 1g). Results of the Satorra-Bentler scaled chi-square difference test comparing these models to Model 1e indicated that constraining the effect of traumatic stress on physical aggression and the effect of physical aggression on traumatic stress each resulted in a significant decrease in model fit. This indicated that the effect of physical aggression on traumatic stress varied over time, as did the effect of traumatic stress on physical aggression.

The last model constrained parameters linking demographic variables and trauma symptoms and physical aggression across time (Model 1h). Model 1h was the most parsimonious and best fitting model based on the Satorra-Bentler scaled chi-square difference test. It also fit the data well, RMSEA = .02, CFI = .97, TLI = .95. Coefficients for this model are represented in Figure 2 and reported in Table 6. The model accounted for 34% to 51% of the variance in physical aggression ($ps < .001$), and 32% to 53% of the variance in traumatic stress ($ps < .001$). As expected, the prior level of each construct significantly predicted future levels (i.e., the autoregressive paths). In this model, being African American was a significant predictor of increases in physical aggression at Waves 6B through 7A ($\beta = 0.04$, $ps = .04$), controlling for other demographics and prior levels of physical aggression. Being Hispanic and being in the

intervention did not predict changes in physical aggression or traumatic stress across adjacent waves. Significant cross-variable relations were found between the winter and spring of the 6th grade, but not across any of the other waves. More specifically, traumatic stress at Wave 6B was a significant predictor of increases in physical aggression at Wave 6C ($\beta = 0.24$, R^2 change = 0.05, $p = .001$), controlling for demographics and prior levels of physical aggression. Conversely, physical aggression at Wave 6B predicted decreased levels of traumatic stress at Wave 6C ($\beta = -0.15$, R^2 change = 0.03, $p = .004$), controlling for demographics and prior frequencies of traumatic stress.

Table 5

Fit Indices and Comparison of Models Investigating Bidirectional Relations Between Physical Aggression and Traumatic Stress From Sixth Into Seventh Grade

Model 1: 6th into 7th Grade Full Sample	χ^2 ^a	<i>df</i>	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	$\chi^2 \Delta$ ^b	<i>df</i> Δ	Comparison Model
1a. Initial unconstrained model	98.79***	24	0.05	0.89	0.69	29.63***	6	1b
1b. Added initial paths on all following waves	62.64***	18	0.05	0.94	0.76			
1c. Constrained PA autoregressive paths	45.29***	21	0.03	0.97	0.89	0.55	3	1b
1d. Constrained TS autoregressive paths	67.38***	21	0.04	0.93	0.78	3.00	3	1b
1e. Constrained both sets of autoregressive paths	51.15**	24	0.03	0.96	0.89	6.00	6	1b
1f. Constrained prior TS waves on PA paths	61.20***	27	0.03	0.95	0.88	11.48**	3	1e
1g. Constrained prior PA waves on TS paths	59.23***	27	0.03	0.95	0.88	8.10*	3	1e
1h. Constrained autoregressive paths and demographics	64.63*	42	0.02	0.97	0.95	9.03	18	1e

Note. *N* = 1,188. Bolded model is the one determined to best fit the data. RMSEA = Root mean square error of approximation. PA = Physical Aggression. TS = Traumatic Stress. CFI = comparative fit index. TLI = Tucker-Lewis Fit index.

^aChi-square test of model fit. ^bSatorra-Bentler scaled chi-square difference test comparing fit of each model to the comparison model. Significant chi-square values indicate that the comparison model resulted in a significant improvement in fit.

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

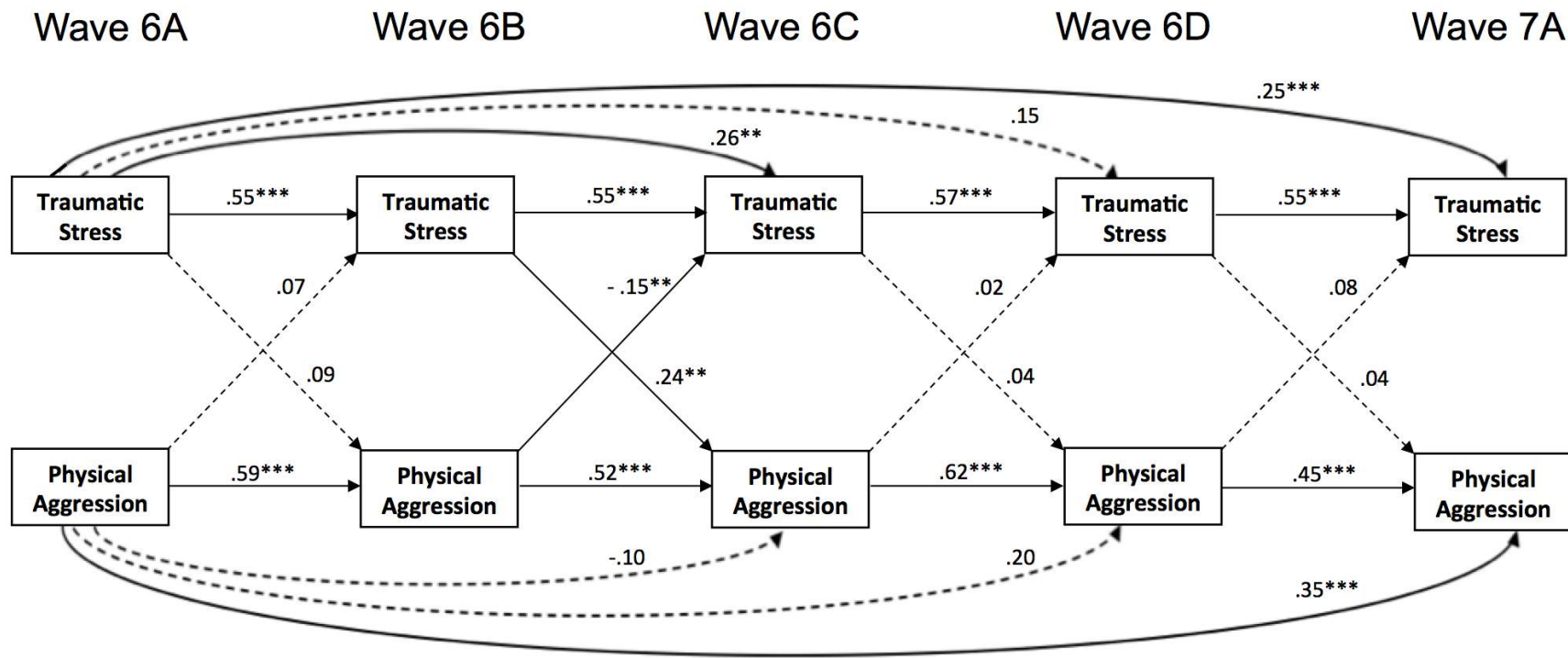


Figure 2. Final autoregressive path model examining the reciprocal relation between physical aggression and traumatic stress across five waves between the fall of the sixth grade and the fall of the seventh grade. Demographic covariates and correlations between measures within each wave were included in the model but not shown in the figure. Non-significant paths are represented by dashed lines.

Table 6

Standardized Parameter Estimates and Standard Errors for Regression of Physical Aggression and Traumatic Stress of All Paths from the Final Sixth Into Seventh Grade Model (Model 1h)

Dependent Variable: Physical Aggression				
Predictors	Wave 6B PA	Wave 6C PA	Wave 6D PA	Wave 7A PA
African American	0.04* (0.02)	0.04* (.02)	0.04* (0.02)	0.04* (0.02)
Hispanic	-0.003 (0.02)	-0.003 (0.02)	-0.003 (0.02)	-0.002 (0.02)
Intervention	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
6A PA		-0.10 (.25)	0.20 (0.13)	0.35*** (0.08)
Prior Wave PA	0.59*** (.07)	0.52 *** (0.09)	0.62*** (0.07)	0.45*** (0.07)
Prior Wave TS	0.09 (.06)	0.24** (0.07)	0.04 (0.07)	0.04 (0.05)
R^2	0.39*** (0.08)	0.34*** (0.06)	0.51*** (0.09)	0.47*** (0.08)
Dependent Variable: Traumatic Stress				
	Wave 6B TS	Wave 6C TS	Wave 6D TS	Wave 7A TS
African American	0.003 (0.2)	0.003 (0.2)	0.003 (0.03)	0.003 (0.02)
Hispanic	0.05 (0.03)	0.05 (0.03)	0.05 (0.03)	0.05 (0.03)
Intervention	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
6A TS		0.26** (0.09)	0.15 (0.11)	0.25*** (0.07)
Prior Wave PA	0.07 (0.06)	-0.15** (0.05)	0.02 (0.07)	0.08 (0.08)
Prior Wave TS	0.55*** (0.04)	0.55*** (0.05)	0.57*** (0.04)	0.55*** (0.04)
R^2	0.32*** (0.05)	0.51*** (0.08)	0.46*** (0.06)	0.53*** (0.06)

Note. N = 1,188. Standard errors are in parentheses. PA = Physical Aggression. TS = Traumatic Stress.

6A = first wave during the sixth grade, 6B = second wave in the sixth grade, etc.

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

Model 2: Gender differences. Gender differences were explored using a multiple group approach to test reciprocal relations between traumatic stress and aggression in the sixth into seventh grade model separately for boys and girls. A series of models was used to determine the extent to which effects within and across constructs were similar for boys and girls. All models had the same overall structure as Model 1b from the full sample analyses. Constrained and unconstrained multiple group models were compared using fit indices and the Satorra-Bentler scaled chi-square difference test. The initial model (Model 2a) allowed all parameters to vary across gender and across waves. Model 2b constrained coefficients representing the relations between the demographic variables (i.e., race, ethnicity, and intervention status) and the paths linking physical aggression and traumatic stress at Wave 6A to subsequent waves across gender (i.e., wave A paths). Model 2b also constrained the autoregressive paths for physical aggression and traumatic stress to the same values across gender but not over time (i.e., the 6A to 6B paths for traumatic stress and for physical aggression were constrained to the same value for boys and girls, as were the 6B to 6C paths, and so on). Model 2c constrained additional coefficients representing the relations between the demographic variables and autoregressive paths across gender *and across time*. Results of the Satorra-Bentler scaled chi-square difference test indicated that constraining the relations between demographics variables and autoregressive paths across gender and time did not result in a significant decrease in model fit compared to the unconstrained model (see Table 7). These results indicated that wave A paths on subsequent waves for physical aggression and traumatic stress were consistent across gender, and that autoregressive paths for physical aggression, traumatic stress, and the effects of the demographic variables on these constructs did not significantly differ for boys and girls or across waves. The next series of models was compared to this model (Model 2c).

The next series of models tested the extent to which the effect of traumatic stress on subsequent changes in physical aggression could be constrained across gender (Model 2d) and across both gender and time (Model 2e). Results of the Satorra-Bentler scaled chi-square difference test indicated that both sets of constraints resulted in significant decreases in model fit. This indicated that the relation between traumatic stress and subsequent changes in physical aggression was not consistent across gender or across waves within the models for boys and girls.

The next pair of models used a similar approach to test constraints on the effect of physical aggression on traumatic stress across gender (Model 2f) and across gender and time (Model 2g). Model 2f emerged as the most parsimonious and best fitting model based on the Satorra-Bentler scaled chi-square difference test.

The final model (Model 2f) constrained the effects of demographics and autoregressive paths across time and gender, and constrained the cross-lagged paths examining prior levels of physical aggression on traumatic stress by gender. The overall model fit the data adequately, $RMSEA = .03$, $CFI = .94$, $TLI = .92$. Coefficients for this model are represented in Figures 3 and 4 reported in Table 8. For girls, prior levels of physical aggression and traumatic stress and demographics accounted for 28% to 49% of the variance in physical aggression ($ps < .001$), and 34% to 48% of the variance in traumatic stress ($ps < .001$). For boys, prior levels of physical aggression and traumatic stress and demographics accounted for 35% to 56% of the variance in physical aggression ($ps < .001$) and 29% to 60% of the variance in traumatic stress ($ps < .001$).

The pattern of relations was mostly consistent with the full sample model in terms of the autoregressive paths and influence of race, ethnicity, and the intervention. Specifically, being African American was a significant predictor of increases in physical aggression at Waves 6B

through 7A for both boys and girls (β s = .03 to .05, p s = .03 to .04), controlling for other demographics and prior levels of physical aggression. Traumatic stress did not significantly predict changes in physical aggression for girls at any of the waves. The frequency of boys' traumatic stress at Wave 6B predicted a significant increase in physical aggression at Wave 6C ($\beta = 0.36$, R^2 change = 0.14, $p < .001$), controlling for prior levels of physical aggression. The overall impact of traumatic stress at Wave 6B on physical aggression at Wave 6C was significantly different for boys than for girls ($B = .22$, $p = 0.04$). Physical aggression at Wave 6B predicted decreased levels of traumatic stress at Wave 6C for both boys ($\beta = -0.16$, R^2 change = 0.07, $p < .01$) and girls ($\beta = -0.11$, R^2 change = 0.01, $p = .02$), controlling for prior levels of traumatic stress. This coefficient did not differ across gender ($B = .003$, $p = .98$).

Table 7

Fit Indices and Comparison of Models Investigating the Bidirectional Relations Between Physical Aggression and Traumatic Stress Sixth into Seventh Grade by Gender

Model 2: 6th into 7th Grade By Gender	χ^2_a	df	RMSEA	CFI	TLI	χ^2_b	df Δ	Comparison Model
2a. Initial unconstrained model	86.77***	36	0.05	0.93	0.74			
2b. Constrained wave A paths, autoregressive paths and demographic effects across gender	132.09***	74	0.04	0.92	0.86	51.30	38	
2c. Constrained wave A paths across gender and autoregressive paths and demographic effects across gender and time	145.74**	98	0.03	0.94	0.91	16.10	24	2b
2d. Constrained autoregressive paths and demographic effects across gender and time, and wave A paths and prior TS on PA paths across gender	163.96*	102	0.03	0.92	0.89	25.81***	4	2c
2e. Constrained wave A paths across gender, autoregressive paths and demographic effects across gender and time, and prior TS on PA paths across time	165.07***	104	0.03	0.92	0.89	21.35**	6	2c
2f. Constrained autoregressive paths and demographic effects across gender and time, and wave A paths and prior PA on TS paths across gender	147.69**	102	0.03	0.94	0.92	2.49	4	2c
2g. Constrained wave A paths across gender, autoregressive paths and demographic effects across gender and time, and prior PA on TS paths across gender and time	156.56***	105	0.03	0.93	0.91	9.04*	6	2f

Note. $N = 1,188$. Bolded model is the one determined to best fit the data. RMSEA = Root mean square error of approximation. CFI = comparative fit index. TLI = Tucker-Lewis Fit index.

^aChi-square test of model fit. ^bSatorra-Bentler scaled chi-square difference test comparing fit of each model to the comparison model. Significant chi-square values indicate that the comparison model resulted in a significant improvement in fit.

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

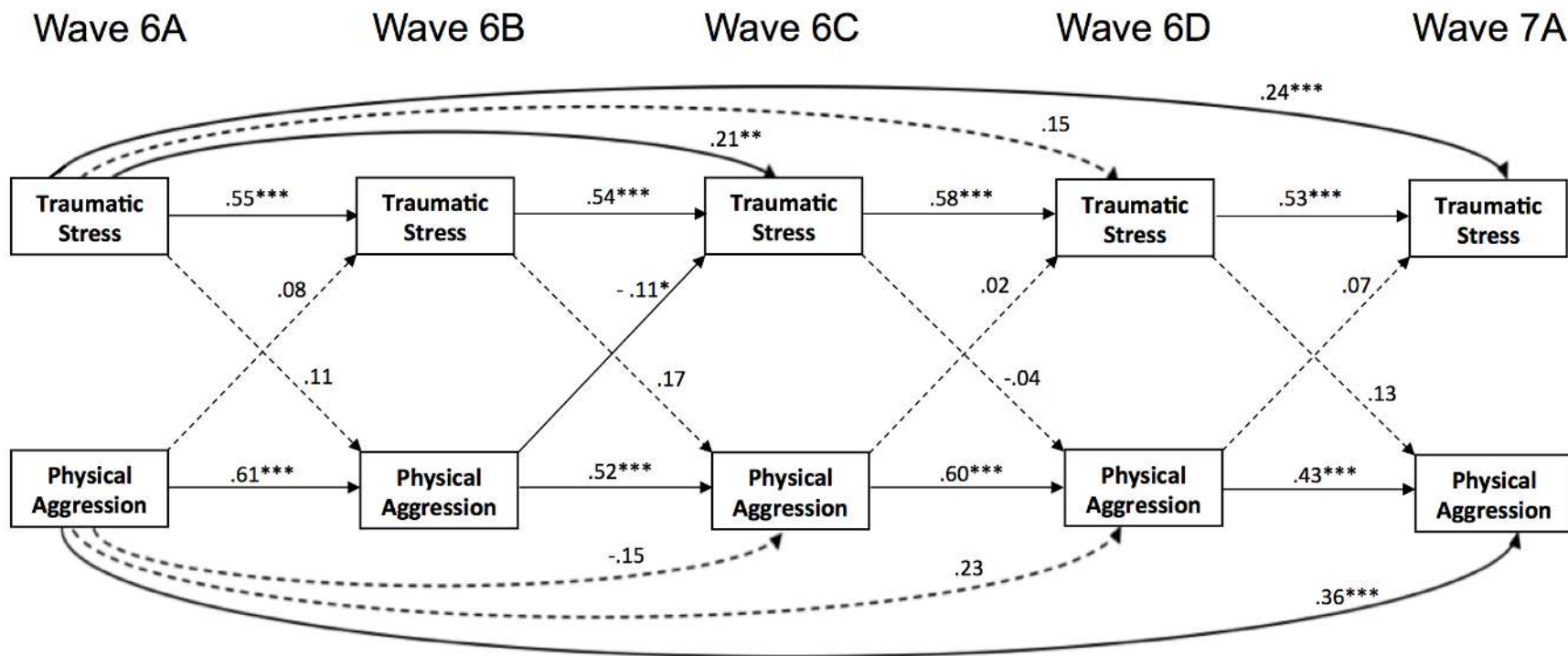


Figure 3. Multiple group autoregressive path model examining the reciprocal relation between traumatic stress and physical aggression across the fall of the sixth grade to the fall of the seventh grade for girls. Demographic covariates and correlations between measures within each wave were included in the model, but are not shown in the figure.

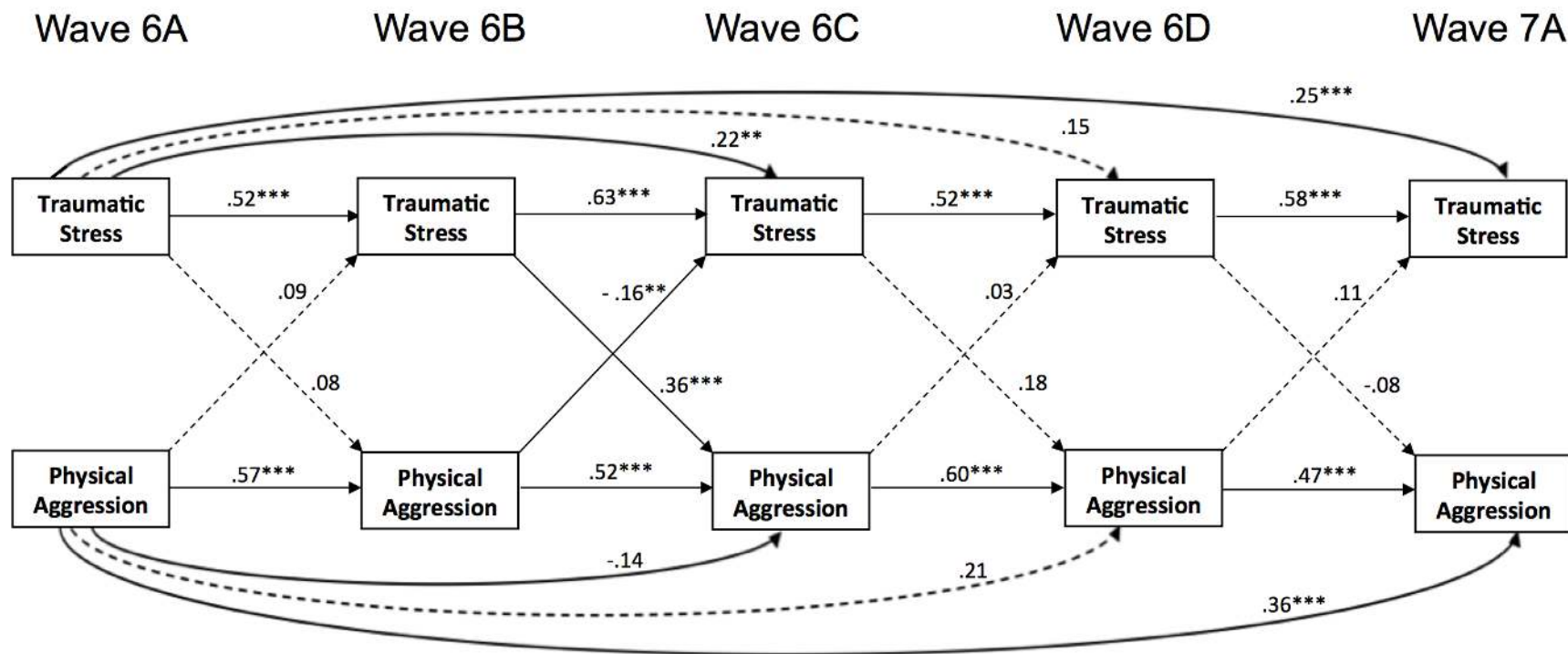


Figure 4. Multiple group autoregressive path model examining the reciprocal relation between traumatic stress and physical aggression across the fall of the sixth grade to the fall of the seventh grade for boys. Demographic covariates and correlations between measures within each wave were included in the model, but are not shown in the figure.

Table 8

Standardized Parameter Estimates and Standard Errors for Regression of Physical Aggression and Traumatic Stress for Sixth into Seventh Grade by Gender (Model 2f).

Predictors	Dependent Variables							
	Wave 6B PA	Wave 6C PA	Wave 6D PA	Wave 7A PA	Wave 6B TS	Wave 6C TS	Wave 6D TS	Wave 7A TS
Girls								
African American	0.05* (0.02)	0.04* (0.02)	0.05* (0.2)	0.04* (0.02)	0.001 (0.02)	0.001 (0.02)	0.001 (0.03)	0.001 (0.01)
Hispanic	-0.01 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.01 (0.02)	0.04 (0.03)	0.04 (0.02)	0.04 (0.03)	0.04 (0.02)
Intervention	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
6A PA		-0.15 (0.24)	0.23 (0.12)	0.36*** (0.08)				
Prior wave PA	0.61*** (0.10)	0.52*** (0.11)	0.60*** (0.09)	0.43*** (0.07)	0.08 (0.05)	-0.11* (0.05)	0.02 (0.06)	0.07 (0.06)
6A TS						0.21** (0.09)	0.15 (0.12)	0.24*** (0.07)
Prior wave TS	0.11 (0.08)	0.17 (0.09)	-0.04 (0.08)	0.13 (0.08)	0.55*** (0.05)	0.54*** (0.05)	0.58*** (0.04)	0.53*** (0.05)
R ²	0.44***	0.28***	0.48***	0.49***	0.34***	0.43***	0.46***	0.48***
Boys								
African American	0.04* (0.02)	0.03* (0.02)	0.04* (0.02)	0.03* (0.02)	0.001 (0.02)	0.001 (0.03)	0.001 (0.03)	0.001 (0.03)
Hispanic	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	0.04 (0.03)	0.05 (0.03)	0.04 (0.03)	0.05 (0.03)
Intervention	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
6A PA		-0.14 (0.22)	0.21 (0.11)	0.36*** (0.08)				
Prior wave PA	0.57*** (0.07)	0.52*** (0.09)	0.60*** (0.09)	0.47*** (0.08)	0.09 (0.06)	-0.16** (0.07)	0.03 (0.08)	0.11 (0.09)
6A TS						0.22** (0.09)	0.15 (0.12)	0.25*** (0.07)
Prior wave TS	0.08 (0.11)	0.36*** (0.08)	0.18 (0.10)	-0.08 (0.06)	0.52*** (0.04)	0.63*** (0.06)	0.52*** (0.05)	0.58*** (0.05)
R ²	0.35***	0.41***	0.56***	0.46***	0.29***	0.57***	0.39***	0.60***

Note. $N = 1,188$. Standard errors are in parentheses. PA = Physical Aggression. TS = Traumatic Stress.

6A = first wave during the sixth grade, 6B = second wave in the sixth grade, etc.

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

Bidirectional Changes Across Waves for the Seventh into Eighth Grade Sample

Model 3: Full sample. Table 9 reports the fit statistics for variations of Model 3, which investigated the reciprocal relations between changes in physical aggression and traumatic stress across five waves within the seventh into eighth grade sample. The starting point was the basic unconstrained model similar to the model represented in Figure 1 (Model 3a). This model did not adequately fit the data (see Table 9). Similar to the sixth into seventh grade sample, a second model (Model 3b) that added paths linking physical aggression at Wave 7A to physical aggression at every wave, and traumatic stress at Wave 7A to traumatic stress at every wave was tested to see if the initial levels of these constructs predicted subsequent changes across all waves. These additional paths significantly improved the overall fit compared to Model 3a (see Table 9). Model 3b was therefore used to compare the effect of additional constraints.

Consistent with the full sample sixth into seventh grade models, a series of constraints was imposed to test differences across waves. More specifically, Model 3b was compared to models that constrained (a) all autoregressive coefficients representing the impact of physical aggression across subsequent waves to the same value (Model 3c), (b) all autoregressive coefficients for traumatic stress across waves to the same value (Model 3d), and (c) both sets of constraints on autoregressive coefficients (Model 3e). Results of the Satorra-Bentler scaled chi-square difference test indicated that constraining autoregressive coefficients for physical aggression and for traumatic stress did not result in a significant decrease in model fit compared to the unconstrained model (see Table 9). This indicated that physical aggression and traumatic stress showed similar levels of stability across waves.

Additional constraints were imposed on Model 3e to evaluate differences across waves in the relations between traumatic stress and changes in physical aggression (Model 3f), and the

relations between physical aggression and changes in traumatic stress (Model 3g). In contrast to the sixth into seventh grade models, results of the Satorra-Bentler scaled chi-square difference test indicated that Models 3f and 3g did not significantly decrease the fit (see Table 9).

Therefore, an additional model constrained both sets of cross-lagged paths simultaneously (Model 3h), which did not result in a significant decrease in model fit and was therefore retained to compare the effects of additional constraints. These results indicated that both constructs showed similar levels of stability across waves, and that the effect of physical aggression on traumatic stress varied over time, as did the effect of traumatic stress on physical aggression.

Additional constraints were imposed on Model 3h to test differences across waves in the relations between the demographic variables and changes in traumatic stress and physical aggression (Model 3i). Results of the Satorra-Bentler scaled chi-square difference test indicated that this model did not fit as well as Model 3h (see Table 9), suggesting that the effect of at least one of the demographic variables varied across time. Therefore, Model 3h was compared to a model that constrained the relations between race and changes in physical aggression and traumatic stress, but the relations between ethnicity and intervention status on changes in both constructs were allowed to vary across waves (Model 3j). The Satorra-Bentler scaled chi-square difference test indicated that this did not result in a significant decrease in model fit compared to Model 3h (see Table 9).

The final model constrained parameters linking race and ethnicity and changes in physical aggression and traumatic stress across time (Model 3k). Model 3k was the most parsimonious and best fitting model based on the Satorra-Bentler scaled chi-square difference test. It fit the data very well, RMSEA = .00, CFI = 1.00, TLI = 1.01. Coefficients for this model are represented in Figure 5 and reported in Table 10. The model accounted for 32% to 48% of

the variance in physical aggression within Waves 7B through 8A ($ps < .001$) and 31% to 59% of the variance in traumatic stress within Waves 7B through 8A ($ps < .001$). As expected, both sets of autoregressive paths were significant. Being African American did not predict changes in physical aggression or traumatic stress over time, Being Hispanic predicted changes in physical aggression at Wave 7D ($\beta = -0.04, p = .04$) and Wave 8A ($\beta = -0.04, p = .04$), and being in the intervention predicted changes in traumatic stress at Wave 7D ($\beta = 0.11, p = .01$) and Wave 8A ($\beta = 0.11, p = .02$). Partial support was found for significant cross-variable relations across the waves. Specifically, traumatic stress at each wave was a significant risk factor for increased physical aggression across adjacent waves (β 's ranged from .09 to .12, R^2 change ranged from 0 to 0.01, $p = .001$), controlling for prior levels of physical aggression. In contrast, physical aggression did not predict changes in levels of traumatic stress, controlling for prior levels of traumatic stress (β 's ranged from 0.05 to 0.07, ps ranged from 0.08 to 0.09).

Table 9

Fit Indices and Comparison of Models Investigating the Bidirectional Relations Between Physical Aggression and Traumatic Stress From Seventh Into Eighth Grade.

Model 3: 7th into 8th Grade Full Sample	χ^2 ^a	<i>df</i>	<i>RMSEA</i>	<i>CFI</i>	<i>TLI</i>	$\chi^2\Delta$ ^b	<i>df\Delta</i>	Comparison Model
3a. Initial unconstrained model	61.31	24	0.04	0.94	0.83	36.69***	6	3b
3b. Added initial paths on all following waves	18.02	18	0.00	1.00	1.00			
3c. Constrained PA autoregressive paths	18.25	21	0.00	1.00	1.02	1.52	3	3b
3d. Constrained TS autoregressive paths	25.13	21	0.01	0.99	0.98	6.55	3	3b
3e. Constrained both sets of autoregressive paths	25.23	24	0.01	1.00	0.99	6.84	6	3b
3f. Constrained autoregressive paths and prior TS waves on PA	26.77	27	0.00	1.00	1.00	1.37	6	3e
3g. Constrained autoregressive paths and prior PA on TS Paths	26.65	27	0.00	1.00	1.00	0.89	6	3e
3h. Constrained autoregressive paths and both sets of cross-lagged paths	28.25	30	0.00	1.00	1.01	2.33	9	3e
3i. Constrained autoregressive paths, both sets of cross-lagged paths, and demographics	57.48	48	0.01	0.99	0.98	34.81**	18	3h
3j. Constrained autoregressive, both sets of cross-lagged paths, and being AA	35.23	36	0.00	1.00	1.00	7.82	6	3h
3k. Constrained autoregressive paths, both sets of cross-lagged paths, being AA and Hispanic	40.00	42	0.00	1.00	1.01	11.98	6	3j

Note. Bolded model is the one determined to best fit the data. RMSEA = Root mean square error of approximation. CFI = comparative fit index. TLI = Tucker-Lewis Fit index. PA = Physical Aggression. TS = Traumatic Stress. AA = African American.

^aChi-square test of model fit. ^bSatorra-Bentler scaled chi-square difference test comparing fit of each model to the comparison model. Significant chi-square values indicate that the comparison model resulted in a significant improvement in fit.

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

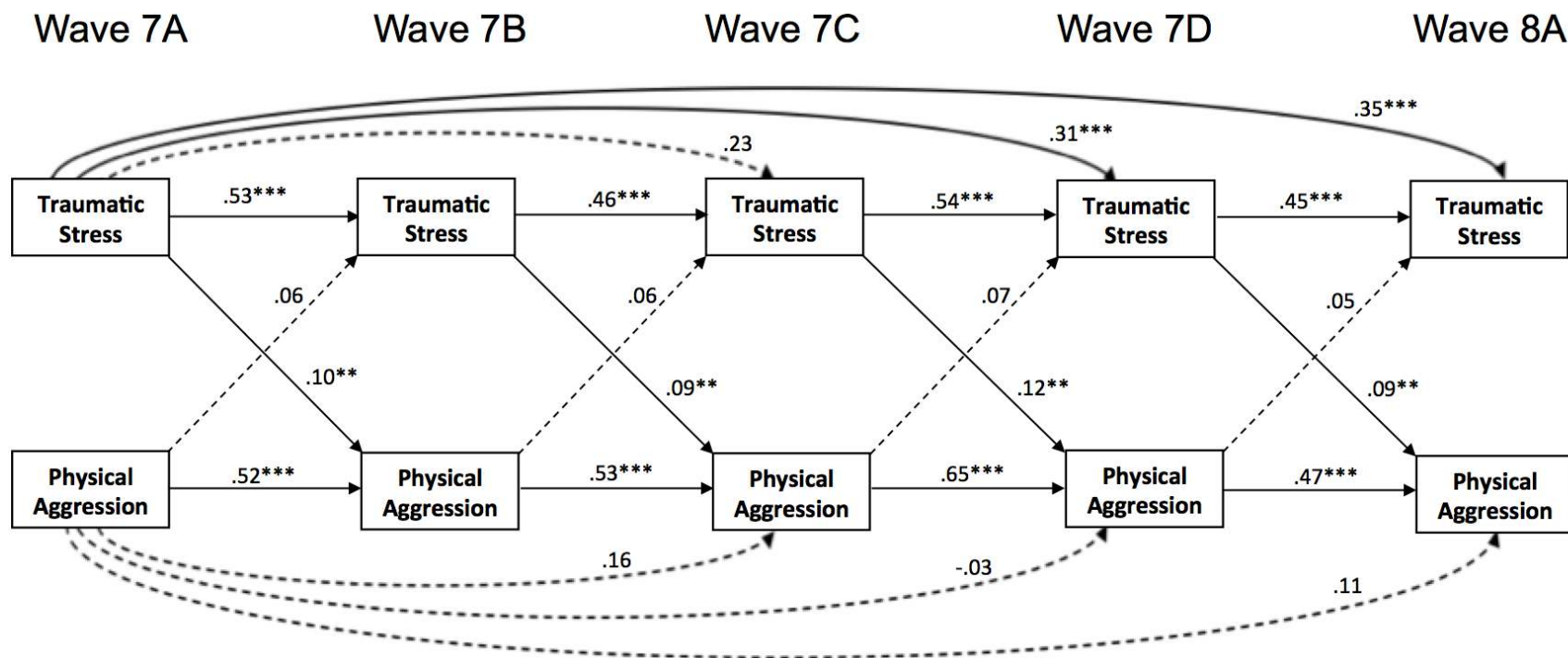


Figure 5. Final autoregressive path model examining the reciprocal relation between physical aggression and traumatic stress across five waves between the fall of the seventh grade and the fall of the eighth grade. Demographic covariates and correlations between measures within each wave were included in the model but not shown in the figure. Non-significant paths are represented by dashed lines.

Table 10

Standardized Parameter Estimates and Standard Errors for Regression of Physical Aggression and Traumatic Stress of All Paths from Seventh Into Eighth Grade (Model 3k).

Dependent Variable: Physical Aggression				
Predictors	Wave 7B PA	Wave 7C PA	Wave 7D PA	Wave 8A PA
African American	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)	0.01 (0.07)
Hispanic	-0.04 (0.02)	-0.03 (0.02)	-0.04* (0.02)	-0.04* (0.02)
Intervention	-0.06 (0.04)	0.08 (0.04)	0.05 (0.05)	-0.04 (0.05)
7A PA		0.16 (0.12)	-0.03 (0.14)	0.11 (0.09)
Prior Wave PA	0.52*** (0.06)	0.53*** (0.07)	0.65*** (0.08)	0.47*** (0.06)
Prior Wave TS	0.10** (0.03)	0.09** (0.03)	0.12** (0.04)	0.09** (0.03)
R^2	0.33***	0.46***	0.48***	0.32***
Dependent Variable: Traumatic Stress				
	Wave 7B TS	Wave 7C TS	Wave 7D TS	Wave 8A TS
African American	0.01 (0.03)	0.01 (0.02)	0.01 (0.03)	0.01 (0.03)
Hispanic	-0.02 (0.03)	-0.02 (0.02)	-0.02 (0.03)	-0.02 (0.02)
Intervention	-0.07 (0.05)	-0.003 (0.04)	0.11** (0.04)	0.11* (0.05)
7A TS		0.23 (0.12)	0.31*** (0.09)	0.35*** (0.07)
Prior Wave PA	0.06 (0.03)	0.06 (0.04)	0.07 (0.04)	0.05 (0.03)
Prior Wave TS	0.53*** (0.07)	0.46*** (0.06)	0.54*** (0.06)	0.45*** (0.06)
R^2	0.31***	0.42***	0.59***	0.56***

Note. $N = 1,201$. Standard errors are in parentheses. PA = Physical Aggression. TS = Traumatic Stress.

7A = first wave during the seventh grade, 7B = second wave in the seventh grade, etc.

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

Model 4: Gender differences. Gender differences within the seventh into eighth grade model were explored using a multiple group approach. A series of models similar to those used in Model 2 was used to determine the extent to which effects within and across constructs were consistent for boys and girls. All models had the same overall structure as Model 2b from the full sample analyses. The initial model (Model 4a) allowed all parameters to vary across gender and across waves. Model 4b constrained coefficients representing the relations between the demographic variables (i.e., race, ethnicity, and intervention status) and the paths linking physical aggression and traumatic stress at Wave 7A to subsequent waves across gender (i.e., wave A paths). Model 4b also constrained the autoregressive paths for physical aggression and traumatic stress to the same values across gender but not over time (i.e., the 7A to 7B paths for traumatic stress and for physical aggression were constrained to the same value for boys and girls, as were the 7B to 7C paths, and so on). In contrast to the sixth into seventh grade model, the results of the Satorra-Bentler scaled chi-square difference test indicated that constraining these relations resulted in a significant decrease in model fit compared to the unconstrained model (see Table 11). These results indicated that either the relation between physical aggression from one wave to the next or the relation between traumatic stress from one wave to the next (or both) varied for boys and girls.

The next series of constraints concerned the extent to which either of the autoregressive paths for physical aggression and traumatic stress varied across gender and time. More specifically, Model 4a was compared to models that constrained the coefficients representing physical aggression wave A paths to all subsequent physical aggression paths and physical aggression autoregressive coefficients representing the impact of physical aggression across subsequent waves to the same value across gender (Model 4c) and time (Model 4d). According

to the Satorra-Bentler scaled chi-square difference test, the results indicated that these constraints resulted in a significant decrease in model fit compared to the unconstrained model (see Table 11). This indicated that the effect of physical aggression on subsequent waves was not similar for boys and girls, nor was it similar over time. Model 4e constrained traumatic stress Wave A paths and traumatic stress autoregressive coefficients representing the impact of traumatic stress across subsequent waves to the same value across gender. Compared to the unconstrained model, these constraints did not result in a significant decrease in model fit according to the Satorra-Bentler scaled chi-square difference test (see Table 11). As such, additional constraints were added to Model 4e to test whether traumatic stress autoregressive coefficients could be constrained to the same value across gender *and time* (Model 4f). Results of the Satorra-Bentler scaled chi-square difference test indicated that Model 4f did not result in a significant decrease in model fit when compared to the previous model that constrained the coefficients of the autoregressive paths across gender (see Table 11). These results suggested that traumatic stress showed similar levels of stability across waves for both boys and girls.

The next series of constraints were added to Model 4f to determine the extent to which the effect of traumatic stress on subsequent changes in physical aggression could be constrained across gender (i.e., Model 4g) and across time (i.e., Model 4h), and the extent to which the effect of physical aggression on traumatic stress could be constrained across gender (i.e., Model 4j) and across time (i.e., Model 4k). Constraining the effect of traumatic stress on physical aggression across gender (Model 4g) and constraining the effect of physical aggression on traumatic stress by either gender (Model 4i) or time (Model 4j) resulted in a negative Satorra-Bentler Scaled Chi-Square tests (see Table 11). These results were therefore interpreted as not significantly improving the fit. In contrast, Model 4h, which constrained the effect of traumatic stress on

changes in physical aggression across time (but not gender) did not result in a significant decrease in model fit. This indicated that the relation between physical aggression on subsequent changes in traumatic stress varied for boys and girls and over time, but that the relation between traumatic stress on subsequent changes in physical aggression varied for boys and girls but was stable over time.

The next pair of models used a similar approach to test constraints on the effect of demographics on physical aggression and traumatic stress across gender (Model 4k) and across time but did not converge (Model 4l). Results of the Satorra-Bentler scaled chi-square difference test indicated that constraining the effects of the demographics across gender resulted in a significant decrease in model fit. This indicated that the effect of race, ethnicity, and intervention status on physical aggression and traumatic stress varied across gender and time.

Based on the results, Model 4h was the most parsimonious and best fitting model based on the Satorra-Bentler scaled chi-square difference test. The overall multiple group model fit the data well, RMSEA = .02, CFI = .99, TLI = .97. Coefficients for this model are represented in Figures 6 and 7 and reported in Table 11. For girls, prior levels of physical aggression, traumatic stress and demographics accounted for 42% to 69% of the variance in physical aggression ($ps < .001$) and 33% to 60% of the variance in traumatic stress ($ps < .001$). For boys, prior levels of physical aggression and traumatic stress and demographics did not account for a significant amount of the variance in physical aggression at Waves 7C ($p = .16$) and 8A ($p = .05$), but accounted for 27% of the variance in physical aggression at Wave 7B ($p < .001$) and 81% at Wave 7D ($p < .001$). Prior levels of physical aggression, traumatic stress and demographics accounted for 26% to 57% of the variance in traumatic stress ($ps < .001$).

The pattern of significant findings was consistent with the full sample model in terms of the autoregressive paths. For boys, race, ethnicity, and intervention status did not predict changes in physical aggression or traumatic stress across adjacent waves, with the exception of being African American predicting changes in traumatic stress at Wave 8A ($\beta = 0.23$, $p = .02$), controlling for other demographics and prior levels of traumatic stress. For girls, being African American predicted changes in physical aggression at Wave 7C ($\beta = 0.15$, $p = .02$), controlling for other demographics and prior levels of physical aggression. Being in the intervention group predicted changes in traumatic stress at Wave 7D ($\beta = 0.16$, $p = .003$) and Wave 8A ($\beta = 0.22$, $p < .001$), controlling for other demographics and prior levels of traumatic stress. The frequency of physical aggression did not significantly predict changes in traumatic stress for either boys or girls at any of the waves, controlling for demographics and prior levels of traumatic stress. The frequency of boys' traumatic stress did not significantly predict changes in physical aggression, controlling for demographics and prior levels of physical aggression. In contrast, the frequency of girls' traumatic stress predicted increases in the frequencies of physical aggression at each adjacent wave, controlling for demographics and prior levels of physical aggression (β 's ranged from 0.07 to 0.16, R^2 change ranged from 0 to 0.03, $p = .04$). However, the effect of traumatic stress on physical aggression was not significantly different for boys and girls, controlling for demographics and prior levels of physical aggression ($B = 0.03$, $p = .65$).

Table 11

Fit Indices and Comparison of Models Investigating the Bidirectional Relations Between Physical Aggression and Traumatic Stress Seventh Into Eighth Grade by Gender.

Model 4: 7th to 8th Grade By Gender	χ^2_a	df	RMSEA	CFI	TLI	$\chi^2\Delta^b$	df Δ	Comparison Model
4a. Initial unconstrained model	41.12	36	0.02	0.99	0.97			
4b. Constrained wave A paths, autoregressive paths and demographics across gender	123.11***	74	0.03	0.93	0.87	84.95***	38	4a
4c. Constrained PA wave A paths and PA autoregressive paths across gender	75.53**	43	0.04	0.95	0.85	34.13***	7	4a
4d. Constrained PA wave A paths across gender and PA autoregressive paths across time	67.69*	45	0.03	0.97	0.90	21.40*	9	4a
4e. Constrained TS wave A paths and TS autoregressive paths by gender	44.21	43	0.01	1.00	1.00	3.68	7	4a
4f. Constrained TS wave A paths across gender and TS autoregressive paths across time and gender	50.24	46	0.01	0.99	0.98	5.78	3	4e
4g. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender, and prior TS on PA paths across gender	57.45	50	0.02	0.99	0.97	-4.43 ^c	4	4f
4h. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender and prior TS on PA paths across time	59.44	52	0.02	0.99	0.97	1.86	6	4f
4i. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender and prior PA on TS paths across gender	57.87	50	0.02	0.99	0.97	-4.43 ^c	4	4f
4j. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender and prior PA on TS paths across time	81.39**	52	0.03	0.96	0.89	-2.75 ^c	6	4h
4k. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender, prior TS on PA paths across time, and demographics across gender	104.72*	76	0.03	0.96	0.93	50.48***	24	4h
4l. Constrained TS wave A paths across gender, autoregressive TS paths across time and gender, prior TS on PA paths across time, and demographics across time	d							

Note. Bolded model is the one determined to best fit the data. RMSEA = Root mean square error of approximation. CFI = comparative fit index. TLI = Tucker-Lewis Fit index. PA = Physical Aggression. TS = Traumatic Stress. ^aChi-square test of model fit. ^bSatorra-Bentler scaled chi-square difference test comparing fit of each model to the comparison model. Significant chi-square values indicate that the first model resulted in a significant improvement in fit. ^cA negative Satorra-Bentler scaled chi-square difference test was found and was interpreted as not significantly improving the fit. ^dNo chi-square was available because the model did not converge.

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

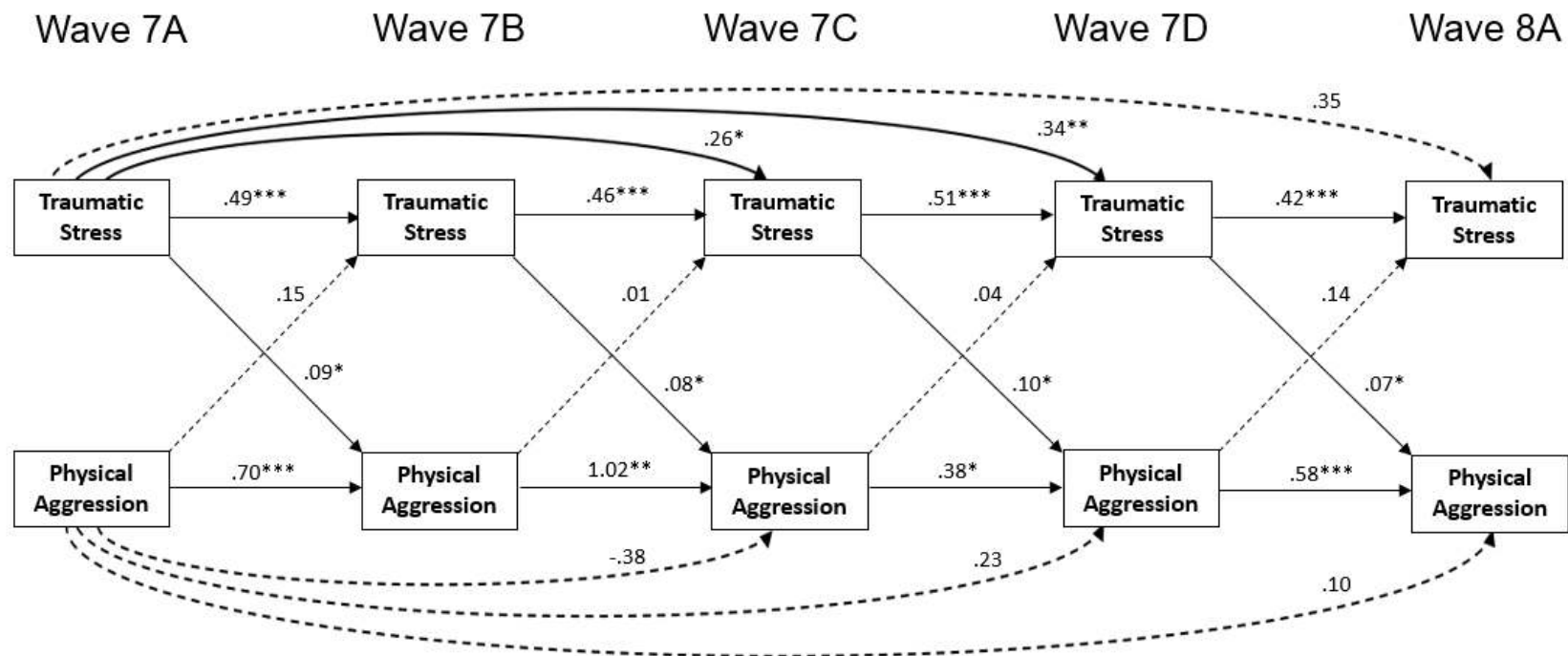


Figure 6. Multiple group autoregressive path model examining the reciprocal relation between traumatic stress and physical aggression across the fall of the seventh grade to the fall of the eighth grade for girls. Demographic covariates and correlations between measures within each wave were included in the model, but are not shown in the figure.

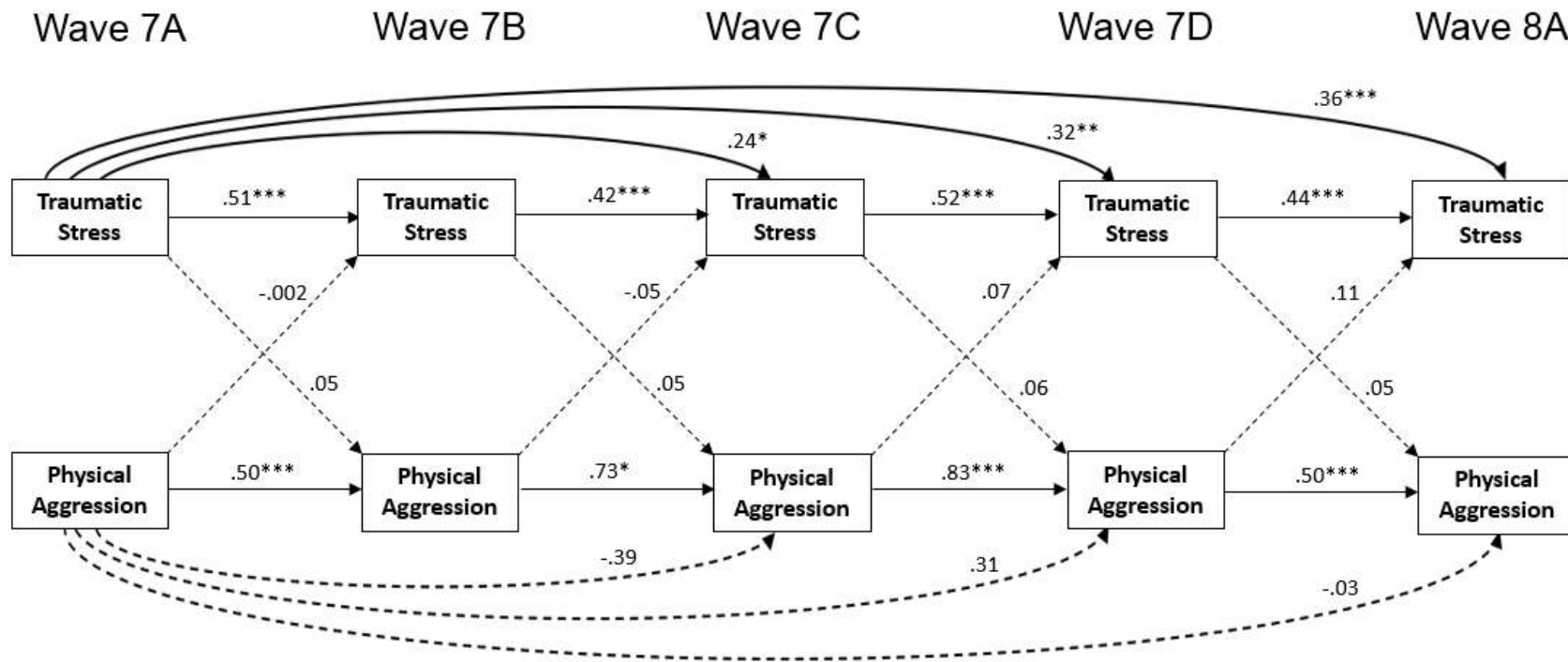


Figure 7. Multiple group autoregressive path model examining the reciprocal relation between traumatic stress and physical aggression across the fall of the seventh grade to the fall of the eighth grade for boys. Demographic covariates and correlations between measures within each wave were included in the model, but are not shown in the figure.

Table 12

Standardized Parameter Estimates and Standard Errors for Regression of Physical Aggression and Traumatic Stress of All Paths from the Final Model from the Fall of the Seventh Grade to the Fall of the Eighth Grade By Gender (Model 4h)

	Wave 7B PA	Wave 7C PA	Wave 7D PA	Wave 8A PA	Wave 7B TS	Wave 7C TS	Wave 7D TS	Wave 8A TS
Girls								
African American	-0.04 (0.06)	0.15* (0.07)	0.11 (0.06)	-0.13 (0.08)	-0.03 (0.08)	0.03 (0.07)	0.12 (0.08)	-0.09 (0.07)
Hispanic	-0.02 (0.07)	-0.06 (0.07)	-0.02 (0.05)	-0.05 (0.08)	-0.03 (0.08)	0.01 (0.07)	-0.05 (0.08)	-0.08 (0.08)
Intervention	-0.03 (0.05)	0.08 (0.06)	0.08 (0.06)	-0.08 (0.07)	-0.03 (0.06)	0.01 (0.06)	0.16** (0.06)	0.22*** (0.06)
7A PA		-0.38 (0.36)	0.23 (0.17)	0.10 (0.08)				
Prior wave PA	0.70*** (0.09)	1.02** (0.30)	0.38* (0.16)	0.58*** (0.08)	0.15 (0.10)	0.01 (0.07)	0.04 (0.09)	0.14 (0.08)
7A TS						0.26* (0.12)	0.34** (0.10)	0.35 (0.07)
Prior wave TS	0.09* (0.04)	0.08* (0.04)	0.10* (0.05)	0.07* (0.04)	0.49*** (0.07)	0.46*** (0.06)	0.51*** (0.07)	0.42*** (0.63)
R ²	0.55***	0.69***	0.36***	0.42***	0.33***	0.41***	0.57***	0.60***
Boys								
African American	-0.13 (0.08)	0.06 (0.13)	-0.08 (0.10)	0.04 (0.11)	0.07 (0.11)	-0.14 (0.09)	0.01 (0.09)	0.23* (0.10)
Hispanic	0.001 (0.09)	-0.06 (0.13)	-0.04 (0.10)	-0.02 (0.10)	0.03 (0.10)	-0.10 (0.10)	0.06 (0.09)	0.19 (0.10)
Intervention	-0.05 (0.08)	0.01 (0.09)	0.06 (0.07)	0.02 (0.07)	-0.13 (0.07)	-0.04 (0.07)	0.05 (0.07)	-0.04 (0.07)
7A PA		-0.39 (0.59)	0.31 (0.36)	-0.03 (0.15)				
Prior wave PA	0.50*** (0.09)	0.73* (0.30)	0.83*** (0.16)	0.50*** (0.13)	-0.002 (0.10)	-0.05 (0.15)	0.07 (0.10)	0.11 (0.08)
7A TS						0.24* (0.11)	0.32** (0.10)	0.36*** (0.07)
Prior wave TS	0.05 (0.05)	0.05 (0.05)	0.06 (0.06)	0.05 (0.04)	0.51*** (0.07)	0.42*** (0.07)	0.52*** (0.07)	0.44*** (0.07)
R ²	0.27**	0.43	0.81***	0.26	0.26**	0.33***	0.56***	0.57***

Note. $N = 1,201$. Standard errors are in parentheses. PA = Physical Aggression. TS = Traumatic Stress. 7A = first wave during the seventh grade, 7B = second wave in the seventh grade, etc.

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

Discussion

The purpose of this study was threefold: (a) to examine the reciprocal longitudinal relations between physical aggression and traumatic stress among early adolescents, (b) to examine gender differences in these relations, and (c) to assess the extent to which these relations differed within and across middle school grades. The current study examined these aims using a predominantly African American sample of adolescents living in urban areas with high rates of crime and poverty. Two samples were used, including one sample that spanned five waves from the fall of the sixth grade to the fall of the seventh grade, and a separate sample spanning five waves from the fall of the seventh grade to the fall of the eighth grade. It was hypothesized that bidirectional relations between physical aggression and traumatic stress would be found. Specifically, youth who reported more physical aggression would be more likely to experience increases in traumatic stress over time and conversely those who endorsed higher frequencies of traumatic stress would report greater increases in physical aggression over time. Data analyses examining seasonal and gender differences were exploratory. Overall, there was limited support for reciprocal relations between physical aggression and traumatic stress. Support was found for traumatic stress predicting increased levels of physical aggression across the winter to the spring of the sixth grade for boys and across all waves from the fall of the seventh grade to the fall of the eighth grade, which did not differ between boys and girls. Conversely, physical aggression during the winter of the sixth grade predicted a decrease in traumatic stress in the spring of the sixth grade for boys and girls, but was not related to changes in traumatic stress across any other waves.

Traumatic Stress as a Risk Factor for Physical Aggression

A key focus of the study was to examine whether traumatic stress during early adolescence predicted increases in physical aggression within a longitudinal design. Partial support for this hypothesis was found, as the findings varied across grades. Whereas only one of the four paths linking traumatic stress to changes in physical aggression was significant in the sixth into seventh grade sample (i.e., winter into spring), all four paths were significant in the analyses of the seventh into eighth grade sample. The direct impact of traumatic stress on physical aggression is consistent with prior work that suggests changes in social information processing, such as heightened perceptions of threat in ambiguous situations (Taft et al., 2008) and impairment in executive functioning, emotion regulation, attention, and impulse control (Beers & De Bellis, 2002; Marsee, 2008; Samuelson et al., 2010), increase traumatized individuals' risk of aggression (Brewin & Holmes, 2003; Crick & Dodge, 1994; Crittenden & Ainsworth, 1989).

Although studies that examine rates of change over broader age ranges provide valuable insights into adolescents' trajectories (e.g., Moffit, 1993), the current findings suggest that the impact of traumatic stress on physical aggression varies by season and across grades. These inconsistent findings highlight the need to examine adolescents' rates of change within and across grades (Booth & Gerard, 2014). Early adolescence is a time of rapid change (Eccles, Midgley, Wigfield, & Buchanan, 1993), and contextual and developmental changes during middle school require more frequent observations to capture these changes (Collins, 2006). In particular, we found that traumatic stress predicted increases in physical aggression during the middle to the end of the sixth grade but not at the beginning of the school year or during the summer. Fluctuations between constructs are often to be expected during the transition period to

middle school (Pellegrini & Long, 2002). Sixth graders may also be less likely to interact with their peers during the summer between sixth and seventh grade compared to later years. These contextual factors may have attenuated the association between traumatic stress and aggression across the sixth grade. Developmental changes during the middle school years may also play a role in the inconsistent findings across grades. The timing of puberty, for example, has been found to be a sensitive period during which adolescents are at an increased risk for PTSD (Marshall, 2016) and engaging in aggressive behavior (Najman et al., 2009). These findings suggest that efforts to reduce the impact of traumatic stress on later aggression should focus on the start of the sixth grade prior to their increased risk.

Most of the prior studies that have examined the association between traumatic stress and aggression have been cross-sectional (e.g., Ozkol, Zucker, & Spinazzola, 2011, Marsee, 2008; Moretti et al., 2006; Scott, Lapre, Marsee, & Weems, 2014; Taft et al., 2011; Wood et al., 2002b). Thus, although researchers have inferred a causal link between traumatic stress and aggression, the majority of previous studies provide a weak test of causation. Furthermore, the majority of longitudinal studies investigating adolescent development collected data once or twice a year (e.g., Ojanen & Kiefer, 2013; Pellegrini & Long, 2002; Scott et al., 2014; Wolfe et al., 2004), therefore missing potentially important inter- and intra-individual changes within the middle school years. Assessing adolescents' traumatic stress and physical aggression only once or twice each year would have masked the variability of the current results.

Exploratory analyses of gender differences revealed variations in the findings for boys and girls. More specifically, traumatic stress in the middle of the sixth grade school year was related to subsequent changes in the frequency of physical aggression at the end of the school year for boys, but not for girls. This effect became more consistent in the seventh grade, did not

differ by gender, and was evident across all waves within the full sample. Although there were no a priori hypotheses regarding gender differences, these exploratory findings differ from several studies examining gender differences that found that the association between traumatic stress and aggression to be consistent across gender in adolescent samples (Marsee, 2008; Scott et al., 2014). It is important to note that these prior studies, along with the current study, used broad measures of traumatic stress that included re-experiencing, avoidance or numbing, and physiological arousal items. Other studies have found differences in the association between traumatic stress and violent behavior for boys and girls depending upon the type of traumatic stress examined. For example, Allwood and Bell (2008) found that girls' re-experiencing symptoms were associated with violent behavior, whereas boys' hyperarousal symptoms were significantly associated with violent behaviors. Thus, the current study could be masking additional unique differences between boys and girls by using a composite score of traumatic stress.

Physical Aggression as a Risk Factor for Traumatic Stress

A secondary aim of the study was to investigate reciprocal relations by examining whether physical aggression levels predicted increased traumatic stress over time. Support was not found for our hypothesis that physical aggression would predict increases in traumatic stress across middle school. In fact, physical aggression assessed during the winter of the sixth grade predicted a significant *decrease* in traumatic stress during the spring of the sixth grade, controlling for prior frequencies of traumatic stress. Although no studies could be found that examined a causal link between physical aggression and changes in traumatic stress, this finding is inconsistent with prior theory and past findings that have suggested a link between aggression and different forms of victimization that could potentially lead to traumatic stress among early

adolescents (Bettencourt et al., 2013; Crick & Dodge, 1994; Hanish & Guerra, 2004; Scholte, Engels, Overbeek, de Kemp, & Haselager, 2007). Peer victimization, for example, has been found to be a significant risk factor for developing traumatic stress (Nielsen et al., 2015), and violent lifestyles, such as those led by gang members, have been shown to increase youth's risk of traumatic stress (Li et al., 2002). Thus, the current findings do not support the notion that changes in social information processing predict increased traumatic stress among aggressive youth. It is important to note that the current sample was restricted to middle school youth, and therefore it is unclear whether older adolescents' aggressive behavior puts them at an increase their risk of traumatic stress compared to middle school youth.

Although it is important not to overstate this single effect across nine waves of data, the frequency of physical aggression during the sixth grade school year predicted an increase in traumatic stress in the spring of the sixth grade for both boys and girls. The current findings thus may suggest that physical aggression may not only come with costs (e.g., increased risky behavior; Reyes et al., 2012) for aggressors and victims, but may also be adaptive in some contexts (Swisher & Latzman, 2008). Further work is needed to investigate possible mechanisms that explain the association between adolescents' physical aggression and decreased traumatic stress. For example, an increase in social status could partially explain this finding. Prior research has shown that aggression among adolescents often increases their social status among their peers even after controlling for prior social status (Faris & Felmlee, 2011; Sentse et al., 2015). The association has been found to be particularly pronounced in inner-city urban settings (Guerra, 1998). Moreover, a previous study found higher social status to predict decreases in victimization (Sentse et al., 2015), thus presumably lowering their risk of developing traumatic stress. It is important to point out that in the current study, the negative relation was not found at

any other waves between the fall of the sixth grade and the fall of the eighth grade. It is unknown whether these findings are indicative of a unique developmental context during the sixth grade or whether this occurs in other developmental periods outside of the current study's sample. The middle of the sixth grade could be a key developmental time period in which youth exert their social power during a time of transition (Eccles et al., 1993), as past research has shown that youth are most vulnerable to peer influences when their own social status is ambiguous (Allen, Porter, & McFarland, 2006).

Implications and Future Directions

The current study's findings regarding the impact of traumatic stress on physical aggression highlight the potential role of trauma-informed care within public systems that adolescents come into contact with, such as the educational and juvenile justice systems. Traumatic experiences are very common among adolescents (e.g., Finkelhor et al., 2009; Finkelhor et al., 2013), yet trauma-informed practices are lacking within the aforementioned settings (Day, Somers, Baroni, West, Sanders, & Peterson, 2015). Teachers and administrators who lack trauma-informed training can misinterpret youths' responses to trauma and its impact on their behavior (e.g., physical aggression; Richardson, Coryn, Henry, Black-Pond, & Unrau, 2012). Furthermore, current disciplinary actions, such as zero tolerance policies and increasing police presence within school environments, often fail to create the types of positive school environments that have been shown to buffer the impact of traumatic exposure on the development of traumatic stress (Yablon, 2015). In contrast, trauma-informed and restorative justice practices, such as those that maintain safety while cultivating supportive connections, emotion regulation, and incorporate an understanding of how children and adolescents view and understand the world (e.g., Perry & Daniels, 2016; Walker & Tory, 2013), have been found to be

more effective in reducing violent behavior than severe punishment (Karp & Breslin, 2001).

Given the current results, it is not surprising that trauma-informed care not only reduces traumatic stress but also problem behaviors such as aggression. Trauma-informed practices have also been shown to increase youth's participation in class and improve their overall attachment to their schools (Wong et al., 2007), which are known protective factors against additional problem behaviors (e.g., Espelage, Low, & Jimerson, 2014; Henry, Farrell, Schoeny, Tolan, & Dymnicki, 2011).

Additional work should aim to investigate aggression not only as a risk factor for detrimental outcomes but also its adaptive use in certain contexts. The concept of adaptive violence is currently a controversial yet emerging topic in the violence prevention literature (Swisher & Latzman, 2008). It is well established that aggression leads to a host of serious consequences for both victims and perpetrators (e.g., United States Department of Health and Human Services [USDHHS], 2001). However, researchers have also shown that aggression in the context of community violence can increase one's self-worth when economic prospects are low (Anderson, 1999), gain the respect of peers (Faris & Felmlee, 2011), decrease one's own victimization (Sentse et al., 2015), and is also associated with a lower resting heart rate (Scarpa, Tanaka, & Haden, 2008). These findings should inform current intervention strategies that may inadvertently ignore adolescents' rational for acting aggressively in certain contexts. Addressing the contextual factors that contribute to the adaptive nature of violence, such as promoting other ways to achieve social status and targeting changes in school climate, could provide a greater impact than interventions that solely teach problem-solving and prosocial skills. Targeting the most influential and aggressive adolescents for violence prevention efforts may be another way to impact school cultures of aggression to break the link between aggression and its associated

advantages in some contexts (Ikeda et al., 2004). Prior evaluations of violence prevention efforts found that adolescents' friends often promote the use of fighting, which serves as a barrier to using skills learned during violence prevention programs, as adolescents report not wanting their reputations damaged (Farrell, Mehari, Kramer-Kuhn, Mays, & Sullivan, 2015; Farrell et al., 2010). Determining whether increased social status and decreased victimization mediate the association between physical aggression and decreased traumatic stress could provide valuable information for efforts that combine trauma-informed care and violence prevention.

Limitations

This study attempted to address some of the limitations of previous research, but results still need to be interpreted in light of some additional limitations. The current study focused on *reciprocal* relations between traumatic stress and physical aggression. Physical aggression was chosen due to its strong empirical support that suggests physical aggression puts adolescents at an increased risk for trauma (Farrell et al., 2014; Lynch & Cicchetti, 1988; Salzinger et al., 2006). However, many previous studies have investigated cross-sectional associations between traumatic exposure and reactive aggression (e.g., Marsee, 2008; Silvern & Griese, 2012). Reactive aggression refers to aggression that is characterized as being provoked or threatened by others (Marsee & Frick, 2007). Dodge, Lochman, Harnish, Bates, and Pettit (1997) found that youth who were either reactive or those who endorsed both reactive and proactive aggression were more likely to have a history of experiencing traumatic events compared to either nonaggressive youth or proactive aggression only. The current study did not determine whether youth's endorsement of physical aggression was either reactive or proactive, and a stronger association may have been found if reactive physical aggression was investigated separately.

Further research should examine the relations between different forms of aggression and traumatic stress concurrently to determine their unique and combined impact.

The ways in which physical aggression and traumatic stress were measured was also a limitation. Physical aggression and traumatic stress were both measured using adolescent self-report. Self-report of problem behaviors may lead to underreporting, either due to social desirability issues (DeVellis, 2011) or the possibility that adolescents have trouble recalling their behaviors and experiences (Farrington, 1999). Relying solely on one type of informant to investigate relations among constructs has also been shown to produce biased results due to shared variance in measurement error (Ladd & Kochenderfer-Ladd, 2002). It is important to note however, that there is currently no gold standard for using multiple informants (De Los Reyes, Thomas, Goodman, & Kundey, 2013). Parents and teachers may not be the best reporters on internalizing behaviors or on other behaviors that are less likely to occur in their presence (e.g. physical aggression; Barker, Tremblay, Nagin, Vitaro, & Lacourse, 2006).

Traumatic stress was measured using a continuous variable that did not identify whether adolescents met DSM-5 criteria for PTSD (APA, 2013). Therefore, a more comprehensive understanding of the association between PTSD and aggression is still warranted, as the use of traumatic stress as a continuous variable may have attenuated the link between these relations. Additionally, PTSD rates vary by specific types of trauma (e.g., Gabbay et al., 2004), and the link between aggression and PTSD (and traumatic stress more broadly) may differ dependent upon the precipitating traumatic event. Furthermore, youth exposed to one potentially traumatic event are at an increased risk for experiencing multiple traumatic events over time, known as poly-victimization (Finkelhor, Ormrod, Turner, & Hamby, 2005). Traumatic events are often studied in isolation, which may mask the cumulative effect of poly-victimization on negative

outcomes, such as traumatic stress (Kazdin, 2011). For example, poly-victimization has been shown to fully account for differences in traumatic stress between non-Hispanic African Americans and non-Hispanic Whites (Andrews et al., 2015). Given that the current study did indeed find a longitudinal pathway between traumatic stress and physical aggression, a subsequent follow-up study should investigate traumatic stress as a mediator between poly-victimization and physical aggression.

The use of manifest variables to measure traumatic stress and physical aggression was also a limitation. More recent work has pointed to benefits of using item-response theory approaches, which incorporate differences in item severity and ordered response categories using latent variables (Farrell et al., 2016; Goncy et al., 2015). Although the PBFS-R physical aggression subscale uses frequencies from *Never* to *20 or more times*, the current study's models assumed equal intervals between responses, which is most likely not the case. Additionally, the items were assumed to be equivalent in severity, although injuring someone with a weapon and pushing someone are not actually equivalent in severity. Although an item-response theory approach appears to be a more theoretically justifiable approach, there is limited research showing improvement in overall fit of the model after using this approach (Embretson & Reise, 2000).

The data used in this study provided an opportunity to examine the relations between physical aggression and traumatic stress among a predominantly African American sample of middle school youth living in urban areas with high rates of crime and poverty. It is unclear how well the current findings might generalize to other samples, including more racially and ethnically diverse samples of youth from broader age ranges. Broadening the age range could also shed light on unique developmental and environmental factors that impact the relation

between traumatic stress and physical aggression in elementary and high school contexts, such as changes in school climate, peer influences, and exposure to traumatic events. Expanding the sample to younger ages may better capture the relation between traumatic stress and physical aggression before the effect has taken place. In contrast, because aggression tends to peak in later adolescence (Moffitt, 1993), the relations between traumatic stress and physical aggression may become stronger during high school and thus are not fully captured in the current study.

Conclusions

Despite some limitations, this is the first study of which we are aware that examined reciprocal relations between traumatic stress and physical aggression across more than two waves of data and controlled for prior levels of both constructs. The majority of prior studies examining these relations have been cross-sectional in nature, thus making it impossible to infer causation. In particular, we found different associations between traumatic stress and physical aggression across three-month intervals between the fall of the sixth grade to the fall of the eighth grade, underscoring the potential value of analyses of changes across shorter periods of time. Given the results of the present study, interventions may need to incorporate additional skills that are aligned with trauma-informed care practices, including those that take into account the adaptive use of problem behavior in certain contexts in order to reduce physical aggression among adolescents.

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Vita

Erin Lally Thompson was born on May 7, 1986, in Richmond, Virginia, and is an American citizen. She graduated from Trinity Episcopal School, Richmond, Virginia in 2004. She received her Bachelor of Arts degree in Psychology from Washington and Lee University, Lexington, Virginia in 2008. She received a Master of Public Policy from Georgetown University, Washington, DC in 2012. Erin Thompson began her graduate study in the Clinical Psychology program at Virginia Commonwealth University in 2014.