THE POWER OF CHANGE: HOW CHANGES IN COMMUNITY VIOLENCE
AND PARENTAL MONITORING INFLUENCE REACTIVE AND
PROACTIVE AGGRESSION IN AT-RISK YOUTH

by

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A DISSERTATION

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Objective: This study assessed the longitudinal, predictive relationships between community violence, poor parental monitoring, and aggressive behavior over time. Secondary goals included testing these relationships for reactive versus proactive aggression and assessing poor parental monitoring as a mediator in the relationship between community violence and aggression. Data for this study were collected pre- and post-tornado, providing a unique opportunity to examine the effects of changes to these variables post-disaster. Method: Community violence data was gathered from local law enforcement agencies and combined with an existing dataset of at-risk youth who were enrolled in the Coping Power Program. Data were examined over four time points (one pre-tornado and three post-tornado). Parental monitoring was self-reported by parents using the Alabama Parenting Questionnaire and aggression was assessed by teachers using the Reactive and Proactive Aggression Questionnaire. Results: Autoregressive cross-lagged modeling (ACLM), a type of structural equation modeling, was used to test four primary models. Results revealed negative relationships between community violence and both types of aggressive behavior and positive relationships between poor parental monitoring and both types of aggressive behavior. Secondary and exploratory analyses identified intervention type and elements of tornado exposure as moderators in the relationships between community violence and aggressive behavior. Results from this study have important implications for natural disaster relief and preventive interventions for at-risk youth, as well as provide a basis for further examination of children’s resiliency following trauma exposure.
# LIST OF ABBREVIATIONS AND SYMBOLS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>α</td>
<td>Cronbach’s alpha, a measure of internal consistency</td>
</tr>
<tr>
<td>$B$</td>
<td>Unstandardized regression coefficients</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Standardized regression coefficients</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval: proportion of intervals that contain the true value of the parameter</td>
</tr>
<tr>
<td>$F$</td>
<td>Fisher’s $F$ ratio: A ratio of two variances</td>
</tr>
<tr>
<td>$M$</td>
<td>Mean: the sum of a set of measurements divided by the number of measurements in the set</td>
</tr>
<tr>
<td>$n$</td>
<td>Sample size</td>
</tr>
<tr>
<td>$p$</td>
<td>Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value</td>
</tr>
<tr>
<td>$r$</td>
<td>Pearson product-moment correlation</td>
</tr>
<tr>
<td>$SD$</td>
<td>Standard deviation: amount of variation or dispersion of a set of data values</td>
</tr>
<tr>
<td>$SE$</td>
<td>Standard error of the regression coefficients</td>
</tr>
<tr>
<td>$&lt;$</td>
<td>Less than</td>
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<tr>
<td>$=$</td>
<td>Equal to</td>
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ACKNOWLEDGMENTS

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CHAPTER 1
INTRODUCTION

Research in child psychology has consistently focused on the measurement and prevention of youth behavioral problems. In 1999, 16% of all violent crime arrests were accounted for by juvenile offenders and 10.1% of all homicides were committed by children under the age of 18 (Fox & Zawitz, 2001). Another study, following newborns over time, identified 58% of their community sample as being on a rising trajectory of modest aggression and 14% as being on a rising trajectory of high physical aggression (Tremblay et al., 2005). In addition, youth violence costs an estimated $158 billion each year, not including juvenile justice programs and institutions (Welsh, 2005). The elevated prevalence and cost of children’s aggressive behaviors emphasize the importance of better understanding the risk factors and causes precipitating such behaviors to develop successful intervention and prevention strategies to reduce these issues early on.

Theoretical Basis

Several theories from social and developmental psychology have focused on children’s relationship to the environment to better understand how contextual influences may drive certain displays of behavior. The ecological systems theory, for example, outlines five environmental systems with which individuals interact, each with rules and norms that may shape psychological development (Bronfenbrenner, 1979). The five systems are outlined by Bronfenbrenner (1979) as follows: 1) the microsystem contains a child’s immediate environment, which may include family, schools, neighborhoods, or even an individual’s own biology 2) the mesosystem
refers to the interaction between several closely linked microsystems, for example, the relationship between parents and teachers 3) the exosystem includes the indirect influence of social contexts that are beyond a child’s immediate context 4) the macrosystem contains the broader culture and ideologies of which a child is involved 5) finally, the chronosystem refers to changes and transitions that occur throughout the lifespan.

The ecological systems theory identifies many areas in which children’s behavior, and aggressive behavior, in particular, may be shaped and influenced (e.g., Boxer et al., 2013; Espelage, 2014). While many of these systems have been extensively studied, much research is still needed to understand how children’s environmental context influences their expression of certain behaviors. Aspects of the chronosystem, in particular, have been overlooked in the research, with few studies attempting to understand how changes and transitions throughout child development contribute to the expression of aggressive behaviors.

Another important theoretical model to consider when studying the development of aggressive behavior is social learning theory, which suggests that learning takes place in social contexts through observation or verbal instruction (Bandura, 1973). This concept may be applied to the development of aggression, whereby children learn to exhibit aggressive behaviors through the observation of aggressive acts by family and community members (Bandura, 1973). Children observe the utility and consequences of aggressive behaviors in their environment and experience vicarious reinforcement, during which these behaviors are reinforced by observing positive consequences of other’s behaviors (Bandura & Walters, 1959). Over time, with enough observational learning and vicarious reinforcement, children may learn that aggression can be a useful, instrumental tool to attain external rewards (Bandura, 1973).
While the ecological systems theory identifies systems that influence a child’s development, the social learning theory suggests the *process* by which parts of a child’s immediate environment (i.e., their microsystem) shape his or her behavior. In considering these theories together, it becomes evident that there is a theoretical basis for studying the effects of children’s contextual environments to understand how aggressive behavior may develop. More specifically, these theories demonstrate how exploring the effects of *changes* to known environmental influences (such as increases in the observation of aggressive behavior by community or family members) may help inform understanding of the developmental process in an area in which little research has been done. Therefore, the current study took an ecological systems framework by examining the interactions among factors within the immediate environmental context (i.e., the mesosystem) and how changes to these factors influence the risk of aggression (i.e., the chronosystem).

**Community Violence as a Risk Factor for Aggressive Behaviors**

A widely-supported risk factor for the development of aggressive behavior in children is exposure to community violence (e.g. McMahon et al., 2013; Steinbrenner, 2010). The National Child Traumatic Stress Network defines community violence as interpersonal violence committed in public areas of the community by persons not directly related to the victim (“Community Violence,” n.d.). A nationally representative study of children under 17 found that 19.2% of youth witnessed community violence in the previous year (Finkelhor, Turner, Ormrod, Hamby, & Kracke, 2009). Such high prevalence of community violence exposure demonstrates the widespread implications of understanding the effects of this exposure on children and their mental health outcomes.
Exposure to community violence may increase children’s aggressive behaviors in several ways. In accordance with social learning theory, for example, children who witness community members engaging in aggressive behaviors may be more likely to adopt these behaviors and exhibit them later in life (Bandura, 1973). Furthermore, the observation of community members engaging in aggressive behaviors that are positively reinforced (e.g., attaining a reward or goal as a direct result of a violent act) may allow for vicarious reinforcement and encouragement of these behaviors in the observing children (Bandura, 1973).

Research has also shown that the presence of community violence may shape children’s aggressive behavior through its effect on how parents teach their children to cope with adversity (e.g., Kilewer, 2013). More specifically, parents who report greater fear of crime in their neighborhoods are more likely to encourage their children to engage in active coping strategies, such as violence, to deal with neighborhood issues (Kilewer, 2013). Therefore, it is unsurprising that children who observe the instrumental use of aggressive behavior by community members and whose parents encourage the use of active coping methods are more likely to exhibit aggressive behaviors.

**Other Community-Level Factors**

Community violence is not the only community-level risk factor that has been studied with regards to children’s aggressive behavior. For example, income inequality (or the distribution of income in a society), has been associated with violent crime rates (Kawachi, Kennedy, & Wilkinson, 1999). Regarding adolescent aggressive behavior, in particular, higher income inequality has been associated with violence perpetration and victimization in non-African American males (Pabayo, Molnar, & Kawachi, 2014).
Objective measures of neighborhood disadvantage, as well as children’s negative perceptions of their neighborhood, have also been found to predict increases in aggressive behavior (Romero, Richards, Harrison, Garbarino, & Mozley, 2015). Children living in high levels of concentrated neighborhood disadvantage, characterized by high rates of poverty, public assistance, rental properties, unemployment, and female-headed households, have also been shown to display higher levels of physical aggression than children living in neighborhoods with lower levels of concentrated disadvantage (Farrell, Mehari, Kramer-Kuhn, & Goncy, 2014). Neighborhood disadvantage has also been shown to interact with family conflict and gender to predict trajectories of physical aggression (Karriker-Jaffe, Foshee, Ennett, & Suchindran, 2013). More specifically, girls with high neighborhood disadvantage and high family conflict exhibited the highest and most long-lasting physically aggressive behaviors, while boys with high neighborhood disadvantage and high family conflict had the highest rates of physical aggression until age 15, when they declined to lower levels than all other groups (Karriker-Jaffe et al., 2013). These results highlight the importance of studying community risk factors beyond the rate of criminal behavior and in addition, how these factors may interact with other contextual factors to predict higher risk for engaging in aggressive behaviors.

While it can be extremely beneficial to determine community-level risk factors for the development of aggressive behaviors in children, it is also important to examine how certain community-level factors may protect against the development of these same behaviors. For example, improvements in community cohesion have been associated with reduced levels of indirect (or relational) aggression in children (Kingsbury et al., 2015).

Increased levels of community cohesion may also be an important indicator of high collective efficacy, defined as social cohesion among neighborhoods combined with the ability
of the community to control the behavior of its members. High neighborhood collective efficacy has also been associated with reduced rates of violence (Sampson, Raudenbush, & Earls, 1997). In addition, the previously mentioned study examining the effects of fear of crime on the use of active coping strategies found that higher levels of collective efficacy in neighborhoods were associated with parental messages to use less aggressive coping methods for school-based issues (Kilewer, 2013). Community efficacy has also been implicated as a moderator between early child neglect and later externalizing behaviors (Yonas et al., 2010).

Although there are many community-level factors that have been shown to predict or protect against the development of aggressive behavior, the current study chose to focus primarily on community violence to assess how elements of the exosystem (i.e., community violence) and the microsystem (i.e., parents) interact to more accurately predict children’s behavior. The study also assessed whether other community factors, such as neighborhood disadvantage, interact with community violence to predict aggression in follow-up, exploratory analyses given that there is strong research support for these as separate risk-factors, but not as cumulative risk-factors. The following section outlines research supporting parenting practices as predictors of youth aggression, as well as evidence that there is an important relationship between community violence and parenting in predicting these behaviors.

**Community Violence, Parenting Practices, and Children’s Aggressive Behavior**

Negative parenting practices, such as harsh and inconsistent discipline, have been empirically supported as risk factors for the development of aggressive behavior in children (e.g., Hamner, Latzman, & Chan, 2015; Loeber & Stouthamer-Loeber, 1986; Sawin & Parke, 1979). Positive parenting practices (e.g., parental involvement) have also been implicated as protective factors against the development of aggression (Wenk, Hardesty, Morgan, & Blair, 1994).
Given parenting’s strong influence on children’s aggressive behavior, it is possible that community violence’s effect on children’s behaviors ultimately depends on its effect on parenting. Research has consistently supported both parenting and community violence as predictors of aggression in children, but recent research has begun examining how community violence may alter parenting practices thereby affecting children’s risk for developing aggressive behaviors. For example, higher rates of community violence have been shown to increase psychologically and physically aggressive parenting practices (Zhang & Anderson, 2010). On the other hand, exposure to community violence has also been shown to increase parent’s monitoring and behavioral control over children, ultimately decreasing those children’s exposure to community violence over time (Merrilees et al., 2011). Therefore, while community violence exposure may increase aggressive parenting practices for some parents, it may also increase parental monitoring and control over children for other parents, providing protection against the development of aggressive behavior.

Research suggests that parental monitoring in particular buffers the effect of community violence on children’s aggressive behavior by decreasing involvement in deviant behavior (Low & Espelage, 2014). Therefore, parental monitoring as a construct is particularly important in the context of the ecological systems theory because monitoring may act as a way for parents to become more involved in how the child interacts with their external environment. In this way, parents may control or limit the interactions children have with deviant peers or violent settings, thus reducing the reinforcement of aggressive behaviors in their environment (e.g., Dishion, Patterson, Stoolmiller, & Skinner, 1991). Therefore, consistent with the ecological systems theory, the current study assessed how parental monitoring impacted the relationship between children’s exposure to community violence and their later aggressive behavior.
Reactive and Proactive Aggression

While it is clear that environmental factors, such as parental monitoring and community violence, contribute to aggressive behavior, it is unclear how they influence different manifestations of aggression. Violence prevention research has often distinguished between different types of aggressive behavior to better understand the underlying causes of violence and therefore the most effective ways to prevent it. One way to distinguish between manifestations of aggressive behavior is to categorize them on two specific dimensions—“form” and “function” (Little, Henrich, Jones, & Hawley, 2003). The “form” dimension captures whether aggression is expressed overtly (i.e., use of physical force) or covertly (i.e., ostracism, spreading rumors), while the “function” dimension examines the purpose the aggressive behavior serves (Little et al., 2003).

The current study focused on the “function” of aggression by examining reactive and proactive aggression. Reactive aggression is often referred to as “hot blooded” aggression, which typically manifests in fear responses and defensive actions in response to threat (Dodge, 1991). Reactive aggression is derived from the frustration-aggression model, which suggests that aggression is an angry reaction to perceived frustration or threat (Berkowitz, 1978; Dollard, Doob, Miller, Mowrer, & Sears, 1939). Alternatively, proactive aggression is often referred to as “cold-blooded,” calculating, and fearless aggression and is characterized by motivation towards a reward and a general “underarousal” (Dodge, 1991). Proactive aggression is derived from social learning theory, which suggests that aggression is an acquired behavior that is motivated by external rewards (Bandura, 1973).

Considering how parental monitoring and community violence affect different types of aggression may have important implications for prevention work. For example, neighborhood
disadvantage has been shown to predict proactive, but not reactive aggression (Fite, Wynn, Lochman, & Wells, 2009). Therefore, when considering interventions targeting neighborhood-level factors, it is important to know if certain types of aggression are more influenced than others. Previous research has also indicated that community violence affects reactive and proactive aggression differently (Scarpa, Tanaka, & Chiara Haden, 2008). Therefore, in order to assess differences in the relationships between parental monitoring, community violence, and other study variables among different types of aggression, the current study chose to examine reactive and proactive aggression separately as outcome variables.

**The Role of Children’s Autonomic Functioning in the Prediction of Aggressive Behaviors**

While research has consistently shown that environmental risk factors may interact or be influenced by one another to predict children’s aggressive behaviors, research has also examined how children’s biological predispositions may influence these relationships and in turn, their risk for developing aggressive behaviors. Autonomic functioning, for example, has been shown to interact with both community violence and parenting practices to predict aggressive behavior in children (e.g., Scarpa, Tanaka, & Haden, 2008).

The autonomic nervous system (ANS) is comprised of the sympathetic (SNS) and parasympathetic (PNS) branches. While the SNS prepares the body for fight or flight, the PNS conserves and restores energy. Therefore, activation of the SNS indicates increased physiological arousal, while activation of the PNS indicates reductions in physiological arousal. There are several ways to measure overall autonomic functioning as well as SNS and PNS activity individually. Autonomic functioning may be measured at rest, signifying baseline levels of arousal, or during a stressor, signifying autonomic reactivity. Given that the ANS is believed
to represent emotional arousal, recent research on biological risk factors has explored the relationship between ANS activation and aggressive behavior.

Consistently, the most salient and well-supported ANS predictor of aggression has been reduced resting heart rate (e.g., Ortiz & Raine, 2004; Van Goozen, Mattys, Cohen-Kettenis, Buitelaar, & Van Engeland, 2000). However, heart rate is heavily influenced by both the SNS and PNS, making it difficult to distinguish between the unique effects of each system on an individual’s heart rate. As a result, recent studies have examined other indicators of ANS activity that more accurately measure either the SNS or the PNS to gain a better understanding of autonomic functioning among aggressive individuals.

Parasympathetic arousal and aggression. One well-supported indicator of PNS activity is respiratory sinus arrhythmia (RSA) or the naturally occurring change in heart rate that occurs during the breathing cycle. Heightened levels of RSA are thought to indicate increased emotion regulation; therefore, reduced levels of baseline RSA are typically associated with aggressive behavior (e.g., Beauchaine, 2015; Beauchaine, Katkin, Strassberg, & Snarr, 2001). However, when reactive and proactive aggression are considered separately, more mixed patterns emerge. Reactive aggression, for example, has been associated with heightened parasympathetic arousal in Chinese elementary students (Xu, Raine, Yu, & Krieg, 2014), which conflicts with the conceptualization of heightened parasympathetic arousal as a protective factor. With regards to proactive aggression, associations have been found with heightened parasympathetic arousal among American school-aged children (Scarpa, Haden, & Tanaka, 2010) and reduced parasympathetic arousal among Chinese and American student samples (Hubbard et al., 2002; Xu et al., 2014).
**Sympathetic arousal and aggression.** Other studies have examined indicators of ANS activity that correspond more directly to the SNS. A widely-supported correlate of aggressive behavior that specifically measures SNS activity is electrodermal activity (EDA) or skin conductance. EDA refers generally to any electrical phenomenon of the skin, while skin conductance is a type of EDA that refers more specifically to how well the skin conducts electricity when an external current is applied (Figner & Murphy, 2011). Given their subtle differences, these two terms are often used interchangeably in the literature.

Reduced levels of sympathetic arousal, based on measures of skin conductance and electrodermal activity, have been most often associated with aggressive behavior (Baker, Shelton, Baibazarova, Hay, & Goozen, 2013; Jimenez-Camargo, Lochman, & Sellbom, 2017; Van Goozen et al., 2000). Given that sympathetic arousal is an indicator of the fight or flight response, it may be surprising that reduced levels are associated with aggressive behaviors; however, this is consistent with previous research implicating reduced heart rate as a risk factor for aggressive behavior (e.g., Ortiz & Raine, 2004; Van Goozen et al., 2000). This relationship is often explained by sensation seeking and low arousal theories which suggest that individuals use aggressive behaviors to “feel something” or increase their physiological or emotion response (Hare, 1970).

Similar to parasympathetic arousal, when sympathetic arousal has been examined among reactive versus proactive aggression, conflicting patterns emerge. Reactive aggression has been associated with heightened sympathetic arousal in community samples and Dutch samples of at-risk, school-aged children (Hubbard et al., 2002; Schoorl, Rijn, Wied, Goozen, & Swaab, 2016), but also reduced levels of sympathetic arousal in community samples of school-aged children (Scarpa et al., 2010). Similarly, research has indicated that heightened levels of sympathetic
arousal predict proactive aggression among community samples (Scarpa et al., 2010), but that reduced levels of sympathetic arousal predict proactive aggression in mixed community and clinical samples of Dutch children (Schoorl et al., 2016).

Conflicting findings may be partially explained by differing methodologies and study populations. For example, several of the previously cited studies were conducted outside of the United States (e.g., Schoorl et al., 2016; Xu et al., 2014). Among the cited studies, there is also diversity in the chosen indicators of autonomic functioning. For example, some used heart rate variability, as opposed to RSA, to examine parasympathetic arousal (e.g., Scarpa et al., 2010; Schoorl et al., 2016) and others examined autonomic reactivity to emotionally-provoking tasks, as opposed to autonomic arousal at rest (e.g., Hubbard et al., 2002). Given that these studies were conducted in different samples and used different indicators of autonomic functioning, it is important to test these relationships among the current study’s population. Furthermore, most of the cited studies were conducted with community samples. Therefore, this will be the first study to assess the effects of baselines levels of skin conductance and RSA on the relationship between community violence and aggressive behavior among a U.S sample of at-risk, school-aged children.

**Autonomic arousal’s interaction with other factors.** Another possible explanation for conflicting findings among research examining autonomic functioning and reactive versus proactive aggression may be the influence of environmental factors. In fact, research conducted on the same data as the current study found that different patterns of sympathetic and parasympathetic arousal were associated with reactive and proactive aggression in at-risk children depending on levels of inconsistent discipline (Kassing, Lochman, & Glenn, under review). Therefore, considering the influences of environmental factors, such as parenting
practices or community-level influences, may help to explain differences among research examining autonomic functioning in different types of aggression.

Some research has examined how community factors may interact with children’s autonomic functioning to predict aggressive behaviors. One study found heightened parasympathetic arousal to be predictive of reactive aggression under high levels of social adversity (Zhang & Gao, 2015). Another study, examining community violence specifically, found that in the presence of reduced overall autonomic arousal, community violence victimization was positively related to proactive aggression (Scarpa et al., 2008). Alternatively, in the presence of heightened parasympathetic arousal, witnessed community violence was positively associated with reactive aggression (Scarpa et al., 2008).

These studies suggest that in the context of community or social adversity, reactive aggression is characterized by heightened parasympathetic arousal, while proactive aggression is characterized by reduced overall autonomic arousal. Given that previous research has implicated heightened parasympathetic arousal as an indicator of emotional regulation and therefore a buffer in adverse situations (Katz & Gottman, 1995), it seems counterintuitive that this autonomic indicator would be predictive of reactive aggression. However, previous research has also suggested that indicators of overall autonomic functioning (i.e., heart rate) are inversely associated with indicators of parasympathetic arousal and that low heart rate and parasympathetic arousal together predict aggression in young adults (Scarpa, Fikretoglu, & Luscher, 2000).

Given the conflicting findings regarding how autonomic functioning and community violence interact to predict different types of aggressive behavior, it is important to decisively test these relationships in an at-risk sample to better understand which conditions predict which
types of behaviors. Examining how these relationships differ under varying conditions of community violence adds to the novelty of this study and will provide more insight into the interactions and pathways among predictors of aggressive behavior in at-risk children.

**Community Change as a Risk Predictor: A New Approach**

While the research described above has consistently supported community violence as a risk factor for aggressive behavior in children, less research has examined how changes to children’s environments impact children’s behavior differently than the measurement of the more “stable” factors. In an ever-evolving cultural climate, it is important to understand how changes to children’s environments and communities may affect their behavior as this understanding may ultimately help uncover causal relationships between community characteristics and aggressive behavior.

Following tornado exposure, for example, children have been shown to express more aggressive behaviors (Durkin, Khan, Davidson, Zaman, & Stein, 1993). A study examining the effects of tornado exposure among the current study’s sample found that children exhibited less reduction in aggressive behavior one year following a tornado if they experienced fears for their life or distress after the tornado, along with reduced levels of pre-tornado anxiety (Lochman et al., 2017). However, it is important to distinguish between direct effects of tornado exposure (e.g., posttraumatic stress disorder symptoms) and more indirect effects of tornado exposure (e.g., increased neighborhood disadvantage and violence). In a study of relocation following Hurricane Katrina, researchers determined that children who relocated as a result of the disaster experienced more trauma symptoms, especially if they were older (Hansel, Osofsky, Osofsky, & Friedrich, 2013). These results suggest that children who relocated following the natural disaster
experienced more severe symptomology, perhaps in part because of their relocation and not simply as a result of their exposure to the hurricane.

Natural disasters, such as tornados, are often accompanied by a host of proximal changes to contextual influences. Following natural disasters, damage to communities and neighborhoods often facilitate the shifting of community climates through relocation of families to new neighborhoods and the influx of relocated individuals to already established neighborhoods (Spokane, Mori, & Martinez, 2013). In addition, these changes and effects following natural disasters may disrupt social processes in communities, leading to damages to the social functioning and well-being of those neighborhoods (Spokane et al., 2013). Given the negative implications of community changes following a natural disaster, it is important to understand how changes to children’s environments may impact their behavior development and life outcomes, but first, it must be established that changes have indeed occurred.

While conducting a literature review for this research project, only one study was found that directly examined how changes in community characteristics over time affected children’s aggressive behavior. Specifically, the study assessed changes in neighborhood social cohesion—the level of belonging, availability of social support networks, sense of social order, and presence of shared values within a community (Kingsbury et al., 2015). The study found that children in neighborhoods with stable, low cohesion had higher rates of aggression than children in neighborhoods with stable, moderate cohesion; however, the study also found that improvements in cohesion reduced aggressive behaviors, while declines in cohesion increased hyperactivity and aggressive behaviors (Kingsbury et al., 2015). Such research begins to suggest causal relationships between community factors and children’s aggressive behaviors as well as provides potential targets for interventions aimed at increasing positive outcomes for community youth.
Current Study

The current study is the first to examine how changes in community violence influence children’s involvement in aggressive behaviors. The study addressed this research question by measuring changes in community violence, parental monitoring, reactive, and proactive aggressive behavior over four time points (i.e., pre-tornado, summer post-tornado, 1-year post-tornado, and 3-years post-tornado) and by examining how these variables relate to one another. In addition, this study explored how additional variables of interest (e.g., autonomic functioning and neighborhood disadvantage) strengthened (or weakened) the relationship between community violence and aggressive behavior. While many of the individual relationships described have been established in the literature, no study to date has examined a model including all of the aforementioned variables, and no studies have examined these relationships as they relate to changes over time. Defining these relationships will help understand the development of aggressive behaviors in children in a changing environment and therefore provide an opportunity for more informed prevention and intervention methods.

Hypotheses

Based on the research described above, the following hypotheses for four primary models were offered:

1. There will be a positive relationship between community violence and teacher-reported reactive and proactive aggression across all four time points, indicating that higher levels of community violence predict higher levels of aggressive behaviors.

2. There will be a positive relationship between poor parental monitoring and teacher-reported reactive and proactive aggression across all four time points, indicating that poorer monitoring predicts higher levels of aggressive behaviors.
3. There will be a negative relationship between community violence and poor parental monitoring across all four time points, indicating that higher levels of community violence predict higher levels of parental supervision and monitoring.

Given the findings regarding parental monitoring’s relationships with community violence and aggression, the following hypotheses are made for the fourth primary model:

4. Poor parental monitoring will mediate the predictive relationship between summer post-tornado community violence and teacher-reported aggression 1-year post-tornado. It is expected that increased levels of community violence following the tornado will predict decreased levels of poor parental monitoring (indicating better supervision), which will, in turn, predict decreased levels of reactive and proactive aggression 3-years post-tornado. It is hypothesized that as poor parental monitoring decreases, teacher-reported reactive and proactive aggression will also decrease, but that children whose poor parental monitoring stays the same or increases will exhibit similar or increased aggressive behaviors.

**Research Questions**

In addition to the primary analyses described above, moderation models were used to examine the effects of secondary variables of interest on the relationship between community violence and aggression over time. The following secondary research questions were proposed:

1. Does neighborhood disadvantage measured summer post-tornado moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?
2. Does baseline RSA moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?

3. Does baseline skin conductance moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?

4. Does gender moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?

5. Does level of exposure to the tornado moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?

6. Does intervention type moderate the relationship between summer post-tornado community violence and 1-year post-tornado aggression when pre-tornado community violence is controlled for?
CHAPTER 2

METHODS

Participants

The current study used data from a larger dataset assessing the efficacy of the Coping Power Program, an intervention implementing aggression prevention strategies in at-risk children. Children were recruited from twenty, public elementary schools in north, central Alabama. Teachers from each school were asked to compile ratings of all of their students to identify children who would likely benefit from the intervention based on their aggressive behaviors in the classroom. Students who scored within the highest 25% of the teachers’ ratings were then contacted to complete an initial assessment interview and then participate in the intervention. The final sample consisted of 360 fourth graders, with 64.8% of the sample being male (n = 234) and 75.6% of the sample identifying as African American (n = 273). 61.9% of the sample (n = 223) had a household income below $30,000 (for demographic breakdown see table 1).
Table 1

Demographic Breakdown of Sample

<table>
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Procedure

The Coping Power intervention began at the end of students’ fourth-grade year and continued until the end of fifth grade. Three cohorts of 120 students each were collected over three subsequent years. The initial assessment (pre-intervention) was completed with children and parents at the time of enrollment during the spring semester of children’s fourth-grade year. Subsequent assessments were completed each summer following completion of the intervention. Assessments were conducted at the child’s home, unless otherwise specified, and children and parents were interviewed separately.

In April of 2011 (immediately prior to intervention for cohort 3) a tornado struck the areas in which data collection and interventions were occurring. This provided a unique
opportunity to examine direct and indirect effects of natural disasters on at-risk children and their families. Since each cohort was at different points in the intervention when the tornado hit, new naming conventions were created to compare each cohort immediately before and after the disaster. Therefore, the pre-tornado time point corresponds to the data taken the spring and summer prior to the tornado (summer 2010 for aggression and poor parental monitoring and the 3.5 months leading up to the tornado in 2011 for community violence), the summer post-tornado time point corresponds to the data taken immediately following the tornado (summer 2011 for poor parental monitoring and aggression and the first 3.5 months of 2012 for community violence), and the 1- and 3-year post-tornado time points correspond to the data taken one and three years following the tornado (spring and summer 2012 and 2014 respectively).

**Primary Measures**

**Community violence.** A new variable was created and added to the existing dataset to measure community violence for each participant’s neighborhood. Based on methodology used to collect data for the National Crime Victimization Survey (Morgan, Kena, & BJS Statisticians, 2017), community violence was defined as the number of violent crimes (i.e., assault, assault with a deadly weapon, homicide, kidnapping, robbery, and sexual assault) occurring in a designated area. Data were collected from CrimeReports.com and the University of Alabama’s Center for the Advancement for Public Safety. Local law enforcement agencies send data on the location, date, time, and type of crime to CrimeReports.com to provide real-time updates on local criminal activity to the public. CrimeReports.com has been successfully used in previous peer-reviewed research as a measure of community violence (Sherman, Minich, Langen, Skufca, & Wilke, 2016).
Tuscaloosa and surrounding areas were divided into census block groups and Geographic Information Systems (GIS) was used to calculate community violence levels for each time point based on aggregated crime reports within each block group. Based on their reported addresses at each time point, participants received an individualized value based on the community violence level of their census block. Scores from the pre-tornado time point were used as a baseline measure of community violence since data were collected prior to the tornado and therefore presumably before major shifts in community makeup occurred. Scores from the summer, 1-year, and 3-year post-tornado time points were used to examine changes and stabilizations in community violence at three follow-ups. Census block group was the chosen geographical unit for the community violence variable because it provided the most specific data on neighborhood violent crime rate while still respecting participant privacy and encompassing a large enough area to capture multiple violent crimes per neighborhood.

Currently, only the Tuscaloosa City Police Department and the Tuscaloosa County Sheriff’s Department upload data to CrimeReports.com. Therefore, community violence scores for approximately 70% of the participants (between 245 and 279 participants depending on the time point) are currently available and were used for the current study’s analyses.

Data from the Tuscaloosa Sheriff’s Department started being collected in January 2011 on CrimeReports.com; therefore, data are not available prior to this date. To assess community violence pre-tornado, crime reports from both jurisdictions (i.e., Tuscaloosa City and Sheriff’s departments) were aggregated for the time period leading up to the tornado in 2011 (January 1, 2011 to April 26, 2011). To maintain consistency across time points, this time frame was used for each time point as a measure of violent crime rate per neighborhood during the same 3.5-month period each year.
To supplement statistical analysis and provide a visual representation of the community violence variable, choropleth maps were created for each time point using ArcMap software. Choropleth maps provide visual depictions of how variables of interest (in this case community violence) vary across a geographic space by shading areas of the map based on the proportion of the measured variable. Therefore, these maps demonstrate variability across regions, as well as changes in variability and community violence density over time.

According to the Federal Bureau of Investigation’s data on violent crime from 2014, Tuscaloosa is within one standard deviation of the average violent crime rate for cities between 80,000 and 99,999 people (United States Department of Justice, Federal Bureau of Investigation, 2015). In 2014 Tuscaloosa was cited as having a population of 96,412; therefore, Tuscaloosa appears to represent a typical level of violent crime for a city of similar size (United States Department of Justice, Federal Bureau of Investigation, 2015).

**Reactive and proactive aggression.** Teachers completed the Reactive and Proactive Aggression Questionnaire (RPQ; Dodge & Coie, 1987). Teachers reported on the frequency of six aggressive behaviors on a 5-point Likert scale (totals ranging from 6 to 30). Previous studies have found adequate internal consistency for the RPQ (α = .66 for proactive aggression, α = .83 for reactive aggression; Vitaro, Barker, Boivin, Brendgen, & Tremblay, 2006). In the current sample, the teacher-rated proactive aggression scale demonstrated Cronbach’s alphas of .88 pre-tornado, .67 summer post-tornado, .90 1-year post-tornado, and .69 3-years post-tornado. Furthermore, the teacher-rated reactive aggression scale demonstrated Cronbach’s alphas of .88 pre-tornado, .67 summer post-tornado, .87 1-year post-tornado, and .91 3-years post-tornado. The scale includes three items reflecting reactive aggression (e.g., “when this child has been...
teased or threatened, he or she gets angry easily and strikes back”) and three items reflecting proactive aggression (e.g., “this child threatens or bullies in order to get his or her own way”).

**Poor parental monitoring.** Poor parental monitoring was assessed using the Alabama Parenting Questionnaire (APQ; Shelton, Frick, & Wootton, 1996). The APQ is a 42-item parent report measuring five parenting constructs: parental involvement, positive reinforcement, poor parental monitoring and supervision, inconsistent discipline, and corporal punishment. Parent behaviors were rated by typical frequency on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Past research has found the APQ to have excellent construct validity (Shelton et al., 1996) and adequate internal consistency (*α* = .6 – .8; Lochman et al., 2009). In the current sample, the poor parental monitoring scale demonstrated Cronbach’s alphas of .62 pre-tornado, .64 summer post-tornado, .73 1-year post-tornado, and .72 3-years post-tornado. The poor parental monitoring subscale consists of 10 items (e.g., “your child fails to leave a note or let you know where he/she is going”). It is important to note that high scores on this subscale indicate higher levels of *poor* monitoring, while low scores indicate that parents report engaging in more supervisory and monitoring behaviors.

**Variables for Secondary Research Questions**

**Neighborhood disadvantage.** Based on methods used by Lochman, Wells, Qu, and Chen (2013), a composite neighborhood disadvantage score was created using 2010 census information and each child received a neighborhood disadvantage score based on the census tract that they lived in during the summer after the tornado. The 2010 census data were only available at the census tract level; therefore, the neighborhood disadvantage variable was calculated for larger neighborhood areas than the community violence variable, which had finer units available (i.e., census block groups). The study chose to prioritize using finer, more specific data for the
community violence variable over having consistent geographic units across the two community
variables since community violence was one of the study’s primary variables of interest.

The following six variables were summed to create a composite score for each
participant’s census tract: percent of the population below poverty, receiving public assistance,
unemployed, having 12 or fewer years of education, having female-headed households, and
percent of households not in owner-occupied housing. High values indicate high levels of
neighborhood disadvantage.

**Physiological measures.** Heart rate and skin conductance were recorded with a Biolog, a
portable physiological data recorder available to the public. The Biolog was attached to
participants through bioelectric and transducer input assemblies. Heart rate and interbeat
intervals (collected to determine respiratory sinus arrhythmia [RSA]) were measured through the
placement of three electrodes. One electrode was placed just above the collarbone on the
participant’s right side, another electrode was placed behind the left knee, and a reference
electrode was placed on the right side of the neck. To measure skin conductance, electrodes
were placed on the volar surface of the distal phalanx of the first and third fingers on the
participant’s non-dominant hand. Following the placement of the electrodes, each participant
watched a three-minute video. The video was meant to be neutral and unlikely to elicit an
emotional reaction. Baseline RSA and skin conductance were calculated using measurements
from the last 60 seconds of the video.

Baseline RSA was calculated using the computer software and procedures outlined in the
manual *Inter-Beat-Interval Editing for Heart Period Variability Analysis: An Integrated
Training Program with Standards for Student Reliability Assessment* (Porges, 2007), which has
been empirically supported (Denver, Reed, & Porges, 2007; Grossman, van Beek, & Wientjes,
1990). First, interbeat interval data collected from the Biolog were cleaned. Based on procedures outlined in the manual, each participant’s heart rate data was hand-edited using the CardioEdit program to remove unwanted artifacts, or errors in the interbeat interval data that are likely due to the digitizing process of the data or to physiological anomalies. Next, RSA was extracted from one of the predominant rhythms exhibited in the data via computations of the participant’s heart period series using the CardioBatch computer software. Finally, average RSA was determined for the 60-second baseline period. Skin conductance data were processed using Ledalab, which was used to remove artifacts and determine average skin conductance for the 60-second baseline period.

Temperature and humidity of the environment were also recorded during heart rate and skin conductance measurement, given that interviews were conducted in various locations. These two variables have been shown to influence electrodermal activity (Schmidt & Segalowitz, 2007); therefore, temperature and humidity were controlled for in all analyses involving physiological variables.

**Trauma exposure.** Trauma exposure during the tornado (proximal exposure), along with loss, disruption, and distress in the first few weeks after the tornado (distal exposure) and loss and disruption 1-year following the tornado (long-term disruption) were measured using the Tornado-Related Traumatic Experiences (TORTE) questionnaire, which was adapted from a measure previously used to assess hurricane-related traumatic experiences among children and adolescents (Vernberg, La Greca, Silverman, & Prinstein, 1996). Proximal trauma exposure was measured with 7 yes/no items. One item represented perceived life threat (“At any time, did you think you might die during the tornado?”) and six items represented additional elements of traumatic events that might occur during severe tornadoes (e.g., windows or doors broke, saw
someone get hurt badly, hit by something falling or flying during the tornado). Distal exposure was assessed with 10 yes/no items regarding loss and disruption in the several weeks following the tornado (e.g., home badly damaged or destroyed, clothes or toys ruined) and one binary item measuring subjective level of distress after the tornado (“Overall, how upset about things were you during the first few weeks after the tornado?”). Long-term disruption was assessed with five yes/no items regarding continued loss and disruption 1-year following the tornado (e.g., living in a home that still had leaks from the tornado, having a parent who lost a job due to the tornado). Children completed the TORTE questionnaire one year after the tornado and therefore retrospectively reported on their own experiences during and several weeks after the tornado.

Consistent with the methodology used in other studies on the current data (e.g., McDonald et al., in preparation), total trauma exposure was the primary variable assessed in this study. Total trauma exposure was calculated in two steps. First, the life threat, the traumatic proximal events, the loss and disruption items in the few weeks following the tornado, and the binary upset item were summed. Second, because of the infrequent occurrence of higher scores in the range, the variable was recoded into a total trauma exposure variable with a 0 to 9 range (0 = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 or 8 = 7, 9 or 10 = 8, and 11 or greater = 9).

Follow-up analyses also examined the individual item measuring perceived life threat, given prior research on the current sample demonstrating less reduction in aggressive behavior following tornado exposure when children perceived life threat during the tornado (Lochman et al., 2017). Furthermore, the long-term disruption subscale was examined in follow-up analyses given the longitudinal nature of the study and interest in whether short-term versus long-term tornado effects influenced relationships between the study variables.
**Intervention type.** The overarching study sought to assess the differences between individual versus group formatted Coping Power. While all participants received interventions comprised of the same content and material, half participated in individual meetings and half participated in group meetings. Research by the primary investigators has found no difference in outcomes of children who received individual versus group formatted intervention (Lochman et al., 2015); however, the present study used intervention type as an additional moderator to ensure any differences by intervention type were accounted for.

**Analytic Plan**

In order to assess the longitudinal, bidirectional, and mediational relationships between community violence, poor parental monitoring, and aggression over four time points, autoregressive cross-lagged modeling (ACLM), a type of structural equation modeling, was used to test four primary models. Models 1, 2, and 4 were tested twice, once with proactive aggression as the outcome variable and once with reactive aggression as the outcome variable. Model 3 did not include aggression and therefore was only run once. ACLM is particularly useful for longitudinal designs where scores at each time point depend on scores from previous time points because the models control for previous time points and can be used to demonstrate how the outcomes are unequivocally explained by the predictor variables (Bast & Reitsma, 1997; Curran & Bollen, 2001).

Coefficients obtained by regressing the measure at each time point onto the same measure at the previous time point correspond to autoregressive paths, while coefficients obtained by regressing outcome variables on predictor variables over time correspond to cross-lagged paths (Kline, 2015). Path models were estimated using Mplus software (Muthen & Muthen, 2012). The pre-tornado time point was used as a baseline measure for the variables.
prior to the tornado. The summer, 1-year, and 3-years post-tornado time points were used to assess changes in the study variables up to three years following the tornado.

There is no “rule of thumb” for determining sample size when using structural equation modeling because there are many factors that influence the required sample size (Kline, 2015). However, research has provided several guidelines for determining adequate sample size for structural equation modeling; for example, one such guideline suggests a sample size of fewer than 100 is considered small, a sample size between 100 and 200 is medium, and a sample size exceeding 200 is large (Kline, 2005). Similarly, data proposed by Ding, Velicer, and Harlow (1995) suggests that a minimum sample size of 100 to 150 participants is adequate for structural equation modeling. The size of the sample used for the primary analyses varied based on the variables in each model but ranged from 162 to 208. Therefore, based on the aforementioned guidelines, even the smallest sample size would be acceptable.

To evaluate the fit of the autoregressive cross-lagged models, the chi-squared fit index, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) were used based on recommendations from Kline (2015). Non-significant results (at the .05 level) indicate good fit for the chi-squared fit index (Barrett, 2007), while values of .95 or above for CFI indicate good fit, and values of .90 or above indicate adequate fit (Hu & Bentler, 1999). Values below .06 indicate good fit for the RMSEA (Hu & Bentler, 1999), although values below .10 are considered acceptable (MacCallum, Browne, & Sugawara, 1996). For the SRMR, values below .08 are considered acceptable (Hu & Bentler, 1999); however, values below .05 indicate a good fit (Diamantopoulos, Siguaw, & Siguaw, 2000). The chi-squared fit index has been shown to be highly sensitive to sample size
(Hong, You, Kim, & Kim, 2008); therefore, other fit indices were given more weight when there was a discrepancy between goodness of fit between the chi-squared and other fit indices.

Full information maximum likelihood (FIML) methods were used within Mplus to address attrition and missing data within the sample. FIML does not delete or impute missing cases, but rather creates subsets of the data with equal proportions of missing data to calculate relevant statistical information (e.g., means, variances) directly from the available data (Kline, 2015). This method has also been shown to generally outperform classical methods of addressing incomplete data (Kline, 2015).

**Secondary research questions.** In addition to ACLM, indirect effects of the moderators identified in this study’s research questions were examined using PROCESS, a computational tool run within SPSS to generate moderation, conditional process analyses, and bootstrapped bias-corrected 95% confidence intervals (Hayes, 2013). Twelve total exploratory moderation models were run to assess six additional variables of interest as moderators between changes in community violence and 1-year post-tornado aggression. The moderators included neighborhood disadvantage, baseline respiratory sinus arrhythmia, baseline skin conductance, gender, tornado exposure, and intervention type. Each of these variables was input into the model as a moderator between summer post-tornado community violence (controlling for pre-tornado community violence) and each type of aggression. Twelve total models were tested: six for proactive aggression and six for reactive aggression.
CHAPTER 3
RESULTS

Means, standard deviations, ns, minimum values, maximum values, skewness, and kurtosis for study variables are presented at the bottom of Table 2.

Correlations

**Correlations between primary study variables.** Proactive aggression rates measured summer, 1-year, and 3-years post-tornado were significantly, positively correlated with one another (r values ranging from .305 to .480), implying stability in the rates of proactive aggression over the three years following the tornado (see table 2 for exact values for all correlations). Pre-tornado proactive aggression was only correlated with summer post-tornado proactive aggression (r = .276, p < .001). Reactive aggression rates taken at all time points were significantly, positively correlated with one another (r values ranging from .203 to .499), as were rates of poor parental monitoring taken across all four time points (r values ranging from .495 to .600). Community violence rates taken at all time points were also significantly, positively correlated with one another (r values ranging from .295 to .558).

At each of the four time points, reactive and proactive aggression were strongly, positively correlated with one another (r values ranging from .607 to .689, see table 2 for exact values). Poor parental monitoring was not correlated with reactive aggression at any concurrent time points; however, pre-tornado poor parental monitoring was significantly, positively correlated with 1-year post-tornado reactive aggression (r = .128, p = .027). Poor
parental monitoring was also not correlated with proactive aggression at any concurrent time points; however, poor parental monitoring rates taken pre-tornado and 3-years post-tornado were significantly, positively correlated with summer-post tornado proactive aggression ($r = .186, p = .001$ and $r = .192, p = .003$ respectively). Furthermore, pre-tornado poor parental monitoring was also significantly, positively correlated with 1-year post-tornado proactive aggression ($r = .192, p = .001$).

Community violence and proactive aggression were not significantly correlated across any time points; however, there was a trending, positive correlation between pre-tornado community violence and pre-tornado proactive aggression ($r = .135, p = .073$). Regarding reactive aggression, pre-tornado community violence was significantly, negatively correlated with summer-post tornado reactive aggression ($r = -.150, p = .020$) and pre-tornado reactive aggression was significantly, negatively correlated with 1-year post-tornado community violence ($r = -.158, p = .047$). Furthermore, there was a trending, negative correlation between pre-tornado reactive aggression and 3-years post-tornado community violence ($r = -.158, p = .052$) and a trending, positive correlation between pre-tornado community violence and pre-tornado reactive aggression ($r = .138, p = .067$). Community violence and poor parental monitoring were not significantly correlated at any time points, but there were trending, positive correlations between 1-year post-tornado community violence and poor parental monitoring at 1-year post-tornado ($r = .118, p = .076$) and 3-years post-tornado ($r = .138, p = .052$) time points. Furthermore, there was a trending, positive correlation between summer post-tornado community violence and 3-years post-tornado poor parental monitoring ($r = .116, p = .097$).

**Correlations with secondary study variables.** Variables of interest for secondary analyses (i.e., neighborhood disadvantage, baseline skin conductance, baseline respiratory sinus
arrhythmia [RSA], and total tornado exposure) were correlated with the primary study variables (i.e., community violence, poor parental monitoring, reactive aggression, and proactive aggression). Neighborhood disadvantage for children’s neighborhoods during the summer following the tornado was significantly, positively correlated with proactive aggression measured summer \( (r = .140, p = .016) \) and 1-year post-tornado \( (r = .149, p = .009) \) and there was a trending, positive correlation with proactive aggression measured 3-years post-tornado \( (r = .214, p = .050) \). Neighborhood disadvantage was also significantly, positively correlated with reactive aggression measured summer \( (r = .182, p = .002) \) and 1-year post-tornado \( (r = -.117, p = .040) \) and with poor parental monitoring measured pre-tornado \( (r = .132, p = .017) \). There was also a trending, positive correlation between neighborhood disadvantage and summer post-tornado poor monitoring \( (r = .097, p = .078) \). Interestingly, community violence was not correlated with neighborhood disadvantage at any time points.

Regarding physiological arousal, baseline RSA was significantly, negatively correlated with community violence measured summer \( (r = -.231, p = .001) \) and 1-year post-tornado \( (r = -.151, p = .040) \). There was also a trending, positive correlation between baseline skin conductance and community violence measured summer post-tornado \( (r = .119, p = .099) \). Baseline RSA had a trending, negative correlation with reactive aggression measured pre-tornado \( (r = -.140, p = .066) \) and a trending, positive correlation with proactive aggression measured 3-years post-tornado \( (r = .227, p = .069) \). Baseline skin conductance was not correlated with proactive aggression at any time points, but was significantly, negatively correlated with reactive aggression measured summer post-tornado \( (r = -.193, p = .003) \) and had a trending, negative correlation with reactive aggression measured 1-year post-tornado \( (r = -.
.116, \( p = .074 \)). Poor parental monitoring was not correlated with physiological variables at any time points.

Total tornado exposure was significantly, positively correlated with proactive aggression measured summer post-tornado (\( r = .136, \ p = .028 \)) and had a trending, positive correlation with reactive aggression measured 1-year post-tornado (\( r = .102, \ p = .095 \)). Furthermore, there was a trending, positive relationship between total tornado exposure and community violence measured 1-year post-tornado (\( r = .125, \ p = .067 \)). Total tornado exposure was not correlated with poor parental monitoring at any time points.
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Note: T1= Pre-tornado time point; T2= Summer post-tornado time point; T3= 1-year post-tornado time point; T4= 3-years post-tornado time point; CV = Community violence; Monitor= Poor parental monitoring; ND = Neighborhood disadvantage; Base SC = Baseline skin conductance; Base RSA = Baseline respiratory sinus arrhythmia; Total TORTE= Total tornado exposure
Note. *p < .05, **p < .01, † p < .10.
Autoregressive Cross-Lagged Model 1: Community Violence and Aggression

ACLM was used to examine the bidirectional relationships between community violence and aggression over four time points. Two separate models were examined: one for proactive aggression and one for reactive aggression.

**Proactive aggression model.** The fit of the initial hypothesized model was adequate \[\chi^2(12) = 23.834, \ p = .021; \ CFI = 0.925; \ RMSEA = 0.075; \ SRMR = 0.066\], but modification indices suggested that the overall model fit could be improved. Modification indices were therefore examined and conceptually relevant direct paths were added. A path was added from community violence pre-tornado to community violence 3-years post-tornado. With this additional path, the final model had good fit \[\chi^2(11) = 12.244, \ p = .346; \ CFI = 0.992; \ RMSEA = 0.026; \ SRMR = 0.051\]. The results of this final model, with standardized coefficients, are presented in Figure 1.
Figure 1: Results of the final model, with standardized coefficients, for community violence and proactive aggression.
Note. *p < .05, **p < .01, †p < .10.
Note. Dashed lines represent direct paths added as the result of modification indices to improve the overall model fit.

Community violence and proactive aggression were both stable over time (with p’s < 0.01 for all autoregressive paths). The additional path added based on modification indices suggested additional stability for community violence across time points (i.e., from pre-tornado to 3-years post-tornado). No significant cross-lagged paths emerged; however, there were two trending paths. The first indicated that pre-tornado proactive aggression negatively predicted summer post-tornado community violence (β = -.118, p = .073). The second trending cross-lagged path indicated that summer post-tornado proactive aggression positively predicted 1-year post-tornado community violence (β = .135, p = .087). There was also a significant, positive relationship between community violence and proactive aggression at the 3-years post-tornado time point (β = .439, p = .005).
**Reactive aggression model.** The fit of the initial hypothesized model was not adequate \[\chi^2(12) = 36.519, p < .001; \text{CFI} = 0.862; \text{RMSEA} = 0.109; \text{SRMR} = 0.110\]. Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. A path was added from community violence pre-tornado to community violence 3-years post-tornado. With this additional path, the final model had acceptable fit for the CFI and RMSEA fit indices \[\chi^2(11) = 26.516, p = .005; \text{CFI} = 0.913; \text{RMSEA} = 0.090; \text{SRMR} = 0.104\]. The results of this final model, with standardized coefficients, are presented in Figure 2.

![Diagram](image_url)

**Figure 2:** Results of the final model, with standardized coefficients, for community violence and reactive aggression.

*Note.* *p < .05, **p < .01, †p < .10.*

*Note.* Dashed lines represent direct paths added as the result of modification indices to improve the overall model fit.

Community violence and reactive aggression were both stable over time (with *p’s < 0.01 for all autoregressive paths). The additional path added based on modification indices suggested additional stability for community violence across time points (i.e., from pre-tornado to 3-years...
post-tornado). The only significant cross-lagged path that emerged indicated that pre-tornado community violence negatively predicted summer post-tornado reactive aggression ($\beta = -.199, p = .005$).

**Autoregressive Cross-Lagged Model 2: Poor Monitoring and Aggression**

ACLM was used to examine the bidirectional relationships between poor monitoring and aggression over four time points. Two separate models were examined: one for proactive aggression and one for reactive aggression.

**Proactive aggression model.** The fit of the initial hypothesized model was not adequate [$\chi^2(12) = 48.656, p < .001; \text{CFI} = 0.881; \text{RMSEA} = 0.121; \text{SRMR} = 0.078$]. Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. First, a path was added from poor monitoring summer post-tornado to poor monitoring 3-years post-tornado. The model still did not provide a good fit; therefore, a path was also added from poor monitoring pre-tornado to poor monitoring 1-year post-tornado. With these additional paths, the final model had good fit [$\chi^2(10) = 15.718, p = .108; \text{CFI} = 0.981; \text{RMSEA} = 0.052; \text{SRMR} = 0.051$]. The results of this final model, with standardized coefficients, are presented in Figure 3.
Poor monitoring and proactive aggression were both stable over time (with $p$’s < 0.01 for all autoregressive paths). The two additional paths added based on modification indices suggested additional stability for poor monitoring across time points (i.e., from summer to 3-years post-tornado and from pre- to 1-year post-tornado). The only significant cross-lagged path that emerged indicated that pre-tornado poor monitoring positively predicted summer post-tornado proactive aggression ($\beta = .251, p = .002$).

**Reactive aggression model.** The fit of the initial hypothesized model was not adequate [$\chi^2(12) = 54.779, p < .001$; CFI = 0.864; RMSEA = 0.131; SRMR = 0.088]. Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. First, a path was added from poor monitoring summer post-tornado to poor
monitoring 3-years post-tornado. The model still did not provide a good fit; therefore, a path was added from poor monitoring pre-tornado to poor monitoring 1-year post-tornado. With these additional paths, the final model had good fit [$\chi^2(10) = 19.640, p < .108; \text{CFI} = 0.969; \text{RMSEA} = 0.068; \text{SRMR} = 0.066$.] The results of this final model, with standardized coefficients, are presented in Figure 4.

![Diagram](image.png)

**Figure 4:** Results of the final model, with standardized coefficients, for poor monitoring and reactive aggression.

Note. *p < .05, **p < .01, † p < .10.

Note. Dashed lines represent direct paths added as the result of modification indices to improve the overall model fit.

Poor monitoring and reactive aggression were both stable over time (with $p$’s < 0.01 for all autoregressive paths). The two additional paths added based on modification indices suggested additional stability for poor monitoring across time points (i.e., from summer to 3-years post-tornado and from pre- to 1-year post-tornado). The only significant cross-lagged path that emerged indicated that pre-tornado poor monitoring positively predicted summer post-tornado reactive aggression ($\beta = .137, p = .046$). There was also a trending, negative relationship
between poor monitoring and reactive aggression at the 3-years post-tornado time point ($\beta = -0.238, p = .068$).

**Autoregressive Cross-Lagged Model 3: Poor Monitoring and Community Violence**

ACLM was used to examine the bidirectional relationships between poor monitoring and community violence over four time points. Only one model was needed since aggression was not included in this model. The fit of the initial hypothesized model was not adequate [$\chi^2(12) = 69.194, p < .001; \text{CFI} = 0.885; \text{RMSEA} = 0.136; \text{SRMR} = 0.078$]. Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. In total, three additional paths were added in the following order until the model provided adequate fit and there were no more suggested paths based on modification indices: 1) poor monitoring summer post-tornado to poor monitoring 3-years post-tornado, 2) poor monitoring pre-tornado to poor monitoring 1-year post-tornado, and 3) community violence pre-tornado to community violence 3-years post-tornado. With these additional paths, the final model had excellent fit [$\chi^2(9) = 14.440, p = .108; \text{CFI} = 0.989; \text{RMSEA} = 0.049; \text{SRMR} = 0.026$]. The results of this final model, with standardized coefficients, are presented in Figure 5.
Community violence and poor monitoring were both stable over time (with \( p \)'s < 0.05 for all autoregressive paths). The additional paths added based on modification indices suggested additional stability for both variables across time points. There was a significant, positive correlation between poor monitoring and community violence at the 1-year post-tornado time point (\( \beta = .162, p = .018 \)). There were no significant cross-lagged paths.

**Autoregressive Cross-Lagged Model 4: Community Violence, Monitoring, and Aggression**

Within the fourth model, ACLM was used to assess poor monitoring as a mediator in the relationship between community violence and aggressive behavior over time. Two separate models were examined: one for proactive aggression and one for reactive aggression.
**Proactive aggression model.** The fit of the initial hypothesized model was not adequate \(\chi^2(43) = 85.645, p < .001; \text{CFI} = 0.887; \text{RMSEA} = 0.078; \text{SRMR} = 0.094\). Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. In total, three additional paths were added in the following order until the model provided adequate fit and there were no more suggested paths based on modification indices: 1) poor monitoring pre-tornado to poor monitoring 1-year post-tornado 2) community violence pre-tornado to community violence 3-years post-tornado 3) poor monitoring pre-tornado to poor monitoring 3-years post-tornado. With these additional paths, the final model had adequate fit \(\chi^2(40) = 46.439, p = .224; \text{CFI} = 0.983; \text{RMSEA} = 0.032; \text{SRMR} = 0.079\). The results of this final model, with standardized coefficients, are presented in Figure 6.
Figure 6: Results of the final model, with standardized coefficients, for community violence, poor monitoring, and proactive aggression.

Note. *p < .05, **p < .01, †p < .10.

Note. Dashed lines represent direct paths added as the result of modification indices to improve the overall model fit.

Community violence, poor monitoring, and proactive aggression were all stable over time (with p’s < 0.05 for all autoregressive paths). The additional paths added based on modification indices suggested additional stability for poor monitoring and community violence across time points. There were significant, positive correlations between poor monitoring and community violence at the 1-year post-tornado time point (β = .261, p = .003) and between community
violence and proactive aggression at the 3-years post-tornado time point ($\beta = .448, p = .002$), both of which were present in previously tested models. There were no significant cross-lagged paths.

**Reactive aggression model.** The fit of the initial hypothesized model was not adequate $[\chi^2(43) = 99.234, p < .001; CFI = 0.855; RMSEA = 0.090; SRMR = 0.101]$. Modification indices were examined and conceptually relevant direct paths were added to improve the overall model fit. Two additional paths were added in the following order until the modification indices suggested no further paths and the model provided adequate fit: 1) poor monitoring pre-tornado to poor monitoring 1-year post-tornado) 2) community violence pre-tornado to community violence 3-years post-tornado. With these additional paths, the final model had good fit for the RMSEA fit index and adequate fit for the CFI fit index $[\chi^2(41) = 70.738, p = .003; CFI = 0.923; RMSEA = 0.067; SRMR = 0.090]$. The results of this final model, with standardized coefficients, are presented in Figure 7.
Figure 7: Results of the final model, with standardized coefficients, for community violence, poor monitoring, and reactive aggression.

Note. *p < .05, **p < .01, †p < .10.

Note. Dashed lines represent direct paths added as the result of modification indices to improve the overall model fit.

Community violence, poor monitoring, and reactive aggression were all stable over time (with p’s < 0.01 for all autoregressive paths). The additional paths added based on modification indices suggested additional stability for poor monitoring and community violence across time points. There was a significant, positive correlation between poor monitoring and community
violence at the 1-year post-tornado time point ($\beta = .260, p = .003$), which was present in previously tested models. There were no significant cross-lagged paths.

**Visual Analyses**

Choropleth maps were created for each time point using ArcMap to visually depict the distributions of violent crime across census block groups in Tuscaloosa and surrounding areas. This approach allows for a visual representation of how violent crime rates either shifted or remained stable within the context of the 2011 tornado path.

These choropleth maps do not rely on statistical analyses to determine whether violent crime rates significantly changed across time; however, it is still beneficial to use GIS to provide supplemental data on how neighborhoods may have changed following the tornado. For example, in 2013 (figure 10), compared to 2012 and 2011 (figures 9 and 8 respectively), violent crime density appeared to have increased in several areas further from the tornado impact area. By 2014 (figure 11) however, violent crime density remained high in census block groups further from the tornado path but also appeared to have increased in census block groups in downtown areas and areas near the tornado path.
Figure 8: 2011 (pre-tornado) violent crime distribution.
Figure 9: 2012 (less than 1-year post-tornado) violent crime distribution.
Figure 10: 2013 (~1.5-years post-tornado) violent crime distribution.
Figure 11: 2014 (~3-years post-tornado) violent crime distribution.
Exploratory Moderation Models

Based on findings from ACLM models, exploratory analyses were conducted on significant, individual paths in non-hypothesized directions to explore whether additional variables could help explain these unexpected findings. Tested moderators included demographic variables, cohort, physiological variables, tornado exposure, neighborhood disadvantage, poor monitoring, and relocation post-tornado. These moderators were chosen based on the variables used in secondary analyses and other study variables that may reasonably be expected to affect these relationships (e.g., relocation/moving following the tornado). Models with significant interactions were run again with control variables (i.e., demographic variables and the outcome variable at the previous time point).

Proactive aggression models. First, ACLM analyses revealed a trending, negative relationship between pre-tornado proactive aggression and summer post-tornado community violence. This relationship did not remain when tested in a simple, linear regression analysis. Demographic variables, cohort, physiological variables, reactive aggression from the first two time points, tornado exposure, neighborhood disadvantage, and poor monitoring from the first two time points were tested as moderators in this relationship but found to be non-significant. However, after controlling for demographic variables and pre-tornado community violence, children’s relocation following the tornado was tested and found to be a significant moderator between pre-tornado proactive aggression and summer post-tornado community violence ($B = - .995, SE = .462, p = .033, 95\% CI = [-1.909, -.082]$. The overall model accounted for 32% of the total variance of summer post-tornado community violence ($F_{(8, 157)} = 9.447, p < .001$). Results revealed a negative relationship between proactive aggression and community violence regardless of whether children moved; however, this relationship was only significant and
therefore more robust for children who moved/relocated following the tornado (see figure 12; \( B = -1.049, SE = .394, p = .009 \)).

![Graph](image)

**Figure 12:** Pre-tornado proactive aggression and relocation’s interaction in predicting summer post-tornado community violence.

ACLM analyses also revealed a trending, positive relationship between summer post-tornado proactive aggression and 1-year post-tornado community violence. This relationship did not remain when tested in a simple, linear regression analysis. Although this relationship was in the hypothesized direction, moderators were still examined to explore why this relationship was positive for the two time points following the tornado, but negative for the time points directly before and after the tornado. Demographic variables, cohort, physiological variables, reactive aggression from the first two time points, tornado exposure, neighborhood disadvantage, relocation following the tornado, and poor monitoring from the first two time points were tested as moderators in this relationship but found to be non-significant.
Reactive aggression models. ACLM analyses revealed a significant, negative relationship between pre-tornado community violence and summer post-tornado reactive aggression. This relationship remained significant when tested in a simple, linear regression analysis ($\beta = -.150, p = .020$). Demographic variables, cohort, physiological variables, proactive aggression from the first two time points, tornado exposure, neighborhood disadvantage, relocation following the tornado, and poor monitoring from the first two time points were tested as moderators in this relationship but found to be non-significant. Therefore, no variables collected as part of this study could explain this relationship.

Secondary Analyses

Secondary moderation models were run to assess additional variables of interest as moderators between changes in community violence and 1-year post-tornado aggression. Each of these variables was input into the model as a moderator between summer post-tornado community violence (controlling for pre-tornado community violence) and each type of aggression. Models with significant interactions were run again with control variables (i.e., demographic variables and aggression at the previous time point).

Neighborhood disadvantage. After pre-tornado community violence was controlled for, neighborhood disadvantage was tested as a moderator between summer post-tornado community violence and both proactive and reactive aggression 1-year post-tornado. Both moderation models were found to be non-significant; however, there was a significant, positive main effect for neighborhood disadvantage on proactive aggression ($\beta = .004, p = .020$).

Baseline skin conductance. After pre-tornado community violence, temperature, and humidity were controlled for, baseline skin conductance was tested as a moderator between
summer post-tornado community violence and both proactive and reactive aggression 1-year post-tornado. Both models were found to be non-significant.

**Baseline respiratory sinus arrhythmia.** After pre-tornado community violence, temperature, and humidity were controlled for, baseline RSA was tested as a moderator between summer post-tornado community violence and both proactive and reactive aggression. Both models were found to be non-significant.

**Gender.** After pre-tornado community violence was controlled for, gender was tested as a moderator between summer post-tornado community violence and both proactive and reactive aggression 1-year post-tornado. Both models were found to be non-significant.

**Tornado exposure.** After pre-tornado community violence was controlled for, total trauma exposure was tested as a moderator between summer post-tornado community violence and both proactive and reactive aggression 1-year post-tornado. Neither moderation model was found to be significant. However, when individual components of trauma exposure were examined, number of long-term disruption events ($B = -.046, SE = .020, p = .021, 95\% \text{CI} = [.840, -.007]$) and perceived life threat ($B = -.098, SE = .044, p = .026, 95\% \text{CI} = [.185, -.012]$) were found to be significant moderators between summer post-tornado community violence and proactive aggression 1-year post-tornado. The overall model including number of long-term disruption events accounted for 18\% of the total variance of proactive aggression ($F_{(4,201)} = 1.671, p = .158$). The interaction remained significant after gender, race, cohort, family income, and summer post-tornado proactive aggression were controlled for. The Johnson-Neyman test used for determining regions of significance indicated significant conditional effects of long-term disruption events at levels below .398 and above 2.675. Results revealed a positive relationship between community violence and proactive aggression in the presence of fewer long-term
disruption events and a negative relationship between community violence and aggression in the presence of more long-term disruption events (see figure 13).

Figure 13: Summer post-tornado community violence and long-term disruptions’ interaction in predicting 1-year post-tornado proactive aggression.

The overall model including perceived life threat accounted for 22% of the total variance of 1-year post-tornado proactive aggression ($F_{(4,201)} = 2.508, p = .043$). The interaction remained significant after gender, race, cohort, and family income were entered as control variables; however, the interaction was no longer significant at the .05 level when summer post-tornado proactive aggression was controlled for. Results revealed a positive relationship between community violence and proactive aggression under conditions of perceived life threat and a negative relationship between community violence and aggression under conditions of no perceived life threat; however, neither of these simple slopes were significant (see figure 14).
Interpretation type. After pre-tornado community violence was controlled for, intervention type was tested as a moderator between summer post-tornado community violence and 1-year post-tornado proactive aggression but was found to be non-significant. Regarding reactive aggression, after pre-tornado community violence was controlled for, intervention type significantly moderated the relationship between summer post-tornado community violence and 1-year post-tornado reactive aggression. This interaction remained significant even when gender, race, cohort, family income, and summer post-tornado reactive aggression were controlled for ($B = -.094, SE = .044, p = .034, 95\% CI = [-.181, -.007]$. The overall model accounted for 40% of the total variance of reactive aggression ($F_{(9, 211)} = 4.411, p < .001$). Results revealed a positive relationship between community violence and reactive aggression in
the group condition and a negative relationship between community violence and aggression in the individual condition; however, neither of these simple slopes were significant (see figure 15).

![Figure 15: Summer post-tornado community violence and intervention type’s interaction in predicting 1-year post-tornado proactive aggression](image)

**Figure 15**: Summer post-tornado community violence and intervention type’s interaction in predicting 1-year post-tornado proactive aggression
CHAPTER 4
DISCUSSION

Overall, as expected, results revealed some significant relationships between community violence, poor parental monitoring, and both reactive and proactive aggression over time; however, these relationships were not consistent and were not always in hypothesized directions. The study’s first hypothesis that community violence and aggression would be positively related over time was not supported by the study’s findings. In fact, most cross-lagged paths between community violence and aggression were non-significant, and those that were significant were in the negative direction (opposite to the study’s hypothesis). Furthermore, findings suggested that strength and directionality of these relationships are influenced by the timing of variable measurement, direct and indirect effects of the tornado, and the type of aggression being measured (i.e., reactive versus proactive).

The study’s second hypothesis that poor parental monitoring and aggression would be positively related over time was supported for both functions of aggression for the time points closest to the tornado. However, the study’s third and fourth hypotheses assessing relationships between poor parental monitoring and community violence and poor parental monitoring as a mediator between community violence exposure and aggression were not supported by the study’s findings.

Overall, although primary hypotheses involving community violence were not supported in this at-risk sample, some interesting findings emerged regarding the relationships between community violence and aggression within the context of natural disaster exposure. More
specifically, relocation immediately following the tornado, disruptions one year after the tornado, and perceived life threat during the tornado emerged as important variables in the relationship between community violence and aggression. Furthermore, results differed for reactive and proactive aggression, supporting the assessment of these two functions of aggression as similar, yet distinct constructs.

**Effects of Longitudinal Variable Measurement**

A major strength of this study was its reliance on longitudinal data. In fact, results suggested that limiting analyses to cross-sectional or even two time point analyses would only provide a small window into the complexity of the associations between the primary study variables. The findings from this study indicate that the relationships between community violence, poor parental monitoring, and aggressive behavior can change in strength and direction depending on measurement timing. Furthermore, longitudinal data collection allowed for the exploration of measurement stability and variability within the context of tornado and intervention effects.

A novel contribution of this study was to examine the stability of community violence, poor parental monitoring, and aggression in an at-risk sample over a three-year period. Correlations between the study’s variables, along with results from ACLM models, suggested stability for community violence and poor parental monitoring. In fact, model fit for ACLM analyses improved when additional autoregressive paths for community violence and poor parental monitoring were added, emphasizing the stability of these variables over the four time points. Aggression, on the other hand, demonstrated more variability over the three-year period. For example, measures of proactive aggression were not correlated across all four time points, and the path between pre- and summer post-tornado proactive aggression was only significant at
the .05 level (rather than the .01 level) during model four analyses. Furthermore, modification indices suggested that additional autoregressive paths for either form of aggression would not have improved overall model fit, as it did for community violence and poor parental monitoring.

There are several possible reasons that there was more variability seen for aggressive behavior. First, all participants in the current study’s sample received the Coping Power intervention, which has been shown to reduce teacher- and parent-reported externalizing behaviors up to 1-year following the intervention (Lochman et al., 2015). Therefore, children’s aggressive behaviors likely decreased over time at least partially as a function of receiving the intervention.

Another potential explanation for the variability seen in aggressive behavior over time involves the use of teacher-reported data. Overall, reliance on teacher data was a strength of the current study. In fact, teacher reports have been shown to better predict later aggressive behavior and mental health impairment when compared to parent ratings (e.g., Hill, Coie, Lochman, & Greenberg, 2004; Kassing, Godwin, Lochman, Coie, & Conduct Problems Prevention Research Group, under review; Madison, Rhonda, & Rosemary, 2016). However, it is important to consider that the reporting teacher varied across the four time points, whereas the reporting parent likely remained consistent for the entire three-year period. Teacher ratings at each time point may act as a “snapshot” of children’s aggressive behaviors for that specific year and should be relatively unaffected by children’s prior levels of aggressive or problematic behaviors. Therefore, it is possible that aggression varied across time points as a function of changing reporters who may have rated the same student differently, whereas poor parental monitoring and community violence were drawn from more consistent data sources across the three-year period.
Effects of Parental Monitoring

One of the study’s primary goals was to assess poor parental monitoring as a mediator between community violence and aggressive behavior. Although this hypothesis was not supported by the study’s findings, some interesting relationships between poor parental monitoring and the other study variables emerged. For example, poor parental monitoring and community violence were significantly, positively correlated at the 1-year post-tornado time point. This was the only significant relationship between these two variables, emphasizing the importance of considering timing and proximity to the tornado in the assessment of these relationships.

Regarding poor parental monitoring’s relationship with aggression, for both reactive and proactive aggression, higher levels of pre-tornado parental monitoring and supervision acted as a buffer against the development of aggressive behaviors following the tornado. While this relationship was not impacted by community violence, it has important implications for post-disaster interventions seeking to reduce aggression and externalizing behaviors in at-risk youth through parent involvement and training.

Relationships between Community Violence and Aggression

Another primary goal of the current study was to examine the relationships between community violence and aggression over time. Unexpectedly, some negative relationships between community violence and aggression emerged, which was contrary to hypotheses and prior research support.

For example, pre-tornado community violence was found to negatively predict summer post-tornado reactive aggression. This finding indicated that children living in more violent neighborhoods prior to the tornado displayed fewer reactively aggressive behaviors during the
summer following the tornado and that children living in less violent neighborhoods prior to the tornado displayed more reactively aggressive behaviors during the summer following the tornado. Furthermore, exploratory analyses did not support any tested variables as moderators of this relationship. These findings were contrary to hypotheses and prior research that has demonstrated positive relationships between community violence exposure and aggressive behavior (e.g, McMahon et al., 2013; Steinbrenner, 2010). Given that the negative relationship between community violence exposure and reactive aggression was only seen in the time points immediately before and after the tornado, it is possible that the 2011 tornado affected “typical” relationships between these variables among this at-risk sample. Therefore, based on natural disaster and resiliency research, three potential explanations were developed to describe these unusual findings.

First, research on natural disasters has suggested that the probability of receiving disaster relief is higher for lower income and more damaged households (e.g., Morris & Wodon, 2003). In the case of the 2011 tornado, news stories cited that 71% of the homes that were damaged or destroyed were rentals with a household median income of less than $25,000, 32% of which had a household median income of less than $15,000 (Flanagan, 2016). Given the high correlation between neighborhood crime and poverty (e.g., Bell, 1987; Greene, 1993), it is possible that children coming from the higher crime neighborhoods of the study area also experienced more tornado-related damage and thus received heavier relief efforts in the aftermath of the tornado. Research has demonstrated that children exhibit improvements in posttraumatic stress symptoms and adaptive functioning when they receive post-disaster, school-based interventions (Wolmer, Laor, Dedeoglu, Siev, & Yazgan, 2005). Therefore, children living in worse neighborhoods prior to the tornado may have received the most support from relief efforts following the tornado,
buffering against the development of aggressive behaviors that often follows community violence exposure.

On the other hand, the opposite pattern was seen for children coming from neighborhoods with lower levels of pre-tornado community violence. Research suggests that children exhibit more overall aggressive behaviors (e.g., Burke, Borus, Burns, Millstein, & Beasley, 1982; Durkin et al., 1993; Scott, Lapré, Marsee, & Weems, 2014) and more reactively aggressive behaviors (e.g., Marsee, 2008) following natural disaster exposure; therefore, children coming from low-crime neighborhoods demonstrated “typical” responses to disaster exposure. Furthermore, these children may have received less disaster relief either because they lived further from the direct path of the tornado, or because relief was focused on poorer, more disadvantaged neighborhoods, thus limiting their protection against the development of aggressive behaviors.

The relationship between community violence and reactive aggression may have also been impacted by children’s own engagement in relief efforts and rebuilding of their communities. This potential explanation is supported by the “altruism born of suffering” theory, which posits that individuals who have suffered and/or experienced trauma may become more motivated to engage in prosocial behaviors because of their experiences (Staub, 2003; Vollhardt, 2009). Furthermore, research suggests that natural disaster exposure increases children’s altruistic giving immediately after the disaster (Li, Li, Decety, & Lee, 2013). Therefore, it is possible that children coming from neighborhoods with high levels of community violence are more susceptible to the “altruism born of suffering” effect and are therefore more likely to demonstrate prosocial, rather than aggressive, behaviors after a natural disaster.
A third explanation for the study’s unusual findings draws from resiliency research. Research suggests that a history of *some* adverse life events predicts better mental health and more positive well-being-related outcomes compared to having many or no adverse life events (Seery, Holman, & Silver, 2010). Therefore, a history of community violence exposure and other difficult life events associated with these types of living environments may help children learn to adapt and deal with adversity at an early age, thus reducing the probability of negative adjustment following subsequent trauma exposure, such as natural disaster exposure. Children coming from safer, more advantaged neighborhoods, on the other hand, may experience less adversity growing up and therefore may be more likely to exhibit problematic adjustment, rather than resilience, following natural disaster exposure.

**Effects of Tornado Exposure**

A secondary goal of this study was to assess how relationships between community violence and aggressive behavior changed within the context of a recent natural disaster. Although results did not support the study’s hypothesis that community violence would positively predict aggression over time, important and informative findings emerged when direct and indirect effects of tornado exposure were considered. Furthermore, exploratory and secondary analyses involving tornado-related variables provided some insight into these relationships and potential explanations for the unexpected findings.

For example, a secondary goal of this study was to assess whether tornado exposure moderated the relationship between changes to community violence following the tornado and aggression 1-year post-tornado. While children’s total tornado exposure did not moderate this relationship, two components of tornado exposure (i.e., perceived life threat and number of long-term disruptions) emerged as moderators during secondary analyses indicating that certain
elements of children’s exposure to the tornado affected the relationship between changes in community violence and later proactive aggression.

**Perceived life threat.** First, results revealed that higher levels of community violence immediately following the tornado (regardless of pre-tornado community violence exposure) predicted higher levels of proactive aggression 1-year later if children reported fearing for their lives during the tornado. Therefore, “typical,” positive associations between community violence exposure and proactive aggression were present when children perceived life threat during the tornado. This is consistent with prior research on the current dataset demonstrating less reduction in aggressive behavior following tornado exposure when children perceived life threat during the tornado (Lochman et al., 2017). Perceived life threat during a natural disaster may lead children to have more difficulties with emotional and behavioral adjustment post-disaster, which may present as more frequent displays of aggression (Lochman et al., 2017). This theory is supported by research demonstrating more emotion regulation difficulties and irritability following natural disaster exposure (Kunimatsu & Marsee, 2012; Scott et al., 2014). Therefore, in this sample, there appears to be a compounding effect when children experience risks for aggressive behavior associated with high community violence exposure and perceived life threat during a natural disaster.

Interaction effects also revealed that higher levels of community violence immediately following the tornado (regardless of pre-tornado community violence exposure) predicted lower levels of proactive aggression 1-year later if children did not experience fear of death during the tornado. This suggests that children living in neighborhoods with higher levels of community violence exhibited lower levels of proactive aggression one year later when they perceived less danger and distress during the tornado. There are two potential explanations for this unexpected
finding. First, as previously mentioned, all study participants received the Coping Power intervention, which may explain reductions in proactive aggression at later time points. Furthermore, it is possible that intervention effects were stronger for children coming from high crime neighborhoods. In fact, prior research on the Coping Power program has demonstrated greater reductions in aggressive behavior for children coming from neighborhoods with lower social organization (i.e., lower perceptions of neighborhood belonging and support; Lochman et al., 2013). Hypotheses supporting proactive aggression are derived from the social learning theory and suggest that these behaviors are first learned from others in the environment; therefore, it is possible that problem-solving, anger management, and social skills learned through the Coping Power program are particularly useful for children who have learned to use proactive behaviors and had these behaviors reinforced in their neighborhood contexts.

An additional explanation for the relationship between community violence and proactive aggression under lack of perceived life threat goes back to the “altruism born of suffering” theory. Similar to the relationship seen between community violence and reactive aggression, it is possible that children coming from more violent neighborhoods are less likely to exhibit proactively aggressive behaviors following a tornado if they are actively engaging in prosocial behavior and/or relief efforts.

**Long-term disruptions.** Results also revealed that higher levels of community violence immediately following the tornado (regardless of pre-tornado community violence exposure) predicted higher levels of proactive aggression one year later if children experienced zero or very few long-term disruptions from the tornado. Items assessing long-term disruptions included disruptions to children’s lives that had not been resolved one year after the tornado, such as damage to homes, farther commutes to school, and parental job loss. Therefore, “typical,”
positive associations between community violence exposure and proactive aggression were present when damage and other tornado-related disruptions were resolved soon after the tornado. On the other hand, higher levels of community violence immediately following the tornado (regardless of pre-tornado community violence exposure) predicted lower levels of proactive aggression one year later if children experienced three or more long-term disruptions from the tornado. This suggests that children living in neighborhoods with higher levels of community violence exhibited lower levels of proactive aggression when their families experienced more long-term tornado damage and disruptions. As with the negative relationship seen between community violence and reactive aggression and between community violence and proactive aggression under conditions of no perceived life threat, “altruism born of suffering” effects may help explain these findings. Building on this hypothesis, these results suggest that children who come from higher crime neighborhoods and whose families experienced more long-term tornado damage are the most likely to demonstrate lower levels of proactive aggression. This is supported by research suggesting that individuals demonstrate more prosocial behavior following natural disasters if they experienced more disaster-related devastation (Rao et al., 2011). Therefore, participants from the current study’s sample who experienced more long-term disruptions may have been more likely to demonstrate prosocial and altruistic behavior after the tornado, potentially helping families and neighbors rebuild and taking on additional responsibilities at home and in their communities.

Relocation following the tornado. Although not significant at the .05 level, a trending negative relationship was revealed between pre-tornado proactive aggression and summer post-tornado community violence. This relationship was moderated by children’s relocation following the tornado. These results indicate that children who exhibited higher levels of
proactive aggression prior to the tornado ended up in neighborhoods with lower levels of community violence immediately after the tornado, but only if they moved. It is possible that children who had higher levels of pre-tornado proactive aggression lived in more disadvantaged and higher crime neighborhoods in the years leading up to the tornado (although data was only gathered for the few months leading up to the tornado for the current study). These children may have subsequently moved from these neighborhoods due to tornado damage, which would be consistent with previously cited data suggesting that the 2011 tornado impacted a large number of impoverished areas (Flanagan, 2016). Furthermore, according to Tuscaloosa’s mayor, Walt Maddox, most individuals who lost their homes during the tornado were placed in nicer homes following the natural disaster (Flanagan, 2016), which further supports this explanation. Although results from this study did not indicate that children who moved to better neighborhoods experienced reductions in aggressive behavior, these findings still have interesting implications for how relief efforts are allocated post-disaster and how this allocation affects children’s and families’ adjustment following natural disaster exposure.

Differences for Reactive and Proactive Aggression

Overall, results differed significantly across models involving reactive versus proactive aggression, which supports the consideration of these functions of aggression as distinct constructs. While there were some ways in which models for reactive and proactive aggression were similar, further probing of these relationships suggested differences between these two types of aggression.

As previously mentioned, although reactive and proactive aggression were both more variable across time than the other study variables, proactive aggression was more variable than reactive aggression across the time points. More specifically, pre-tornado proactive aggression
was only associated with summer-post tornado aggression and even this relationship became less robust during more complex ACLM models. This may be partially explained by the Coping Power intervention, which has been shown to reduce proactive, but not reactive aggression at post-intervention (Lochman & Wells, 2002). Therefore, the variability seen in proactive aggression may be attributed more to intervention effects.

A primary finding of the study was that there were negative relationships between community violence and both reactive and proactive aggression; however, these relationships occurred across different time points and were impacted by different moderators. The relationship between community violence and reactive aggression, for example, was seen for the time points immediately before and after the tornado, but also during the two time points following the tornado, which was moderated by intervention type received. For proactive aggression, on the other hand, the relationship with community violence emerged only during the two time points following the tornado and was moderated by children’s perceived life threat during the tornado and endorsement of long-term disruptions one year after the tornado.

These differences suggest that while the associations between community violence and both forms of aggressive behavior appear to be impacted by the presence of a natural disaster, timing and direct effects of the natural disaster and intervention differentially affect these relationships for the two functions of aggression. More specifically, reactive aggression appears to be impacted immediately and up to one year following a natural disaster, whereas effects for proactive aggression emerge one-year later. Furthermore, tornado exposure seems to influence displays of proactive, but not reactive, aggression, which is contrary to prior research demonstrating increases in reactive aggression following natural disaster exposure (Marsee, 2008). This suggests that there is something about the combination of community violence and
natural disaster exposure that affects proactive aggression, whereas the relationship between community violence and reactive aggression may be relatively unaffected by natural disaster exposure in an at-risk sample. Given that proactive aggression is theorized to be reinforced in the environmental context (Dodge, 1991), it is possible that this process of aggression development can be disrupted by a natural disaster. For example, proximal and distal effects of a natural disaster may force children to move to new neighborhoods or impact the make-up of the neighborhoods they already live in, which may, in turn, affect children’s involvement in deviant peer groups and observations of aggressive behaviors by others in their communities.

Another difference seen for the two types of aggression measured in the current study was that intervention type moderated the relationship between summer post-tornado community violence and reactive, but not proactive, aggression. More specifically, results suggested that children receiving the group intervention displayed a positive relationship between community violence and reactive aggression, while children receiving the individual intervention displayed a negative relationship between community violence and reactive aggression. This was an interesting finding considering the aforementioned research indicating stronger Coping Power intervention effects for proactive aggression at post-intervention (Lochman & Wells, 2002). Results from this study, on the other hand, suggest that children demonstrate reductions in reactively aggressive behaviors post-community violence exposure only if they received the individual format of the intervention. This is supported by research on the group versus individual format of the Coping Power program that has demonstrated greater improvements for children in the individual format, especially when children had low levels of initial self-regulation (Lochman et al., 2015). This is consistent with reactive aggression’s conceptualization as a reaction to perceived threat (e.g., Dodge, 1991), and suggests that children
with higher levels of pre-tornado community violence exposure display fewer reactively aggressive behaviors when they receive more individualized preventive interventions.

Relationships with Secondary Variables

Although most secondary variables that were examined did not significantly moderate the relationship between community violence and aggression, some interesting correlations emerged between primary and secondary study variables.

For example, children’s neighborhood disadvantage during the summer after the tornado was positively correlated with proactive aggression, reactive aggression, and parental monitoring measured during at least one time point. These findings replicate previous research demonstrating a positive relationship between neighborhood disadvantage and aggressive behavior (e.g., Farrell et al., 2014; Romero et al., 2015). Furthermore, there was a main effect for neighborhood disadvantage on proactive, but not reactive, aggression during secondary analyses, which has also been demonstrated in prior studies (e.g., Fite et al., 2009). Interestingly, neighborhood disadvantage was not correlated with community violence at any time point, which is contrary to previous research demonstrating positive associations between neighborhood disadvantage and perceived levels of violence in communities (e.g., Sampson et al., 1997). Since census data used to create the neighborhood disadvantage variable were only available from the 2010 census, it is possible that relationships between community variables would be more robust if measured at concurrent time points (rather than from two separate points during a several year period). Therefore, it is possible that discrepancies in timing of data collection for these neighborhood characteristics affected correlations.

Interesting patterns of correlations also emerged between physiological variables and primary study variables. Baseline skin conductance, for example, was significantly, negatively
correlated with reactive aggression summer post-tornado, but not with any other primary study variables. This implies that children were more likely to display reactively aggressive behaviors immediately following the tornado if they had lower levels of baseline skin conductance pre-tornado and pre-intervention. Prior research on the relationships between baseline skin conductance and reactive aggression has been mixed; however, low levels of baseline skin conductance have been consistently supported as a risk factor for aggression more broadly (e.g., Baker et al., 2013; Van Goozen et al., 2000), and several studies have found low levels of baseline skin conductance to predict higher levels of reactive aggression (e.g., Scarpa et al., 2010).

Regarding findings for baseline respiratory sinus arrhythmia (RSA), correlations revealed trending relationships between baseline RSA and both proactive and reactive aggression; however, directionality and time point differed depending on the type of aggression. More specifically, baseline RSA had a trending, negative correlation with reactive aggression measured pre-tornado and a trending, positive correlation with proactive aggression measured 3-years post-tornado. These results indicate that children with lower levels of baseline RSA are at-risk for developing reactively aggressive behaviors prior to natural disaster exposure, but also that children with higher levels of baseline RSA are at-risk for developing proactively aggressive behaviors three years following natural disaster exposure. Given that heightened levels of baseline RSA are thought to indicate increased emotion regulation, the association between lower levels of baseline RSA and reactive aggression is supported by the conceptualization of reactive aggression as a reaction to perceived threat (Berkowitz, 1978). The opposite pattern (i.e., higher levels of baseline RSA) can be expected for proactive aggressive based on
fearlessness and sensation seeking theories and the characterization of “under-arousal” for this subtype of aggression (Dodge, 1991).

Interestingly, baseline RSA was significantly, negatively correlated with community violence measured summer and 1-year post-tornado. This finding suggests that children living in higher crime neighborhoods are more likely to have lower levels of baseline RSA (indicating more difficulty with emotion regulation). Prior research has demonstrated interactions between community violence exposure and physiological arousal in predicting aggressive behavior (e.g., Scarpa et al., 2008); however, these relationships were not replicated in the current study. Therefore, it is possible that different relationships among these variables were observed in the current study due to the recent occurrence of a natural disaster. This potential explanation is supported by research on posttraumatic stress disorder (PTSD), indicating that children who developed PTSD following traumatic events were characterized by autonomic nervous system hyperarousal (Perry, Pollard, Blakley, Baker, & Vigilante, 1995). Therefore, it is reasonable to expect that children’s autonomic functioning may have been impacted by their exposure to the 2011 tornado, thus impacting “typical” associations between community violence, physiological arousal, and different types of aggression.

Limitations

The primary limitations of this study include generalizability, reliance on self-reported parenting data, and potential confounding effects of the intervention. Given that the present study’s sample was drawn from identified aggressive children, it is unclear how these results would generalize to a low-risk or more variable sample. Assessing these relationships in an aggressive sample aids in the understanding of the development of aggressive behaviors in at-risk youth, however, this comes at the cost of generalizing these findings. In addition, the present
sample was primarily composed of African Americans and Caucasians, limiting the ability to extend findings beyond these two racial groups.

The Alabama Parenting Questionnaire was a self-reported measure completed by parents on their own behaviors. Self-reported data may be somewhat inaccurate due to poor recall and a desire to be viewed in a positive light. However, the present study attempted to compensate for this limitation by utilizing different sources of information for the independent, moderating, and dependent variables. Community violence was measured objectively using archival crime data and therefore required no subjective reporting from the participants, the parent reported on parenting, and teachers reported on aggression. By including three sources of data (archival data, parent, and teacher) the present study avoided relying solely on self-reported data or on data from only one source.

As mentioned throughout the discussion section, all participants received the Coping Power intervention, which may explain some of the study’s findings. Due to the lack of a control group, it is impossible to tease out effects from the intervention compared to effects from community violence and natural disaster exposure. Therefore, future research should seek to replicate these results in a sample comprised of at-risk children who have both received and not received intervention to determine the true drivers of the relationships found in this study.

Another limitation of this study was the reliance on a sample with different amounts of missing data across each measure. Teacher-reported data on aggressive behavior had the most missing data compared to the other primary variables, particularly at later time points. However, ACLM analyses utilized full information maximum likelihood (FIML) methods to address the issue of missing data and the final sample size was still within an acceptable range for structural equation modeling based on suggestions by Kline (2005) and Ding, Velicer, and Harlow (1995).
Finally, the present study only measured overt forms of aggression and did not consider relational or more covert aggressive behaviors. Future research may wish to explore these relationships in the context of covert aggression, especially with regards to gender differences. Future research should work to determine whether these results may be replicated in other populations (e.g. community samples, more diverse samples, other developmentally significant age groups). It may also be interesting to explore whether these relationships hold when examining different parent-child interaction factors (such as security of attachment) as well as other externalizing behavior outcomes.

**Future Directions and Implications**

Overall, results indicate that the relationships between community violence and aggression in at-risk youth are complex and are influenced by other environmental factors. These results also support parenting monitoring as a protective factor against the development of aggression and illustrate how community violence and tornado exposure interact to indicate enhanced risk for aggressive behaviors.

Future research should seek to replicate these findings in other samples and incorporate other constructs and variables of interest, such as measures of resiliency, to test the present study’s potential explanations for unusual findings. The current study’s findings may have important implications for understanding children’s resiliency following community violence and natural disaster exposure. Therefore, future epidemiological or experimentally-designed studies may wish to more directly examine how children’s altruistic views and engagement in community relief and prosocial behaviors are impacted by natural disaster exposure.

Interesting findings also emerged regarding how relocating following natural disasters may affect relationships between aggression and community violence. Furthermore, patterns and
trends visible through choropleth maps provide the basis for future research examining how children’s relocation and potential return to original, damaged neighborhoods several years later affect their resiliency following community violence and natural disaster exposure. Results from this study also lay the groundwork to suggest that children may be more likely to experience resiliency if they move to better areas post-disaster. Therefore, future studies should expand upon these findings, potentially using GIS, to examine how support, resources, and relief efforts are allocated post-disaster and whether this distribution differentially affects children and families depending on their neighborhood context. Such research could have important implications for interventions and policies designed to improve disaster relief efforts.

Perhaps most importantly, findings from this study highlight the importance of considering how at-risk youth can remain resilient in the face of diverse trauma exposure (e.g., community violence, natural disasters). In the wake of natural disasters and changing environments, researchers and interventionists may use this information to better inform prevention and treatment strategies. Interventions may wish to focus on improving children’s neighborhood environments through community outreach as well as work to improve parenting practices. Furthermore, disaster relief and other efforts targeting children’s adjustment following major environmental change may wish to put more emphasis on the neighborhood context and the protective role of parenting, in addition to providing services to those experiencing direct and indirect stress and trauma.
REFERENCES


APPENDIX A: IRB APPROVAL

July 20, 2017

John Lochman, PhD
Department of Psychology
College of Arts & Sciences
Box 870348

Re: IRB Application #: 08-016-R9 A
Application Title: “Individual and Group Intervention Formats with Aggressive Children”

Dear Dr. Lochman:

The University of Alabama Non-Medical Institutional Review Board has recently reviewed the revision request for your protocol. The board has approved the change in your protocol.

Please remember that your approval period expires one year from the date of your original approval, 2/16/2017, not the date of this revision approval.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants.

Good luck with your research.

Sincerely,

Stuart Usdan, PhD
Chair, Non-Medical Institutional Review Board