AMERICAN PSYCHOLOGICAL ASSOCIATION

Journal of Family Psychology

ISSN: 0893-3200

2024, Vol. 38, No. 6, 945–955
https://doi.org/10.1037/fam0001249

The Mutual Influence of Parent–Child Maladaptive Emotion Regulation on Posttraumatic Stress Following Flood Exposure

Jazzmyn S. Ward[1], Erika D. Felix[1], Karen Nylund-Gibson[2], Tamara Afifi[3], and Aprile D. Benner[4]

[1] Department of Counseling, Clinical, and School Psychology, University of California, Santa Barbara
[2] Department of Education, University of California, Santa Barbara
[3] Department of Communication, University of California, Santa Barbara
[4] Department of Human Development and Family Sciences, University of Texas at Austin

Decades of disaster research support the influence parents have on their children's adaptation. Recently, research has shifted to focus on disasters as a whole family experience. Using the actor-partner interdependence model, this study examines maladaptive cognitive emotion regulation strategies in parents and children and how these strategies influence their own and one another's posttraumatic stress symptoms (PTSS). The present study includes 485 parent–child dyads who experienced the 2015–2016 Texas floods. The majority of parents identified as mothers (66.3%), with a male child (52.8%) whose average age was 13.75 years. Mplus was used to identify the models and evaluate differences between each cognitive emotion regulation strategy across parent–child dyads in the high disaster exposure group compared to all other levels of exposure (other-exposure). Odds ratios examined differences not captured by the actor-partner interdependence model. Support for interdependence was found for the other-exposure group, suggesting parents and children mutually influence each other's PTSS by their own cognitive emotion regulation. No interdependence was found in the high-exposure group. However, high-exposure child actor effects were found for self-blame and other-blame, and child partner effects were only found for self-blame. Parent actor effects were only significant for catastrophizing and parent partner effects for catastrophizing and rumination. Odds ratios for the high-exposure group found that only child self-blame influenced parent PTSS, and only parent rumination and catastrophizing influenced child PTSS. Implications for supporting families after disasters are discussed.

Keywords: emotion regulation, parent–child dyads, posttraumatic stress, disaster exposure

Between May 2015 and May 2016, Texas endured a series of extreme weather conditions, including tornadoes, severe storms, and floods, which impacted thousands of people across much of the state in what the American Red Cross noted was "a year of relentless disasters in Texas" (American Red Cross, 2016, p. 2). Some of these natural hazards included the Memorial Day Weekend flood of 2015, the Halloween Weekend Flood of 2015, and the April Tax Day flood of 2016. These natural hazards caused flooding of thousands of homes, sparked evacuations and displacements, led to numerous injuries, and, in some instances, caused death, for example, 14 deaths in the Memorial Day Weekend 2015 flood (Austin American-Statesman, 2018). When considering the impact of disasters on mental health, research demonstrates the importance of understanding disaster experiences at the family and community level, beyond just an individual experience (Bonanno et al., 2010; Cobham et al., 2016). Indeed, disasters can adversely impact family functioning, which affects subsequent mental health (Bonanno et al., 2010; Felix et al., 2013, 2020; Juth et al., 2015). But children can also exhibit prosocial behavior (Sprague et al., 2015) and can sometimes appear unaffected in the months following a disaster (Botey & Kulig, 2014). Until recently, most family-focused disaster research has studied the unidirectional impact of parent mental health on children (Bonanno et al., 2010), with a call for examining bidirectional influences (Cobham et al., 2016). Recent research using the actor-partner interdependence model (APIM) has explored how parents and children may mutually influence each other's mental health postdisaster (Hausman et al., 2020; Juth et al., 2015). The present study continues this line of disaster research by exploring the

This article was published Online First June 27, 2024.
Katherine B. Ehrlich served as action editor.
Jazzmyn S. Ward https://orcid.org/0000-0002-4354-0387
This research was supported by the National Institute of Child Health and Human Development Grants 1R03HD077164-01A1 and 20140021, awarded to Erika D. Felix. Some of the data appearing in this article have been presented at conferences. This study's design was not preregistered.

Jazzmyn S. Ward played a lead role in conceptualization, formal analysis, writing–original draft, and writing–review and editing and an equal role in methodology. Erika D. Felix played a lead role in data curation, funding acquisition, investigation, project administration, and resources and a supporting role in writing–original draft and writing–review and editing. Karen Nylund-Gibson played a supporting role in formal analysis, methodology, and writing–review and editing. Tamara Afifi played a supporting role in methodology, project administration, and writing–original draft and an equal role in data curation. Aprile D. Benner played a supporting role in data curation, investigation, methodology, project administration, and writing–original draft.

Correspondence concerning this article should be addressed to Jazzmyn S. Ward, Department of Counseling, Clinical, and School Psychology, University of California, Santa Barbara, Santa Barbara, CA 91316, United States. Email: jazzmynward@ucsb.edu

reciprocal nature of parent and child responses to disasters and extends it by considering cognitive emotion regulation strategies that can be maladaptive as mechanisms of influence on posttraumatic stress symptoms (PTSS) using the APIM.

The Impact of Disaster on Family Functioning

Natural disasters are disruptive in nature and create ongoing stressors for families that can impact family life (Reid & Reczek, 2011; Silverman & La Greca, 2002). A conceptual model of child postdisaster mental health (Silverman & La Greca, 2002) notes that the disaster experience impacts a child's efforts to cope, which has a reciprocal relationship to PTSS. Factors in the recovery environment also affects the coping and PTSS reciprocal relationship. For children, the family environment is the central recovery context for their postdisaster recovery; therefore, parents' efforts to manage their own stress can impact child mental health. Several parent factors are important contributors to family functioning after natural disasters. For example, a study of 1,886 parent–child dyads found that parental mental health, parent–child relationship quality, and positive forms of discipline impacted the risk for an internalizing disorder nearly 2 years postdisaster (Felix et al., 2013). Family functioning characterized by topic avoidance, verbal rumination, and limited parental affective involvement is also related to greater child psychological distress after disaster exposure (Felix et al., 2015, 2020; Kiliç et al., 2003). Indeed, some qualitative research has noted that the social disruption to family life may have more of an effect on child adaptation than the trauma and loss of the disaster itself (Botey & Kulig, 2014). Other qualitative research found that children and youth reported that the support their parents provided in ensuring safety during the evacuation, providing basic needs, and offering support by being physically present were helpful to their adjustment (McDonald-Harker et al., 2021). The present study contributes to our understanding of how parent–child dyads use of emotion regulation strategies postdisaster affect their own and their family members' PTSS.

The use of APIM has shed light on the interconnectedness of parent and child mental health after disaster exposure. APIM examines both actor and partner effects among dyads (Kenny & Ledermann, 2010). Actor effects represent the degree to which a person's behavior is predicted by their own past behavior, and partner effects represent how much a person's behavior is predicted by a partner's behavior. Within disaster research, there are only two APIM studies that explore interdependence of parent–child adjustment postdisaster (Hausman et al., 2020; Juth et al., 2015). Within a parent–child dyad, parent actor effects represent how the parent impacts their own outcomes, while partner effects represent how the parent impacts the child's outcomes. A study of mother–child dyads who experienced Hurricane Sandy used the APIM to understand the reciprocal effects of mother and child internalizing symptoms (Hausman et al., 2020). Mothers' depressive symptoms were associated with children's depressive symptoms, and, at low levels of exposure, children's anxiety symptoms were related to increases in mothers' depressive symptoms. Hausman et al. (2020) did not find reciprocal effects between mothers' internalizing symptoms and children's internalizing symptoms and instead highlighted increases in symptoms in tandem following the hurricane. Similarly, Juth et al. (2015) used the APIM to explore the interdependent adjustment of parents and children following a devastating earthquake in Indonesia. Findings revealed that parent PTSS after the earthquake was associated with child general distress, but child PTSS was not associated with parent general distress. Gender of the parent or child did not moderate the findings. Both studies explored the reciprocal influence on mental health; however, we need to understand the influence of factors that affect postdisaster mental health, such as emotion regulation. The focus of this study is on how cognitive emotion regulation strategies that can be maladaptive may increase risk for PTSS postdisaster. Families who engage in more potentially maladaptive emotion regulation could benefit from support by mental health professionals postdisaster.

Emotion Regulation

Emotion regulation is an essential aspect of managing stress (Compas et al., 2014) that includes monitoring and modifying emotional responses and is a key component in predicting well-being and psychopathology (Cicchetti et al., 1995). Emotion regulation impacts individuals' behaviors, thoughts, perceptions, and emotion-related physiology, especially during times of stress (Lazarus, 1991). Emotion regulation is studied in a variety of ways, including focusing on particular aspects of emotion regulation such as its cognitive components.

In this study, we focus on cognitive emotion regulation, which is the process of managing the intake of emotionally arousing information and emotional responses via cognitive processes (Thompson, 1991). Cognitive emotion regulation strategies include self-blame, acceptance, rumination, positive refocusing, planning, positive reappraisal, putting into perspective, catastrophizing, and other-blame, which fall into adaptive and maladaptive categories (Garnefski & Kraaij, 2007). Specifically, some strategies can be maladaptive if overused, and this includes self-blame (overfocusing on blaming yourself for the problem), rumination (thinking about the problem repeatedly to a significant degree), catastrophizing (focusing on the worst possible thing that can happen to the near exclusion of other possible outcomes), and other-blame (over-focusing on finding fault or responsibility in others; Doron et al., 2013; Garnefski & Kraaij, 2007). These strategies are the focus of the present study because individuals who use them often report the highest levels of anxiety and depression (Doron et al., 2013). Although there is limited research on cognitive emotion regulation use postdisaster, research on adult survivors of other traumas found that these particular cognitive emotion regulation strategies were significantly related to intrusive thoughts and anxiety and depression symptoms (Kaczkurkin et al., 2017; Slanbekova et al., 2019). Thus, potentially maladaptive cognitive emotion regulation strategies can increase risk for negative mental health outcomes postdisaster.

Family Adaptation Postdisaster: The Potential Role of Emotion Regulation

Parental functioning and response after a disaster impact the way children respond and adapt to stressors (Cobham et al., 2016; McDonald-Harker et al., 2021). Children directly and indirectly learn emotion regulation strategies from parents (Bariola et al., 2012). Parental modeling of emotion regulation strategies post-disaster implicitly and explicitly influences a child's use of emotion regulation techniques and their psychological adjustment (Bokszczanin, 2008). Emotion regulation strategies play an

important role in understanding the effects of disaster exposure on children's mental health postdisaster (Coyne & Racioppo, 2000); however, most disaster studies have only explored within participant emotion regulation. Following the Nashville flood of 2010, children who engaged in more rumination reported more depressive symptoms compared to children that engaged in less rumination (Felton et al., 2013). Similarly, Terranova et al. (2009) found that children's ability to regulate their emotions significantly predicted PTSS after Hurricane Katrina. Given the role of parents in teaching and transmitting emotion regulation strategies, it is critical to see how parents may influence children's use of potentially maladaptive cognitive emotion regulation strategies and vice versa to determine how to focus public mental health efforts for families postdisaster.

Gender can affect the use of emotion regulation (Nolen-Hoeksema, 2012) and levels of posttraumatic stress disorder (PTSD) symptoms postdisaster (Bonanno et al., 2010). There are often more gender similarities than differences, and the relationship between the use of a particular strategy and psychopathology tends to be similar across genders (Nolen-Hoeksema, 2012). Prior APIM research with parent–child dyads postdisaster did not find a moderating role of either parent or child gender on distress. Meta-analytic research (Furr et al., 2010; Rubens et al., 2018) has called for effect sizes disaggregated by ethnicity to better understand potential cultural influences on postdisaster adaptation. Therefore, the present study conducts a preliminary demographic analysis to describe how gender and ethnicity may influence postdisaster adaptation.

The Present Study

Exploring postdisaster experiences that acknowledge the reciprocal nature of parent and child emotion regulation is necessary because families are a system that plays a vital role for youth postdisaster (La Greca et al., 1996), and children can affect parent mental health (Reid & Reczek, 2011). By exploring parent and child emotion regulation that has the potential to be maladaptive, we can extend our current understanding of how families adapt following disaster to better facilitate support for families. By focusing on maladaptive emotion regulation strategies, we can better understand how to support families that may be most at risk for psychopathology and dysfunction postdisaster.

Although emotion regulation has been studied in individuals and families affected by other traumas, such as maltreatment or interpersonal violence (Kaczkurkin et al., 2017; Slanbekova et al., 2019), these traumas are different from natural disasters in several ways that can affect the use of emotion regulation strategies. A natural disaster is often a single-incident potentially traumatic event (PTE) when considering its impact phase, although it does increase life stressors in the postdisaster aftermath for those with the greatest exposure. PTEs like child maltreatment, family violence, and war involve repeated exposure to numerous PTEs, which increases their potential influence on family relationships and emotion regulation. Similarly, natural disasters are community-wide stressors affecting the full-range of families, from more to less healthy in the impact zone. Hence, we have a wider range of families in which to study the role of emotion regulation on mental health following a PTE, compared to family violence.

The level of disaster exposure also affects mental health outcomes postdisaster (Hausman et al., 2020) and will serve as a moderator in the present study. Our previous study with this sample used latent class analysis (LCA) and identified critical items that differentiated the high-exposure group from the other-exposure groups in terms of the relation to mental health (Felix et al., 2019). As such, we use those critical items to operationally define the high-exposure group for this study and explore parent–child maladaptive emotion regulation within families who experienced high levels of disaster exposure and those with less exposure (other-exposure). This study uses the APIM to address the following hypotheses:

1. There will be a positive association between parent and child maladaptive emotion regulation and PTSS.
2. There will be both actor and partner influences for both parents and children. Specifically, parent maladaptive emotion regulation will be positively associated with their own PTSS and their child's PTSS. Likewise, child maladaptive emotion regulation will be positively associated with their own PTSS and their parent's PTSS.
3. These actor and partner associations will be stronger for the high-exposure group compared to other lower levels of disaster exposure.

Method

Participants

The Federal Emergency Management Association made six major disaster declarations for Texas between May 2015 and May 2016, with 62.5% of Texas counties receiving Federal Emergency Management Association declarations for individual and/or public assistance. Initially, the current research began as a study following the Memorial Day Weekend flood of 2015 that affected 44.5% (113) counties in Texas. After receiving institutional review board (IRB) approval from the University of California, Santa Barbara, recruitment began in October 2015. Shortly after, however, the Halloween Weekend Flood occurred, and the study was adapted to ask about both floods, and IRB was modified accordingly. Floods and severe weather events continued throughout the year of study recruitment, culminating in the devastating April 2016 flood that affected Houston and surrounding areas. Therefore, the IRB was modified again to ask which "flood was most stressful," and participants could indicate "Memorial Day Weekend 2015," "Halloween Weekend 2015," "April 2016," or "other" and specify which flood. We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study. Additionally, data, study materials, and analytic code are available upon request. This study was not preregistered.

Participants were recruited from regions affected by the identified floods in partnership with a local research team familiar with the area. Recruitment methods included using flyers in affected areas, door-to-door recruitment, telephone recruitment, and digital advertising, including social media, newsletters, and newspapers. Recruitment began in October 2015 and continued through March 2017. To reach the desired dyadic sample size, we also used an opt-in panel obtained through Qualtrics, which targeted parents in Texas, given that the majority of the state was affected by the severe weather events and that people in "unaffected counties" may also have been affected due to holiday travel in the affected

regions (a lot of the major flooding occurred on holiday weekends). Eligible parents were enrolled if they were exposed to a disaster in the study time frame and had at least one child between 10 and 19 years old. Parents were asked to select their oldest child in the eligible age range to complete the survey. All study participants completed online surveys and received a small incentive upon completion.

The overall study sample includes 581 parents and 510 children. The present study includes 485 parent–child dyads, excluding the parent-only reports ($n = 71$). Further, the present study excluded 26 parents and 24 children who reported their most stressful flood experience was "other," as it included much older experiences unrelated to the Texas floods. Parent respondents were most often mothers (66.3%), followed by fathers (26.0%) and other relations (7.6%). Most parents identified as White (62.2%), and the remaining identified as Latina/o/x (18.2%), African American (9.2%), Asian American or Pacific Islander (7.7%), Native American (1.5%), and biracial/multiethnic (1.3%). Almost half of the parents completed college or graduate school (46.9%), with a median income between $60,001 and $70,000. By design, child participants ranged in age from 10 to 19 years, with an average age of 13.75 years ($SD = 2.56$). Approximately half of the child participants were male (52.8%), with majority identifying as White (57.3%), and the remaining identified as Latina/o/x (18.6%), African American (9.0%), Asian American/Pacific Islander (7.7%), Native American (1.0%), and biracial/multiethnic (6.1%).

Measures

Flood Impact Questionnaire

The Flood Impact Questionnaire was developed by the authors based on previously established measures of disaster exposure (Felix et al., 2011; La Greca et al., 1996), with a few additional flood impact questions obtained from a flood study (Ginexi et al., 2000). Parents and youth completed separate Flood Impact Questionnaires about the flood they identified as most stressful to them, of which 41.9% reported the Memorial Day Weekend flood of 2015, 12.4% reported the Halloween Weekend flood of 2015, and 45.8% reported the April 2016 flood. Items (10) pertaining to child exposure included life threat, loss of material objects, and disruption of child's everyday life. Parents (15 items) provided information about their exposure to the flood, life threat, loss or damage to their home, neighborhood, or place of work, and other flood-related losses and life disruptions. Responses options were 0 = *no*, 1 = *yes*. One item asking about damage to participants' homes and belongings was answered on a 5-point scale from 0 (*no damage*) to 4 (*total loss or destruction*). The answer was converted to a dichotomous scale (0 = *no damage*, 1 = *any damage*) following a descriptive analysis demonstrating that it was *no damage* versus *any damage* that distinguished between mental health outcomes. The parent and child responses were combined to form a family-level flood exposure score, where if either family member endorsed an item, it was counted as a yes. A previous study using LCA identified four patterns of exposure in both parents and children: high exposure (15.5% parent, 9.5% child), moderate exposure (19.8% parent, 28.2% child), community exposure (45.9% parent, 34.4% child), and low exposure (18.8% parent, 27.8% child; Felix et al., 2019). This study found that exposure level was significantly associated with anxiety, depression, and PTSS for both parents and youth. For the present study, total family exposure scores were summed based on the critical items identified in the previous study's LCA (Felix et al., 2019). The critical items that differentiated the high-exposure group from all other-exposure groups included "did you get sick or injured?" "someone close killed" and "an animal lost, hurt, or killed," to name a few. Dyads that endorsed at least three of the five critical items were categorized as the high-exposure group ($n = 87$). Low exposure, community exposure, and moderate exposure were combined to create the other-exposure group ($n = 398$) since prior research established that they have similar outcomes (Felix et al., 2019).

Impact of Event Scale–6

Parents completed the Impact of Event Scale–6 (IES-6; Thoresen et al., 2010), a brief, six-item measure of PTSS reactions derived from the widely used Impact of Event Scale–Revised (IES-R; Weiss & Marmar, 1997). It contains two items from each of the three IES-R subscales assessing intrusion (e.g., "Other things kept making me think about it"), avoidance ("I tried not to think about it"), and hyperarousal ("I had trouble concentrating"). Parents were asked to indicate which flood was most stressful to them and how much they were distressed or bothered during the past 7 days by each difficulty listed. The response options ranged from 0 (*not at all*) to 4 (*extremely*), and a total sum score was created, and imputation was used for parents who had missing data on these items (Felix et al., 2020). Sum scores were used in the APIM analysis. As a post hoc analysis, scores were dichotomized for use in computing odds ratios, where scores of 9 or less indicate low PTSS and 9 or higher indicate high PTSS. The IES-6 sum score strongly correlates (pooled correlation = 0.95) with the IES-R in four different samples of individuals exposed to a PTE, across sex, age, type of trauma, and trauma severity, and has good internal consistency ($\alpha = .80$; Thoresen et al., 2010). IES-6 also has demonstrated good convergent validity with the Patient Health Questionnaire-4 ($r = .109$, $p = .007$; Hosey et al., 2019) and good criterion validity with Clinician-Administered PTSD Scale PTSD diagnosis ($r = .93$; Jeong et al., 2021). Our data yielded reliability estimates of $\alpha = .93$.

The Children's Revised Impact of Events Scale–8

The Children's Revised Impact of Events Scale–8 (CRIES-8; Perrin et al., 2005) is a short version of the original 15-item IES measure of PTSS (Horowitz et al., 1979). The CRIES-8 is used with children aged 8 years and older and contains four items measuring intrusion and four items measuring avoidance. Children were asked to indicate which flood was most stressful to them and how much they were distressed or bothered during the past 7 days by each difficulty listed. Response options were identical to the IES-6. Item scores were summed to create a total score for use in the APIM analysis, with higher scores representing more symptoms. For the post hoc analysis using odds ratios, scores were dichotomized, where 1 indicates above-average PTSS, and 0 indicates below-average PTSS. CRIES-8 has demonstrated good validity, including convergent validity with the Children's PTSS Reaction Index, concurrent validity between two different samples of children, and good face, construct, and predictive validity ($r = .79$, $p < .001$; Giannopoulou et al., 2006; Perrin et al., 2005). CRIES-8 has good

internal consistency (α = .70–.87; Perrin et al., 2005). Our data yielded strong internal consistency (α = .95).

Cognitive Emotion Regulation Questionnaire–Short

The Cognitive Emotion Regulation Questionnaire–Short (CERQ-S; Garnefski & Kraaij, 2006) is an 18-item abbreviation of the original 36-item measure (Garnefski et al., 2001), which identifies various cognitive emotion regulation strategies used following a stressful life event. The CERQ-S is a self-report questionnaire validated for ages 12 years and older, comprising nine two-item subscales: *Self-blame*, *Other-blame*, *Rumination*, *Catastrophizing*, *Putting into Perspective*, *Positive Refocusing*, *Positive Reappraisal*, *Acceptance*, and *Planning*. The present study used the maladaptive subscales only, which include self-blame, other blame, catastrophizing, and rumination. Parents and children completed the CERQ-S using a 5-point Likert scale from 1 (*never*) to 5 (*always*). Subscale scores were computed as mean scores, with higher scores indicating greater use of the strategy. The CERQ-S has good internal consistency among child and adult samples (α = .73–.81) and positive correlations with the full CERQ (r = .47–.88; Garnefski & Kraaji, 2006). The CERQ-S has good convergent validity with the Symptom Checklist–90 (r = .50–.54; Ireland et al., 2017). CERQ-S also has strong convergent validity with the Difficulties in Emotion Regulation Scale and divergent validity with the Positive and Negative Affect Scale (Ireland et al., 2017). Internal consistency in the current sample ranged from α = .80 to .94 for youth and α = .79 to .92 for parents.

Analytic Plan

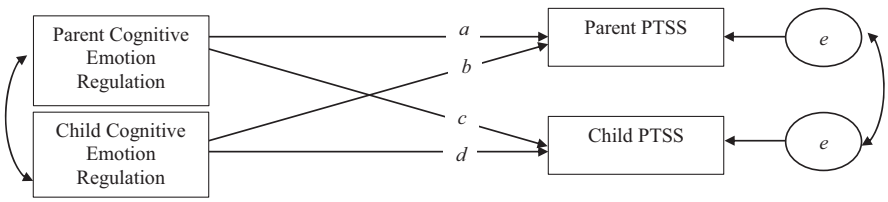
Preliminary data analysis with SPSS was used to understand interrelationship among study variables with correlations and the influence of demographic characteristics using independent sample t tests and analyses of variance. To test study hypotheses, actor and partner effects between parent and child emotion regulation and PTSS were determined using APIM with Mplus (Muthén & Muthén, 1998–2017). APIM examines actor and partner effects among dyads using path analysis and structural equation modeling (Kenny & Ledermann, 2010). The parent–child pair is recognized as the unit of analysis as to not violate the independence assumption (Cook & Kenny, 2005). Actor effects represent the degree to which a person's behavior is predicted by their own past behavior, and partner effects represent how much one person's behavior is predicted by a partner's behavior (see Figure 1). Multiple comparisons were made—first, actor and partner relationships were studied for parent and child PTSS separately. To provide evidence of interdependence, actor and partner effects must be significant. Next, to understand the role of disaster exposure, we compared the APIM estimates between dyads in the high-exposure group to those in the other-exposure group using a multiple-group approach, which allowed for direct testing of the equality of regression coefficients across exposure groups. In addition to the multiple comparisons, odds ratios were used as an indicator of effect size, which was helpful in the context of smaller samples. Given the number of comparisons for each group of estimates, the false discovery rate (FDR) test was conducted using an online FDR calculator (Benjamini & Hochberg, 1995; Carbocation Corporation, 2016).

Results

Preliminary Analysis

Prior research with this sample demonstrated that the high disaster exposure group differs from the other-exposure group in terms of higher PTSS, depression, and anxiety symptoms (Felix et al., 2019). Given the sample size for the high-exposure group (87 dyads) and its effect on power, the APIM models could not be separated by sex or ethnicity. Therefore, our preliminary analyses focus on parent and child sex and ethnicity (see Table 1) to provide context for the reader as they interpret overall findings and can help address questions about family groups that may be most impacted. Independent samples t test revealed that fathers reported significantly greater PTSS and engaged in more maladaptive emotion regulation. There was a statistically significant difference for parent race/ethnicity with respect to PTSS. A Tukey post hoc test revealed significant differences between White parents as compared to Asian American, Black, Latina/o/x, and other parents. Initially, there were racial/ethnic differences among several parent cognitive emotion regulation items. Furthermore, FDR significance test revealed significant differences in self-blame across ethnic groups. For child participants, Asian American children endorsed significantly more PTSS, catastrophizing, and rumination as compared to White and other children. Similarly, Asian American children reported significantly more self-blame compared to Black, Latina/o/x, and other children. Moreover, Asian American children endorsed more other-blame than Black, Latina/o/x, White, and other children. FDR analysis suggests that there was no difference in flood exposure level across child ethnicity. Parent income was not correlated with disaster exposure or PTSS. Child age did not significantly correlate with PTSS,

Figure 1
Sample Actor-Partner Interdependence Model



Note. Paths a and d represent actor effects, b and c represent partner effects, and e represents error. Cognitive emotion regulation represents each maladaptive strategy used in all eight models. PTSS = posttraumatic stress symptoms.

Table 1
PTSS, Exposure Level, and Emotion Regulation Strategies for Entire Sample and by Demographic Group

						Parent						
Variable	Total % or $\bar{X}$	Male (n = 150)	Female (n = 334)	$t(df)\|X^2(df)$	p	White (n = 298)	Latinx (n = 87)	Black (n = 44)	Asian (n = 37)	Other (n = 13)	$F(df)\|X^2$	p
PTSS (high)	42.8%	39.5%	37.4%	13.41 (2)	<.001	52.7%	21.5%	11.7%	10.2%	2.4%	13.19 (5)	.022
Flood exposure (high)	17.9%	47.1%	52.9%	13.15 (2)	<.001	51.7%	18.4%	12.6%	13.8%	3.4%	9.96 (5)	.076
Self-blame	1.92	2.40	1.70	−6.05 (466)	<.001	1.81	2.01	1.87	2.40	2.68	3.36 (4)	**.050**
Other-blame	2.06	2.44	1.89	−4.42 (459)	<.01	1.88	2.34	2.13	2.70	2.06	4.94 (4)	.005
Rumination	2.70	2.87	2.63	−2.17 (461)	.030	2.61	2.74	2.82	3.23	2.90	2.62 (4)	.173
Catastrophizing	2.57	2.81	2.45	−3.04 (459)	.003	2.35	2.92	2.90	2.99	2.82	6.33 (4)	.005
						Child						
Variable	Total % or $\bar{X}$	Male (n = 255)	Female (n = 228)	$t(df)\|X^2$	p	White (n = 274)	Latinx (n = 89)	Black (n = 43)	Asian (n = 38)	Other (n = 34)	$F(df)\|X^2$	p
PTSS (high)	40.6%	23.4%	17.1%	3.26 (2)	.196	56.0%	19.7%	9.8%	10.9%	3.1%	14.87 (5)	.011
Flood exposure (high)	17.9%	11.3%	6.6%	5.08 (2)	.079	48.3%	21.8%	11.5%	13.8%	3.4%	9.58 (5)	**.088**
Self-blame	1.70	1.78	1.59	−1.85 (468)	.065	1.75	1.62	1.51	2.25	1.71	4.08 (4)	.015
Other-blame	1.97	2.10	1.79	−2.67 (455)	.008	1.91	2.05	1.86	2.80	1.39	6.03 (4)	.005
Rumination	2.38	2.46	2.29	−1.59 (464)	.113	2.35	2.34	2.56	2.93	1.98	3.33 (4)	.055
Catastrophizing	2.39	2.49	2.28	−1.86 (458)	.063	2.33	2.51	2.44	2.99	1.86	4.05 (4)	.015

Note. PTSS is posttraumatic stress symptoms, where 1 = greater PTSS. Flood exposure dichotomized, where 0 = other-exposure and 1 = high-exposure. Larger means indicate greater rates of flood exposure and the use of emotion regulation strategy. Bold p value is no longer significant after FDR significance test. FDR = false discovery rate.

exposure, or any of the maladaptive cognitive emotion regulation strategies; therefore, we do not include it in our models (see Table 2). In support of Hypothesis 1, correlations revealed that all parent and child maladaptive cognitive emotion regulation responses were all positively correlated with each other and with PTSS (see Table 2).

APIMs

Multiple APIM models were specified, and estimates for each were compared (see Table 3). Depending on exposure level, the models support some actor-level or individual-level effects (Hypothesis 2). Specifically, for the other-exposure group (i.e., those who did not experience high exposure to a flood), the actor effects for parents and children were significant for all four emotion regulation strategies. This suggests both parents and children reported more PTSS, with more use of maladaptive emotion regulation strategies. However, this was not true for the high-exposure group, where only some actor effects were significant.

The partner effects, or interdependence within each model, also varied based on the level of exposure. A partner effect for each member of the dyad must be statistically significant to support a hypothesis of interdependence. For the other-exposure group, which represents lower levels of flood exposure, all emotion regulation strategies revealed interdependence between parent and child emotion regulation and PTSS. For the high-exposure group, across all four emotion regulation strategies, there was no evidence for interdependence. However, within the high-exposure group, both parent catastrophizing ($\beta = .90$, $p < .05$) and rumination ($\beta = 1.41$, $p < .01$) had a significant positive relationship with child PTSS, indicating a direct influence. Still, because child emotion regulation did not influence parent PTSS, there was no evidence of interdependence for the high-exposure group.

Table 2
Parent–Child Emotion Regulation Correlation Matrix

Variable	1	2	3	4	5	6
1. Rumination	.57***	.68***	.55***	.60***	.49***	−.02
2. Catastrophizing	.65***	.62***	.68***	.56***	.51***	.03
3. Other-blame	.57***	.70***	.69***	.65***	.47***	−.03
4. Self-blame	.61***	.59***	.74***	.70***	.43***	−.01
5. PTSS	.49***	.62***	.55***	.59***	.54***	−.03
6. Child age	−.03	−.02	−.05	−.01	.01	—

Note. Correlations above the diagonal are parent correlations, below the diagonal are child correlations, and values on the diagonal are the parent and child correlations. PTSS = posttraumatic stress symptoms.
*** $p < .001$.

Table 3
Actor-Partner Interaction Results for Maladaptive Emotion Regulation Strategies on PTSS by Disaster Exposure Level

	Other-exposure (n = 398)					High-exposure (n = 87)					
APIM parameter	β	p	Odds ratio	p	95% CI	β	p	Odds ratio	p	95% CI	Sig. estimated dif.
Self-blame → PTSS											
Parent (actor)	0.45	.001	1.57	**.007**	[0, 2.05]	0.24	.569	1.27	.596	[0.57, 2.81]	No
Child (actor)	0.62	<.001	1.86	**.002**	[0, 2.50]	1.37	**<.001**	3.95	.293	[1.12, 13.88]	No
Parent (partner)	0.41	.001	1.51	.011	[0, 1.95]	0.36	.008	1.43	.531	[0.55, 3.75]	No
Child (partner)	0.51	.002	1.66	**.009**	[0, 2.24]	0.89	.490	2.44	.187	[1.01, 5.59]	No
Other-blame → PTSS											
Parent (actor)	0.55	<.001	1.73	**.001**	[0, 2.22]	0.42	.227	1.52	.508	[0.76, 3.06]	No
Child (actor)	0.53	<.001	1.71	**.001**	[0, 2.18]	0.96	.009	2.60	.175	[1.06, 6.38]	No
Parent (partner)	0.31	<.001	1.37	**.027**	[0, 1.73]	0.34	.139	1.41	.508	[0.59, 3.36]	No
Child (partner)	0.52	.010	1.68	**.002**	[0, 2.16]	0.48	.448	1.62	.260	[0.83, 3.15]	No
Rumination → PTSS											
Parent (actor)	0.86	<.001	2.36	**<.001**	[0, 3.15]	0.63	.055	1.87	.197	[0.92, 3.82]	No
Child (actor)	0.64	<.001	1.89	**<.001**	[0, 2.44]	0.57	.144	1.76	.261	[0.82, 1.77]	No
Parent (partner)	0.73	.002	2.06	**<.001**	[0, 2.74]	1.41	.171	4.08	.097	[1.66, 10.04]	No
Child (partner)	0.40	<.001	1.49	**.009**	[0, 1.92]	0.45	<.001	1.56	.271	[0.82, 2.98]	No
Catastrophizing → PTSS											
Parent (actor)	0.79	<.001	2.19	**<.001**	[0, 3.15]	0.85	.010	2.34	.083	[0, 4.49]	No
Child (actor)	0.74	<.001	2.10	**<.001**	[0, 2.71]	0.50	.141	1.65	.247	[0, 3.25]	No
Parent (partner)	0.55	<.001	1.73	**.002**	[0, 2.28]	0.90	.646	2.45	.102	[0, 5.01]	No
Child (partner)	0.74	<.001	2.10	**<.001**	[0, 2.71]	0.15	.013	1.16	.670	[0, 2.21]	No

Note. All significant values in bold remained significant using FDR significance test. APIM = actor-partner interdependence model; PTSS = posttraumatic stress symptoms; CI = confidence interval; Sig. = significance; dif. = difference; FDR = false discovery rate.

Comparisons of actor and partner effects across exposure level found no significant differences between the high-exposure and other-exposure groups (Hypothesis 3). This was true for all four emotion regulation strategies. Constrained difference tests compared the difference of actor effects and partner effects across the two groups. Although there were different patterns of results between the two exposure levels, the estimated differences between the groups were all nonsignificant: child actor effects (β = .24, p = .51), parent actor effects (β = −.06, p = .87), child partner effects (β = .46, p = .19), and parent partner effects (β = −.34, p = .38). These results suggest that the level of flood exposure did not significantly affect the relationship between parent and child use of maladaptive emotion regulation strategies and subsequent PTSS. Results remained significant after accounting for multiple comparisons using FDR. We discuss the results in detail by specific emotion regulation strategy in the following section.

Self-Blame

Within the other-exposure group, actor and partner effects were present for self-blame for both parent and child PTSS, suggesting interdependence. For both parent and child, more self-blame was associated with a higher probability of above-average PTSS, both within themselves and for their family member. However, for the high-exposure group, there was only an actor effect, specifically child self-blame was significantly associated with their own and their parent's PTSS. Odds ratios were used to help provide an indication of practical significance. Highly disaster-exposed parents with children who engaged in self-blame were 2.44 (95% CI [1.01, 5.59]) times more likely to have above-average PTSS compared to highly disaster-exposed parents with children who did not engage in self-blame, indicating the potential influence of child emotion regulation on parent's PTSS. Similarly, children in the high-exposure group who engaged in self-blame were 3.95 (95% CI [1.12, 13.88]) times more likely to have above-average PTSS as compared to children who did not engage in self-blame. In other words, child use of self-blame influenced their own and their parent's level of PTSS (see Table 3).

Other-Blame

For the other-exposure group, actor effects and partner effects were present for both parent and child PTSS. Parents and children who engaged in more other-blame had a higher likelihood of above-average PTSS themselves, and they influenced the level of PTSS of their family member. However, for the high-exposure group, only child other-blame was significantly associated with child PTSS. No partner effects were significant, and parents use of other-blame as an emotion regulation strategy did not influence their PTSS in the high-exposure sample. However, the odds ratios revealed that the highly disaster-exposed children with a parent who engaged in other-blame were 1.41 times (95% CI [0.59, 3.36]) more likely to have above-average PTSS compared to highly disaster-exposed children with a parent who did not engage in other-blame. Similarly, highly disaster-exposed children who engaged in other-blame were 2.60 (95% CI [1.06, 6.38]) times more likely to have above-average PTSS as compared to children who did not engage in other-blame (see Table 3).

Rumination

For the other-exposure group, actor effects and partner effects were present for both parent and child PTSS. Parents and children who engaged in more rumination had higher rates of PTSS themselves, and they influenced the level of PTSS of their family member. However, a different pattern was found in the high-exposure group.

For the high-exposure group, only parent rumination significantly related to a higher probability of above-average child PTSS, suggesting that only parent partner effects are evident. No child partner effects were significant, and no actor effects were significant. Odds ratios revealed that the highly disaster-exposed children who had a parent who engaged in rumination were 4.08 (95% CI [1.66, 10.04]) times more likely to have above-average PTSS as compared to highly disaster-exposed children with a parent who did not ruminate. Similarly, highly disaster-exposed parents with children who engaged in rumination were only slightly more likely to have above-average PTSS, 1.56 (95% CI [0.82, 2.98]) compared to parents who did not engage in rumination (see Table 3).

Catastrophizing

For the other-exposure group, actor effects and partner effects were present for both parent and child PTSS. Parents and children that engaged in more catastrophizing demonstrated high levels of PTSS for themselves, and they influenced the level of PTSS of their family member. For the high-exposure group, only parent catastrophizing significantly related to child and parent PTSS, suggesting that only parent actor and partner effects were present. The odds ratios revealed that the highly disaster-exposed children with a parent who engaged in catastrophizing were only slightly more likely to have above-average PTSS, 2.45 (95% CI [0, 5.01]), compared to highly disaster-exposed children with a parent who did not catastrophize. Similarly, highly disaster-exposed parents were slightly more likely to have above-average PTSS 2.34 (95% CI [0, 4.49]) if they themselves engaged in catastrophizing as compared to those who did not engage in catastrophizing (see Table 3).

Discussion

Children born in 2020 are expected to experience a two- to seven-fold increase in extreme weather events compared to the generation born in 1960 (Thiery et al., 2021). As natural disasters continue to increase in frequency and magnitude (Beaglehole et al., 2018), it is imperative to understand how to support healthy family adaptation postdisaster. By examining the interdependence of potentially maladaptive emotion regulation strategies within families, we can improve our understanding of family adaptation postdisaster and prioritize implementation of interventions that target the mechanisms that lead to poor outcomes. Using APIM, we examined parent and child use of maladaptive emotion regulation strategies and how they related to PTSS within themselves and each other. APIM allows our research to move beyond the individual experience and, thus, uncovers more about how parents and children may influence one another. Although other disaster studies have used APIM, they have examined the interdependence of parent and child PTSS; research has yet to explore a potential mechanism of this process. Further, most emotion regulation research is within the context of personal assault, childhood maltreatment, or combat trauma, and less is available in the disaster context, which is an acute stressor with potential long-term consequences.

Consistent with existing research (Bariola et al., 2012; Bokszczanin, 2008), our correlational analysis found a significant relationship between parent and child use of maladaptive emotion regulation strategies and that this was related to PTSS for both parents and children. This is consistent with research by Terranova et al. (2009), who found a positive correlation between maladaptive emotion regulation and PTSS among adolescents following Hurricane Katrina. However, they did not examine how parents' emotion regulation influences their children's PTSS, whereas our study found that parent and child use of maladaptive cognitive emotion regulation strategies were highly correlated with one another.

Although we did not model by demographics due to power, we explored demographic differences in preliminary analyses and found fathers reported greater levels of PTSS, while more mothers reported greater flood exposure. Furthermore, FDR significance test revealed significant differences in self-blame across ethnic groups. Specifically, Latinx, Black, Asian, and other parents engaged in more self-blame as compared to White parents. Other-blame, rumination, and catastrophizing were not significantly different across ethnic groups. Additionally, parent income and level of disaster exposure did not influence PTSS reports.

Interdependence Between Parents and Children

Consistent with existing APIM disaster models, our study found interdependence within families after experiencing a natural disaster. Prior research has focused on the interdependence of parent and child postdisaster distress (Hausman et al., 2020; Juth et al., 2015). Our study contributes novel findings by demonstrating emotion regulation interdependence within families at lower levels of disaster exposure and how this interdependence influences PTSS. Findings reported here suggest that parent emotion regulation positively relates to child PTSS, and child PTSS positively relates to parent PTSS for families who had lower levels of disaster exposure.

Contrary to our hypothesis, however, we did not find support for interdependence in the high-exposure group. Instead, we found that individuals' own use of maladaptive emotion regulation strategies predicted their own PTSS and, at times, the other family member's PTSS. But both parties did not mutually influence each other in this high disaster exposure group. It could be that, at high levels of disaster exposure, emotion regulation strategies may have a less consistent relationship to PTSS, as the emotions may feel overwhelming as the survivor grieves losses. At high levels of exposure, the focus might be on managing the immediate threat at hand. Qualitative research suggests that parents and children report reevaluating life goals and priorities as well as establishing new routines in the aftermath of a disaster (Botey & Kulig, 2014). These new priorities may affect their use of emotion regulation strategies. At lower levels of exposure, the use of maladaptive emotion regulation strategies may have a stronger relation to the other family members' distress due to coruminating or focusing on blame. This finding is preliminary but furthers our understanding of the family recovery context.

There is also a methodological consideration about this finding. In most disasters, only a minority of people in a region experience high levels of disaster exposure. Thus, our high-exposure group had a small sample size and, subsequently, a larger standard error in the analysis. Based on our prior research, we focused on the high-exposure group because that is where we saw a significant increase in levels of PTSS compared to all other-exposure groups and that there were certain critical items that distinguished their experiences from other groups who also went through the disaster in their region (Felix et al., 2019). Even with a small sample size, we did find that for highly disaster-exposed parents, their use of some maladaptive

emotion regulation strategies influenced their own PTSS, and depending on the type of emotion regulation, parents also influenced their child's PTSS. This is similar for the highly disaster-exposed children, where some emotion regulation strategies significantly influence their own PTSS and parent PTSS, whereas other emotion regulation strategies did not. Specifically, odds ratios indicated that parent use of rumination, other-blame, and catastrophizing was related to child PTSS, and child use of rumination and self-blame was related to parent PTSS. This is consistent with findings that parent emotion regulation influences children after disaster (Pat-Horenczyk et al., 2015). Our study expands on this by demonstrating that child emotion regulation also influences parents' mental health outcomes.

Each emotion regulation strategy also provided unique information. Our study supports prior research that found that for highly disaster-exposed families, parent rumination positively influenced child PTSS (Ehlers & Clark, 2000) and extends this research by finding that at lower levels of exposure, parent and child rumination reciprocally influenced one another's PTSS. Moreover, our results are consistent with research indicating that self-blame is related to increased risk of PTSS (Drury & Williams, 2012), and our study contributes specific details about self-blame between parents and children. Specifically, for families with lower levels of flood exposure, parents' and children's use of self-blame influences the other's PTSS. For the high-exposure group, child self-blame was associated with greater child PTSS. Other-blame has been found to be an ineffective emotion regulation strategy employed after tornadoes (Lack & Sullivan, 2007), and the present study demonstrates that other-blame is related to increased PTSS within the context of floods. For highly disaster-exposed families, children engaging in other-blame reported more PTSS. Finally, our study found that, at high exposure, parents' use of catastrophizing was associated with their PTSS and their child's PTSS. At the other-exposure level, parent and child use of catastrophizing influences their own PTSS as well as the other's PTSS. This is consistent with findings that adolescents who engage in catastrophizing have greater PTSS (Heleniak et al., 2016) and adds detail about the contributions of parents' catastrophizing to adolescent PTSS.

Strengths, Limitations, and Future Directions

There has been a call for research investigating the bidirectional patterns of influence in families postdisaster (Cobham et al., 2016). The present study is one of the first to directly examine the interdependence of potentially maladaptive emotion regulation strategies between parents and children postdisaster using APIM. Our study's analytical approach provides novel contributions to disaster mental health research because it explores mutual influence instead of direct effects alone. We also expand the use of APIM in disaster research. Prior disaster research using APIM explored parent and child reciprocal mental health postdisaster but has not included elements like emotion regulation that contribute to postdisaster mental health. This study has a large sample size of 485 dyads, allowing the opportunity for this type of data analysis. Additionally, our study examined the influence of the level of disaster exposure since it is related to psychosocial outcomes for survivors of natural disasters (Weems et al., 2016). We found differences by exposure level, but they should be further studied given our sample size for the high-exposure group.

This study has limitations that can guide potential future research. The same cross-sectional sample was used for analysis of each emotion regulation strategy. Even though this aligns with APIM, ideally for structural equation modeling, future studies should include a larger sample of high-exposure families to avoid sample reuse. Consistent with structural equation modeling and ordinary logistic regression rule of thumb, there should be 10 cases for every variable to obtain validity of findings (Cook & Kenny, 2005). As family dynamics may change over the long-term recovery period, longitudinal research would better elucidate the nature and direction of changes.

Additionally, future studies could benefit from exploring more diverse samples. The present study includes primarily White mothers, and these results may differ across ethnicity and sex of parent. Unfortunately, our sample size for the high-exposure group did not allow for a comparison of cross-sex and same-sex parent–child dyads on the influence of emotion regulation on PTSS. Future studies should address this, given the complex relationship of gender with use of emotion regulation strategies and subsequent mental health (Nolen-Hoeksema, 2012). Our study focused on maladaptive emotion regulation strategies, but future directions for parent–child disaster research should also explore adaptive emotion regulation strategies to continue promoting our understanding of how families process disasters together. In addition, mental health outcomes beyond PTSS should be explored, as the emotion regulation strategies may have different relationships to anxiety, depression, or externalizing outcomes, all of which have been linked to disaster exposure in prior work (Rubens et al., 2018). Research should also continue to utilize the APIM analytic strategy to uncover additional ways family members respond to disasters interdependently with these additional mental health outcomes. Despite these limitations, the present study provides evidence of the interdependence of emotion regulation and mental health outcomes between parents and children following a natural disaster.

The present study also contributes to clinical implications. Although many postdisaster mental health services tend to be focused on the individual survivor, our findings suggest that it would be helpful to focus attention and support on the family unit. Findings suggest that family-based interventions focused on healthy emotion management may be helpful in supporting healthy adaptations for children and parents alike. Asking about the whole family and how each member is adapting can help clinicians get a better picture of how to support survivors' mental health postdisaster. If one member of the family is struggling and using many maladaptive emotion regulation strategies, our results suggest that it can influence the PTSS of other family members. Even when disaster exposure was lower, this mattered.

Thankfully, in recent years, there has been the adaptation of evidence-based parenting programs for the disaster setting, such as the Triple P Parenting program being modified to Disaster Recovery Triple P (Cobham et al., 2016) and the Child–Adult Relationship Enhancement (CARE) early intervention used with foster families (Messer et al., 2018) modified for use in postdisaster settings as "Respond with CARE." Trainings for disaster-affected communities in the United States are available through the National Child Traumatic Stress Network. These are promising steps toward holistic support of families postdisaster. As early interventions, Respond with CARE and Disaster Recovery Triple P can help build the qualities in disaster-affected families that can lead to individual

and family resilience postdisaster. The challenge is in getting training in these interventions disseminated among mental health professionals in disaster affected communities. The present study suggests that dissemination can be beneficial for many families postdisaster, as adaptation postdisaster is a collective and reciprocal process, and emotion regulation within the family unit plays an important role.

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Received August 23, 2023
Revision received May 11, 2024
Accepted May 14, 2024 ■