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A Life-Course Model of Trauma Exposure and Mental Health Among Low-Income Survivors of Hurricane Katrina

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Prior research has provided robust evidence that exposure to potentially traumatic events (PTEs) during a disaster is predictive of adverse postdisaster mental health outcomes, including posttraumatic stress symptoms (PTSS) and nonspecific psychological distress (PD). However, few studies have explored the role of exposure to other PTEs over the life-course in shaping postdisaster mental health. Based on the broader literature on trauma exposure and mental health, we hypothesized a path analytic model linking predisaster PTEs to long-term postdisaster PTSS and PD via predisaster PD, short-term postdisaster symptoms, and disaster-related and postdisaster PTEs. We tested this model using data from the Resilience in Survivors of Katrina study, a longitudinal study of low-income, primarily non-Hispanic Black mothers exposed to Hurricane Katrina and assessed before the disaster and at time points 1, 4, and 12 years thereafter. The models evidenced a good fit with the data, RMSEA $< .01$–$.04$, CFIs $> .99$. In addition, 44.1%–67.4% of the effect of predisaster PTEs on long-term postdisaster symptoms was indirect. Descriptive differences were observed across models that included PTSS versus PD, as well as models that included all pre- and postdisaster PTEs versus only those that involved assaultive violence. The results suggest the importance of incorporating disaster preparedness in clinical work with trauma survivors and the value in attending to other lifetime PTEs when working in postdisaster contexts.

Exposure to natural and human-made disasters has been associated with a range of adverse mental health outcomes, including posttraumatic stress symptoms (PTSS) and nonspecific psychological distress (PD; Goldmann & Galea, 2014). The mental health impact of disasters is not distributed equally, with female gender, low household income, and racial and ethnic minority status shown to be associated with increased vulnerability (Goldmann & Galea, 2014). Research has demonstrated that disparities in the mental health impact of disasters are due in part to elevated exposure among at-risk groups to disaster-related potentially traumatic experiences (PTEs), including both objective indicators, such as disrupted access to life-sustaining resources, and subjective indicators, such as perceived or actual life threat (e.g., Davidson et al., 2013; Perilla et al., 2002). Yet, a focus on experiences that occur during a disaster and its immediate aftermath fails to capture other exposures over the life-course that could increase an individual's risk for postdisaster mental health problems. Epidemiologic studies have shown that the vast majority of people will experience at least one PTE in their lifetime (e.g., Kessler et al., 2017), with adults in urban settings reporting lifetime exposure to an average of approximately five types of PTEs (e.g., Horesh et al., 2014). Evidence shows that PTEs have a cumulative influence on mental health such that increased PTE exposure has been linked to higher levels of psychiatric symptoms (e.g., Karam et al., 2014). It is perhaps not surprising, then, that exposure to a higher number of pre- and postdisaster PTEs has been linked to poorer postdisaster mental health, including disaster-related PTSS (e.g., Adams et al., 2014; Galea et al., 2008).

Further evidence suggests that PTEs over the life-course are often not independent of each other but rather that prior PTE exposure is associated with an increased risk for further PTE exposure (Benjet et al., 2016; Conley et al., 2017). A few extant studies have suggested that prior PTE exposure is specifically

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associated with elevated disaster-related exposure. For example, in a study of adults affected by a series of hurricanes that hit Florida, in the southeastern United States, in 2004, Ruggiero and colleagues (2009) found that individuals who reported prior trauma exposure were more likely to report extreme fear—an indicator of subjective exposure and potentially a proxy for more objective exposure—during the hurricanes. Another study of school-aged children in New Orleans, Louisiana, found that a higher level of exposure to Hurricane Katrina in 2005 was significantly associated with higher reported exposure to Hurricane Gustav, which struck the same area 3 years later, as well as with increased lifetime community violence exposure (Salloum et al., 2011). Other findings have suggested that exposure to disaster-related trauma is associated with an increased risk for subsequent PTE exposure. For example, studies have linked disaster-related trauma exposure to a subsequent risk for intimate partner violence (Harville et al., 2011; Weitzman & Behrman, 2016).

Links between exposure to different PTEs over the life-course are likely due in part to shared risk factors, such as low socioeconomic status. Additionally, per Hobfoll's (1989) "conservation of resources" theory, PTE exposure can enhance vulnerability by leading to losses in social, economic, and psychological resources. Further augmented risk could be due to the psychiatric symptoms that stem from both PTE exposure and posttrauma resource loss (Hobfoll, 1989). For example, PTSS have been theorized to increase subsequent PTE risk by undermining survivors' ability to accurately detect threats in the environment and impeding adaptive coping (Marx et al., 2005; Messman-Moore & Long, 2003). Although few studies have investigated this pathway in a disaster context, extant research suggests that predisaster psychiatric symptoms are associated with a higher level of disaster-related exposure (Lowe et al., 2013) and that psychiatric symptoms in the immediate postdisaster period are associated with exposure to more postdisaster stressful life events (Jin et al., 2018; Lowe et al., 2013).

Although research and theory to date have suggested that cycles of PTE exposure and mental health symptoms might occur for a range of PTEs—even those, like disasters, that are often conceptualized as independent or fateful—it is nonetheless important to consider how these associations might differ by PTE type. Prior research implicates the involvement of assaultive violence as a key distinguishing factor. For example, previous studies have found that assaultive PTEs, including intimate partner violence and sexual assault, are more strongly associated with increased risk for subsequent trauma exposure as well as more severe and persistent psychiatric symptoms relative to other PTE types (e.g., Benjet et al., 2016; Kessler et al., 2017). Likewise, PTSS have been more consistently linked to subsequent PTEs involving assaultive violence, although some studies suggest that PTSS increase the risk for other types of PTEs as well (Lowe et al., 2014; Lusk et al., 2017).

In the current study, we sought to put exposure to a major disaster—Hurricane Katrina—into a life-course perspective by assessing the role of predisaster, disaster-related, and postdisaster PTEs in shaping long-term postdisaster mental health symptoms. Participants were low-income mothers, mostly non-Hispanic Black and unmarried, who provided data in the short- and long-term aftermath of the hurricane. Based on prior research, we hypothesized a model as shown in Figure 1. In the model, exposure to predisaster PTEs is linked to long-term postdisaster symptoms both directly and indirectly via disaster-related and postdisaster PTEs, as well as higher levels of predisaster and short-term postdisaster PTSS. Similarly, the model links disaster-related PTEs to long-term postdisaster PTSS both directly and indirectly via an increased risk for postdisaster PTE exposure and short-term postdisaster PTSS. We also included paths from PTSS to subsequent PTE exposure and from PTSS at earlier time points to PTSS at later time points. We examined this model for both nonspecific PD and PTSS, which were assessed in reference to the hurricane. Further, we ran models that included a range of pre- and postdisaster PTEs as well as assaultive PTEs specifically. To our knowledge, this was the first study to investigate the impact of both pre- and postdisaster PTE exposure on postdisaster mental health via a path analytic model.

Method

Participants and Procedure

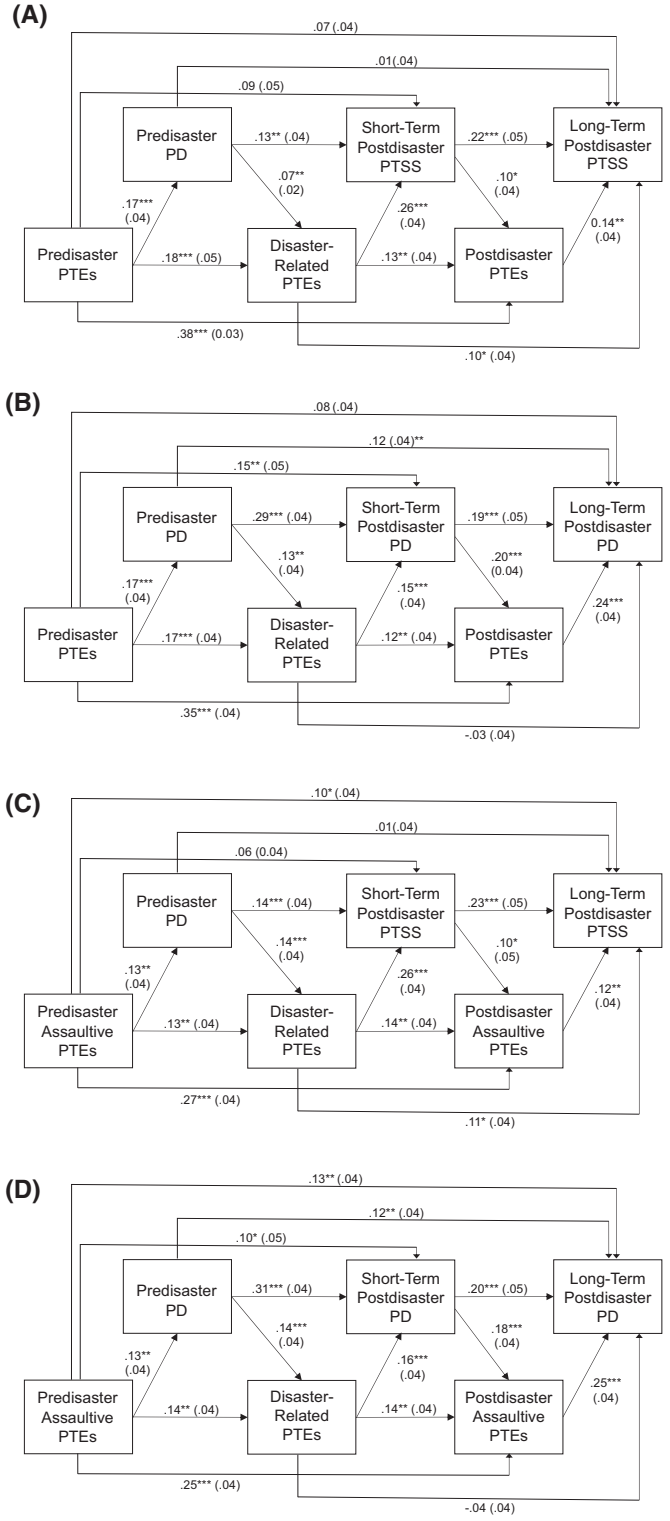
Data for the current study were taken from the Resilience in Survivors of Katrina (RISK) project. The RISK study began in 2003–2004 and was originally part of Opening Doors, a randomized control trial at two community colleges in the New Orleans area. To be eligible for the Opening Doors study, individuals had to be a community college student, a parent, between the 18 and 34 years of age, and earning less than 200% of the poverty level. At Wave 1 (W1; 2003–2005; i.e., predisaster), the study enrolled 1,019 community college students, 942 (92.4%) of whom were women. The W1 sample comprised predominantly single, non-Hispanic Black mothers; on average, participants' monthly income was $993.21 (USD; $SD = \$536.46$).

The Opening Doors study was interrupted by Hurricane Katrina, which made landfall on the U.S. Gulf Coast on August 29, 2005, and led to nearly 2,000 deaths and an estimated $81,000,000,000 (USD) in damages (Knabb et al., 2005). Data from Wave 2 (W2), Wave 3 (W3), and Wave 4 (W4) were collected after Hurricane Katrina in 2005–2006, 2009–2010, and 2016–2018, respectively. In the current study, these waves were conceptualized as the short-term, medium-term, and long-term aftermath of Katrina, respectively. Wave 1 consisted of a paper-and-pencil survey, W2 and W3 consisted of telephone surveys, and W4 was of a mix of telephone and online surveys.

Of the 942 women from the W1 sample, 667 (70.8%) participated in W2, 714 (75.8%) in W3, and 715 (75.9%) in W4. In total, 885 women (93.9%) participated in at least one postdisaster survey and 473 (50.2%) participated in all three postdisaster surveys. The current study included women who provided complete demographic data at baseline and completed at least one

Figure 1

Results of Path Analytic Models Including (A) All Potentially Traumatic Events (PTEs) and Posttraumatic Stress Symptoms (PTSS), (B) All PTEs and Psychological Distress (PD), (C) Assaultive PTEs and PTSS, and (D) Assaultive PTEs and PD.



Note. $N = 821$ for all models. Standardized coefficients are listed.
* $p < .05$. ** $p < .01$. *** $p < .001$.

postdisaster assessment. Of the 942 women in the W1 sample, 821 (87.2%) met these criteria. Participants provided written consent at W1 and oral consent at Waves 2–4. The institutional review board of Princeton University approved this study. Additional detail about the RISK study methodology can be found elsewhere (Waters, 2016).

Each wave included an assessment of PD, and Waves 2–4 included an assessment of PTSS. Disaster-related PTE exposure was assessed at W2 or, for those who did not participate in W2, at W3. Pre- and postdisaster PTE exposure were assessed at W4, and participants indicated whether they experienced PTEs before, after, or both before and after Hurricane Katrina. For our analysis, postdisaster PTEs were assumed to have occurred between the short- and long-term aftermath of Katrina (i.e., between W2 and W4), with short-term postdisaster PD and PTSS predicting postdisaster PTE exposure, and postdisaster PTE exposure predicting long-term postdisaster PD and PTSS. Wave 3 (i.e., medium-term postdisaster) assessments of PD and PTSS were thus excluded from the present analysis; the only W3 data included were disaster-related PTE exposure for participants in the analytic sample who did not complete the W2 survey ($n =$ 138, 16.8%). The number of disaster-related PTEs reported did not significantly differ between participants who provided data at W2 versus W3, $t(704) = -0.36$, $p = .721$.

Measures

Pre- and Postdisaster PTEs

We used an adapted version of the Life Events Checklist (LEC; Blake et al., 1995) to assess pre- and postdisaster exposure to PTEs. Participants answered "yes" or "no" regarding whether they had experienced each of 14 PTEs in their lifetime. Individuals who answered affirmatively were then asked whether they had experienced the event before, after, or both before and after Hurricane Katrina. For each PTE, two binary variables (yes = 1, no = 0) were then created, one indicating whether the participant had experienced the PTE predisaster and the other indicating whether the participant had experienced the PTE postdisaster. Responses were summed to create indices of pre- and postdisaster PTE exposure. Additionally, following prior research (e.g., Lowe et al., 2014), we selected the five PTEs that definitively involved personal experiences of assaultive violence (e.g., being robbed or mugged; rape or sexual assault) and created counts of pre- and postdisaster assaultive PTEs only. Any PTE that may or may not have entailed assaultive violence (e.g., being in combat or a war zone) or may have entailed witnessing assaultive violence to others rather than personally being the victim of an assault (e.g., mass violence) was excluded. The LEC has previously demonstrated adequate psychometric properties, including temporal stability and convergent validity (Gray et al., 2004).

Disaster-Related PTEs

Following a prior study of Hurricane Katrina surveys (Brodie et al., 2006), we used an eight-item scale to assess

disaster-related PTEs. Participants responded "yes" or "no" regarding whether they experienced any of the following during Hurricane Katrina and the week that followed: (a) lacked enough fresh water to drink, (b) lacked enough food to eat, (c) felt one's life was in danger, (d) lacked necessary medicine, (e) lacked necessary medical care, (f) family member lacked necessary medical care, (g) lacked knowledge of the safety of children, or (h) lacked knowledge about the safety of other family members. A sum of affirmative responses was included in the analysis.

Psychological Distress

To assess PD, we utilized the six-item K6 scale (Kessler et al. 2002). Respondents indicated how often in the past 30 days they experienced feelings related to six indicators of PD, such as "hopeless" and "worthless," rating items on a scale of 0 (*none of the time*) to 4 (*all of the time*). Responses were summed to yield a scale ranging from 0 to 24. A previous validation study found that scale scores of 8–12 are indicative of probable mild-to-moderate mental illness (MMI), and scale scores of 13–24 are indicative of probable serious mental illness (SMI; Kessler et al., 2003). The K6 has been used in prior studies of disaster survivors (e.g., Galea et al., 2007), and scale scores have demonstrated strong psychometric properties (e.g., Furukawa et al., 2003). In the present study, the Cronbach's alpha value for internal consistency ranged from .76 to .85.

PTSS

To measure PTSS, we used the Impact of Event Revised (IES-R; Weiss & Marmar, 1997), a 22-item scale that assesses distress related to a specific traumatic event. Scores on the IES-R have demonstrated strong psychometric properties (Creamer et al., 2003). Respondents were asked to rate the degree to which they were bothered or distressed by hurricane-related difficulties (e.g., "any reminder brought back feelings about it," "had trouble staying asleep") during the past 7 days, rating items on a scale of 0 (*not at all*) to 4 (*extremely*). Scale scores are computed as the mean of all items, and scores above 1.5 are indicative of probable PTSD (Creamer et al., 2003). In the current sample, Cronbach's alpha values ranged from .94 to .99.

Demographic Covariates

We included four demographic covariates, each of which was assessed at W1. The covariates included were (a) age (in years), (b) a binary variable for whether the participant identified as African American or Black, (3) a binary variable for whether the participant was married or cohabiting with a partner, and (4) a count of public benefits received (i.e., unemployment, social security income, welfare, and/or food stamps), scored as 0–4. These covariates were included based on prior research showing their associations with postdisaster mental health (Goldmann & Galea, 2014).

Data Analysis

Data analysis consisted of three steps. First, we ran a series of preliminary analyses. Descriptive statistics, including means and standard deviations for continuous variables, and frequencies for categorical variables, were computed using the raw data. As a missing data analysis, independent-samples *t* tests and chi-square tests were used to examine differences between the 821 participants in the analytic sample and the 121 participants who were dropped due to either incomplete demographic data or nonresponse at all three postdisaster waves. A correlation matrix was then computed for key variables in the hypothesized models.

Second, path analysis was used to test the hypothesized models. Cutoffs for acceptable model fit were set at less than .05 for root mean square error of approximation (RMSEA) and greater than .95 for the comparative fit index (CFI; Hu & Bentler, 1999). The Tucker–Lewis Index (TLI), standardized root mean square residual (SRMR), and chi-square test of model fit were also inspected, as were estimates, standard errors, and significance values for hypothesized paths; standardized estimates are provided. Third, all indirect effects from predisaster PTEs to long-term postdisaster symptoms via other variables in the hypothesized model were tested; we also tested the total effect of predisaster PTEs on long-term postdisaster symptoms. Indirect effects were computed as the product of the direct paths comprising them. For example, the indirect path from predisaster PTEs to long-term postdisaster symptoms via postdisaster PTEs was computed as the product of the direct path from predisaster PTEs to postdisaster PTEs, and the direct path from postdisaster PTEs to long-term postdisaster symptoms. Total indirect effects on long-term postdisaster symptoms via intervening variables were computed as the sum of all indirect paths with the direct path from predisaster trauma to each intervening variable. For example, the total indirect path via short-term postdisaster symptoms was computed as the sum of the following indirect paths: (a) predisaster PTEs → short-term postdisaster symptoms → long-term postdisaster symptoms; and (b) predisaster PTEs → short-term postdisaster symptoms → postdisaster trauma → long-term postdisaster symptoms. Standardized estimates were unavailable, and, thus, unstandardized estimates are presented in the results. Direct, indirect, and total effects and their 95% confidence intervals were estimated using 5,000 bootstrapped samples, and 95% CIs that did not contain zero were considered statistically significant (Preacher & Hayes, 2008). Models were run for all pre- and postdisaster PTEs as well as for pre- and postdisaster assaultive PTEs only. Demographic covariates were included as predictors of all other variables in each model. Data were managed and descriptive analyses were conducted in SPSS (Version 25.0; IBM Corp., 2017), and all other analyses were conducted in Mplus (Version 8.0; Múthen & Múthen, 1998–2017). Missing data in the correlation and path analyses were handled using full maximum likelihood in M*plus*.

Table 1
Descriptive Statistics for All Variables in Analysis

	M	*SD*	%	*n*	Participants reporting (*n*)
Baseline demographic characteristics					
Age (years)	25.22	4.45			821
Black race			86.0	706	821
Number of children	1.81	1.00			821
Married or cohabiting			23.4	192	821
Number of benefits	0.93	0.71			821
Predisaster PD	4.93	4.14			785
Short-term postdisaster PTSS	1.47	0.98			625
Short-term postdisaster PD	6.39	4.99			621
Long-term postdisaster PTSS	0.72	0.91			662
Long-term postdisaster PD	5.75	5.02			657
Disaster-related PTEs	2.97	2.30			706
Lifetime PTE exposure					
All predisaster PTEs	1.69	2.00			660
Predisaster assaultive PTEs	0.82	1.12			660
All postdisaster PTEs	2.19	1.80			660
Postdisaster assaultive PTEs	0.40	0.72			660

Note. Descriptive statistics computed with raw data for analytic sample ($N = 821$). PD = psychological distress; PTE = potentially traumatic event; PTSS = posttraumatic stress symptoms.

Results

Preliminary Analyses

Table 1 lists descriptive data for the 821 participants in the analytic sample. As shown, the average participant age was 25.22 years ($SD = 4.45$) at baseline. Most participants (86.0%) identified as African American or Black, and 10.0% identified as White, 2.3% as Hispanic, and 1.7% as another race or ethnicity. Participants reported an average of 1.69 ($SD = 2.00$) predisaster PTEs, 2.97 ($SD = 2.30$) disaster-related PTEs, and 2.19 ($SD = 1.80$) postdisaster PTEs. Based on their K6 and IES-R scores, 18.1% of participants had probable MMI and 5.4% had probable SMI at the predisaster assessment; 22.2% had probable MMI, 12.6% had probable SMI, and 46.9% had probable PTSD at the short-term postdisaster assessment; and 18.6% had probable MMI, 11.0% had probable SMI, and 20.2% had probable PTSD at the long-term postdisaster assessment. Table 2 shows the frequency of each pre- and postdisaster PTE. The most commonly reported predisaster PTEs were the sudden death of someone close (30.5%), rape or sexual assault (22.6%), and being physically hurt by a spouse or partner (21.2%). The most commonly reported postdisaster PTEs were the sudden death of someone close (64.6%), illness or injury of someone close (46.9%), and witnessing someone being injured or killed (23.4%). In the missing data analysis, participants who were dropped due to incomplete demographic information reported significantly more disaster-related PTEs than their counterparts, $t(753) = 1.98$, $p = .049$. All other differences were nonsignificant. As shown in Table 3, all correlations among variables in the path analytic models reached statistical significance.

Path Analysis

Models Including All Pre- and Postdisaster PTEs

The results of the path model that included all pre- and postdisaster PTEs and PTSS as the postdisaster mental health outcome are shown in Figure 1 (Panel A). The model demonstrated good fit with the data, RMSEA = .03, CFI > .99, TLI = .92, SRMR = .01, $\chi^2(1, N = 821) = 1.78$, $p = .182$. All hypothesized paths reached statistical significance except for the path from predisaster PTEs to short-term postdisaster PTSS, the path from predisaster PTEs to long-term postdisaster PTSS, and the path from predisaster PD to long-term postdisaster PTSS. Figure 1 (Panel B) shows the results of the same model but with PD as the postdisaster mental health outcome. This model also had good fit with the data, RMSEA < .01, CFI > .99, TLI = 1.09, SRMR < .01, $\chi^2(1, N = 821) < 0.01$, $p = .949$, and patterns of significance were the same as the model with PTSS, with one exception: The path from predisaster PTEs to short-term postdisaster PD reached statistical significance in the expected direction.

Models Including Pre- and Postdisaster Assaultive PTEs Only

The results of the path models with pre- and postdisaster assaultive PTEs only are shown in Figure 1 (Panel C for PTSS,

Table 2
Number and Percentage of Participants Reporting Pre- and Postdisaster Potentially Traumatic Events

Event type	Predisaster			Postdisaster		
	%	*n*	Participants reporting (*N*)	%	*n*	Participants reporting (*N*)
Assaultive events						
Robbed or mugged	12.3	81	659	11.7	77	659
Physically hurt by parent or caregiver	16.2	106	656	0.8	5	656
Physically hurt by spouse or partner	21.2	141	659	18.4	121	659
Physically hurt by someone else	10.2	67	658	6.1	40	658
Rape or sexual assault	22.6	147	650	3.5	23	650
Other events						
Technological disaster	0.9	6	660	13.5	89	660
Mass violence	1.8	12	660	2.6	17	660
Combat or war zone	2.0	13	658	0.8	5	658
Illness or injury of someone close	18.4	121	659	46.9	309	659
Sudden death of someone close	30.5	200	656	64.6	424	656
Sudden death of child	4.0	26	655	5.0	33	655
Witnessed someone being injured or killed	20.5	135	658	23.4	154	658
Life-threatening illness	3.0	20	658	8.8	58	658
Other	6.7	44	659	13.7	90	659

Note. Descriptive data were computed with raw data for analytic sample ($N = 821$). Pre- and postdisaster potentially traumatic event exposures were reported at Wave 4, approximately 12 years after Hurricane Katrina.

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Table 3
Correlation Matrix for Key Variables in Path Analytic Models

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Predisaster trauma—all events	–	.84***	.17***	.18***	.16***	.24***	.42***	.27***	.18***	.24***
2. Predisaster trauma—assaultive events		–	.13***	.15***	.13***	.18***	.38***	.29***	.18***	.25***
3. Predisaster psychological distress			–	.14***	.17***	.34***	.15***	.14***	.09**	.24***
4. Disaster-related trauma exposure				–	.32***	.23***	.22***	.19***	.24***	.10**
5. Short-term postdisaster PTSS					–	.49***	.19***	.14***	.32***	.18***
6. Short-term postdisaster PD						–	.30***	.25***	.23***	.32***
7. Postdisaster trauma—all events							–	.66***	.23***	.35***
8. Postdisaster trauma—assaultive events								–	.19***	.35***
9. Long-term postdisaster PTSS									–	.40***
10. Long-term postdisaster PD										–

Note. $N = 821$. PD = psychological distress; PTE = potentially traumatic event; PTSS = posttraumatic stress symptoms.
**$p < .01$. ***$p < .001$

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Panel D for PD). These models also showed good fit with the data, RMSEA = .04, CFI > .99, TLI = .84, SRMR = .01, $\chi^2(1, N = 821) = 2.28$, $p = .131$ for PTSS; RMSEA < .01, CFI > .99, TLI = 1.09, SRMR < .01, $\chi^2(1, N = 821) = 0.12$, $p = .897$ for PD. Unlike in the models that included all PTEs, the paths from predisaster assaultive PTEs to short-term postdisaster PD as well as to long-term postdisaster PTSS and PD reached statistical significance in the expected direction. We also noted that the magnitude of effects from assaultive PTEs to postdisaster symptoms was stronger than those for all PTEs to postdisaster symptoms. For example, in reviewing unstandardized estimates (see Supplementary Figure 1), we noted that each additional postdisaster assaultive PTE was associated with an increase of 0.08 in long-term postdisaster PTSS and 0.57 in long-term postdisaster PD, compared to an increase of 0.03 in long-term postdisaster PTSS and 0.19 for long-term postdisaster PD for any postdisaster PTE after controlling for other variables in the models.

Analysis of Indirect Effects

Table4 shows the unstandardized estimates and 95% confidence intervals for indirect, direct, and total effects from predisaster PTEs to long-term postdisaster PD and PTSS. The total effect from predisaster PTEs to long-term postdisaster symptoms was positive and statistically significant in each of the models. In addition, positive and statistically significant indirect effects via disaster-related PTEs and postdisaster PTEs were observed for all models. Indirect paths via predisaster PD and short-term postdisaster symptoms were significant for the PD models only. In total, 63.4% of the total effect of all predisaster PTEs on long-term postdisaster PTSS was indirect, 44.1% of the total effect of predisaster assaultive PTEs on long-term postdisaster PTSS was indirect, 67.4% of the total effect of all PTEs events on PD was indirect, and 48.1% of the total effect of predisaster assaultive PTEs on long-term postdisaster PD was indirect.

Discussion

There were three key findings from the present study, which tested a life-course model of PTE exposure and mental health among a sample of low-income mothers, primarily of non-Hispanic Black race/ethnicity, who experienced Hurricane Katrina. First, the model, which linked predisaster PTE exposure to long-term postdisaster PD and PTSS via predisaster PD, disaster-related PTE exposure, short-term postdisaster symptoms, and postdisaster PTE exposure, evidenced good fit with the data, with most paths reaching statistical significance in the expected direction. An analysis of the effect of predisaster PTEs on long-term postdisaster symptoms showed that a substantial proportion of the sample (range: 44.1%–67.4% across the models) was indirect through other variables. Second, descriptive differences were observed across the models that contained PD versus PTSS as the primary outcome. Specifically, predisaster PTEs were associated with short-term postdisaster PD and had an indirect effect on long-term postdisaster PD via short-term postdisaster PD, whereas these paths were nonsignificant in the models that included PTSS. Third, descriptive differences were also observed in models that contained all pre- and postdisaster PTEs as compared to only those that involved assaultive violence. In this case, direct paths from predisaster PTEs to long-term postdisaster PD and PTSS were larger in magnitude for assaultive PTEs than for all PTEs and only reached statistical significance for assaultive PTEs.

Taken together, the results suggest that the long-term mental health impact of predisaster PTE exposure is largely indirect via more proximal effects on mental health and an increased risk for further PTE exposure. This is consistent with prior research showing PTE history to be a predictor of further PTE exposure (e.g., Benjet et al., 2016; Conley et al., 2017) as well as bidirectional associations between PTE exposure and mental health symptoms (e.g., Lusk et al., 2017). This study was unique in its focus on a disaster-affected sample of vulnerable adults, and the results suggest that their postdisaster mental health cannot be fully understood without attention to other PTE exposures over the life-course.

The main findings add to the small body of literature linking disaster-related trauma exposure to both pre- and postdisaster PTE exposure (e.g., Harville et al., 2011; Ruggiero et al., 2009). Future research should integrate other factors in addition to mental health symptoms that previous studies have shown to contribute to the recurrence of PTEs over the life-course. These include both factors along the path from initial PTE exposure to mental health symptoms, such as loss of social, economic, and psychological resources (e.g., Zwiebach et al., 2010), as well as those that fall between mental health symptoms and subsequent PTE exposure, including impaired threat detection and maladaptive coping (Marx et al., 2005; Messman-Moore & Long, 2003). Additionally, further studies could incorporate other preexisting risk factors, beyond those that were included in the current analysis, that are shared among various PTEs for a better understanding of the extent to which links are due to stable characteristics versus dynamic processes. Future work could also parse out whether associations differ between aspects of exposure that are more objective, such as a lack of food or water, and those that are more subjective, such as perceived danger. Taken together, such work could provide a more complete picture of the associations between PTE exposure and mental health symptoms over time.

The comparison of results for models that contained PTSS and PD suggests that predisaster PTEs have a stronger direct influence on postdisaster nonspecific psychiatric symptoms (i.e., PD), whereas their influence on disaster-related symptoms (i.e., PTSS) is largely indirect via other risk factors, including predisaster PD and disaster-related PTE exposure. Conversely, the long-term direct impact of disaster-related PTEs was exclusive to PTSS, which is consistent with another analysis using this dataset (Raker et al., 2019). Of note, the current study did not directly test the statistical significance of the observed differences in the paths from predisaster and disaster-related PTEs to

Table 4
Indirect, Direct, and Total Effects from Predisaster Potentially Traumatic Events (PTEs) to Long-Term Postdisaster Symptoms

	All PTEs		Assaultive PTEs	
Variable	Est.	95% CI	Est.	95% CI
		PTSS		
Indirect effects via predisaster PD	0.005	[−0.001, 0.014]	0.008	[0.000, 0.022]
Indirect effects via disaster-related PTEs	**0.013**	[0.005, 0.026]	**0.020**	[0.007, 0.041]
Indirect effects via short-term postdisaster symptoms	0.009	[0.000, 0.023]	0.012	[−0.005, 0.036]
Indirect effect via postdisaster PTEs	**0.025**	[0.010, 0.041]	**0.026**	[0.007, 0.050]
Direct effect	0.030	[−0.011, 0.071]	**0.081**	[0.006, 0.152]
Total effect	**0.082**	[0.046, 0.119]	**0.145**	[0.76, 0.211]
		PD		
Indirect effects via predisaster PD	**0.085**	[0.041, 0.154]	**0.114**	[0.044, 0.223]
Indirect effects via disaster-related PTEs	0.016	[−0.020, 0.066]	0.024	[−0.029, 0.104]
Indirect effects via short-term postdisaster symptoms	**0.091**	[0.029, 0.173]	**0.111**	[0.003, 0.255]
Indirect effect via postdisaster PTEs	**0.210**	[0.130, 0.317]	**0.276**	[0.145, 0.453]
Direct effect	0.194	[−0.005, 0.420]	**0.56**	[0.216, 0.952]
Total effect	**0.596**	[0.388, 0.805]	**1.093**	[0.729, 1.476]

Note. $N = 821$. Estimates are unstandardized. Estimates with 95% CIs that did not contain zero were considered statistically significant (Preacher & Hayes, 2008). These are listed in boldface for clarity. PD = psychological distress; PTSS = posttraumatic stress symptoms.

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each outcome. One way of doing this would be to covary PTSS and PD within a single model, which would also permit insight into the role of PTEs in predicting unique, nonshared variance in each outcome. We did not conduct this type of analysis in the current study due to the preliminary nature of this work, a reticence to add additional variables and paths to already complex models, and our interest in predicting both shared and unique variance in PTSS and PD. However, this would be a useful direction for further research.

The results regarding assaultive PTEs align with prior research showing that these events have particularly adverse long-term impacts on mental health (e.g., Kessler et al., 2017). The results further suggest that assaultive PTEs, in particular, might increase the risk for disaster-related PTE exposure. Again, future research is needed to statistically test for differences in the direct, as well as indirect, pathways from assaultive and nonassaultive PTEs to disaster exposure. For example, assaultive PTEs might be more likely than nonassaultive PTEs to yield resource loss, thereby accounting for stronger associations with subsequent PTE risk. Another direction for future exploration is whether observed differences by PTE type persist after the inclusion of additional shared risk factors, such as income level and educational attainment.

The present findings suggest that in addition to their efforts to reduce psychiatric symptoms and boost clients' resilience, clinicians working with trauma survivors should discuss disaster preparedness with their clients; for example, clinicians and clients might discuss making sure the client has the means to evacuate, access to suitable temporary housing, and an adequate supply of any regular medications. Clinicians should also verify that their clients' contact information is up-to-date to prevent any treatment disruptions in the aftermath of a disaster, which could perhaps prevent further PTE exposure. Providers working with disaster survivors should be sure to conduct a thorough assessment of clients' trauma histories and attend to the ways in which prior exposure could exert a direct or indirect influence on their mental health status. Postdisaster providers should also make efforts to mitigate disaster survivors' risk for further PTEs, such as by bolstering social support networks and building adaptive coping strategies. The present research speaks to the broader clinical literature on trauma-informed care (TIC) and suggests that the postdisaster period is an acute and critical stage in the life-course for the delivery of TIC, which requires sensitive delivery of care that considers the compounding effects of PTEs (Center for Substance Abuse Treatment, 2014).

The present study had at least four additional limitations. First, although the use of a checklist to assess lifetime PTE exposure was efficient and thus reduced participant burden, this approach did not allow for in-depth exploration of event characteristics, such as frequency and severity, that likely shape both PTSS and PD. We also assumed in our models that all postdisaster PTEs occurred between the short- and long-term assessments of postdisaster symptoms (i.e., between approximately one year and 12 years after Hurricane Katrina), which might have been erroneous in some cases. Predisaster PTEs were also assessed retrospectively and could have been biased by participants' long-term postdisaster symptomatology. Second, disaster-related PTEs were assessed at W3 (i.e., 4–6 years postdisaster) for 16.8% of our sample. Although the number of disaster-related PTEs did not differ between those who provided data at W2 versus W3, the more distant timeframe at W3 could have nonetheless affected the accuracy of reports, potentially influencing associations between disaster-related PTEs and long-term postdisaster psychiatric symptoms. Third, PTSS and PD were assessed via self-report inventories. Although this was efficient and consistent with other large-scale disaster studies (e.g., Galea et al., 2007; Tracy et al., 2011), these are not substitutable for clinical interviews. Lastly, although the sample of low-income, primarily African American mothers was of interest given their increased risk for postdisaster adversity, it is not representative of all Hurricane Katrina survivors. Because participants were all community college students at baseline, it is also likely that the results do not generalize to all low-income mothers in New Orleans at the time of Hurricane Katrina. Further, the results might not generalize to survivors of other disasters.

Despite these limitations, the results demonstrate the importance of attending to disaster survivors' PTE exposures over the life-course rather than focusing solely on their exposure to the disaster itself. In this sample of low-income parents, exposure to Hurricane Katrina was linked to exposure to PTEs both before the disaster and in its aftermath. The results further indicate the interplay of PTE exposures and psychiatric symptoms from pre- to postdisaster and suggest that predisaster trauma exposure continues to have an influence, much of it indirect, on survivors' long-term functioning.

Open Practices Statement

This study was not formally preregistered. Neither the data nor the materials have been made available on a permanent third-party archive; requests for the data or materials can be sent via email to the lead author at sarah.lowe@yale.edu.

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