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Research Article

Long-Term Impact of Hurricane Sandy Exposure on Positive and Negative Affect: The Role of Perceived Social Support

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Abstract

Objectives: Natural disasters can have devastating, long-lasting effects on the mental health of older adults. However, few studies have examined associations among disaster exposure and positive and negative affect, and no longitudinal studies have investigated the extent to which predisaster perceived social support affects these associations. These analyses examine the associations among predisaster perceived social support, disaster exposure, and positive and negative affect experienced by community-dwelling older adults 4 years after Hurricane Sandy, controlling for predisaster affect.

Methods: Self-reported data collected before and after Hurricane Sandy from participants (aged 50–74 years) in the ORANJ BOWL panel (N = 2,442) were analyzed using linear regression models.

Results: Higher levels of peritraumatic stress experienced during Hurricane Sandy and greater hardship experienced after the storm were associated with more negative affect 4 years following the disaster. Higher perceived social support at baseline was related to more positive affect and less negative affect both before and after the hurricane. Social support did not moderate the effect of hurricane exposure on either positive or negative affect.

Discussion: Findings suggest that psychological effects may persist years after natural disasters and that more effective interventions may be needed during and after a disaster. While social support is critical to positive and negative affect in general, its buffering effects when disaster strikes may be limited.

Keywords: Adversity, Affective well-being, Disaster, Resilience

During the past two decades, more than one million people worldwide have been killed by a natural disasters (United Nations, 2019). Hurricane Sandy hit the East-Coast of the United States on October 29, 2012 (Centers for Disease Control and Prevention, 2013), resulting in 159 deaths (Blake et al., 2017). The hurricane was particularly detrimental to older adults. Kim et al. (2017) found that the all-cause mortality rate for people aged 76 and older increased by 13% in the 3 months after the hurricane. Disasters also have long-term effects on mental health (Makwana, 2019; Norris et al., 2002; Schultz et al., 2013; Wilson-Genderson et al., 2018). However, few studies have examined whether resources such as perceived social support can protect older adults against the negative impact of

a disaster (Tang et al., 2014). The stress-buffering hypothesis (Cohen & Wills, 1985) suggests that the negative impact of adversity should be greater among individuals who perceive that they have low levels of social support than among individuals having high levels of perceived social support. The purpose of these analyses is to investigate how hurricane exposure influences positive and negative affect and how perceived social support reported by community-dwelling older adults prior to a disaster impacts their positive and negative affect following the disaster.

Positive and Negative Affect

While most disaster studies focus on diagnosable mental disorders such as Post traumatic stress disorder (PTSD) and depression (Goldmann & Galea, 2014; Wilson-Genderson et al., 2018), the current analyses center on positive and negative affect. Building on the suggestion of Goldmann and Galea (2014), who stress the importance of studying a broad range of outcomes, we contend that general indicators of mental health, including positive and negative affect provide a more complete understanding about the effects of disaster which may have important implications for intervention.

Negative affect (NA) refers to the experience of unpleasant and distressing emotional states, whereas positive affect (PA) refers to the experience of pleasant and enjoyable emotional states (Watson & Tellegen, 1985). NA and PA are conceptually different, a distinction that has been consistently confirmed, both in terms of associations with stressors, and statistically in factor analyses (Hentschel et al., 2017; Lawton et al., 1992).

The conceptual difference between PA and NA is rooted in the behavioral system literature. Watson et al. (1999) suggested that NA is linked to the behavioral inhibition system, which protects an individual from harm and risks by inhibiting behavior with potentially harmful outcomes. In contrast, PA is linked to the behavioral activation system, which triggers approach behavior in an individual towards rewarding outcomes. Based on this, Vogel et al. (2013) reasoned that PA can be constrained when desired pleasurable interactions with the outside world are hindered, whereas NA reflects an aversion towards the outside world.

Translated to the context of a natural disaster, we hypothesize that due to the destruction caused by disaster, pleasurable interactions with the outside world are less possible, which in turn may result in lower PA. At the same time, disaster may trigger internal aversion or avoidance towards stimuli related to the disaster, such as damaged homes or fallen trees, which may increase NA. To the best of our knowledge, only one previous study focused on positive and negative affect in the context of a natural disaster. Phifer and Norris (1989), studying floods in Kentucky found that high levels of community destruction, but not personal material loss, were related to lower levels of PA and that community destruction and personal material loss were related to higher levels of NA in older adults up to 2 years after the floods.

Different Types of Disaster Exposure

As the disaster literature has developed, it has become clear that the way in which disaster exposure is defined affects the relationship between disaster exposure and mental health (Schwartz et al., 2017; Wilson-Genderson et al., 2018). Building on work by Pruchno et al. (Pruchno et al., 2010; Wilson-Genderson et al., 2018), we examine four types of disaster exposure: peritraumatic stress, personal and property damage, poststorm hardship, and neighborhood damage.

Peritraumatic stress—the emotional responses experienced in the moment of the disaster (Wilson-Genderson et al., 2018)—is a consistent risk factor for depression and PTSD (Boden et al., 2015; Tang et al., 2014). Associations between personal and property loss (e.g., death of a relative or friend, home damage) and mental health are less consistent. For example, Lowe et al. (2015) found no relationship between personal and property damage and depressive symptoms, but Wilson-Genderson et al. (2018) found a positive association with depressive symptoms. Poststorm hardship includes the negative impact a storm has on career, income, and housing after the disaster (Wilson-Genderson et al., 2018). Research focused on postdisaster stressors, such as job loss and displacement found that ongoing stressors postdisaster are associated with an increased rate of depression and PTSD (Goldmann & Galea, 2014). Finally, neighborhood damage is destruction of infrastructure and the loss of essential services in the neighborhood of the victims of a disaster. Davidson and McFarlane (2006) found that the mental health outcomes following disaster were worse for people with high neighborhood damage than others.

In summary, the literature suggests that some types of disaster exposures are associated with mental health whereas others are not.

Perceived Social Support

Perceived social support is associated with both positive and negative affect (Cobo-Rendón et al., 2020; Lee et al., 2022; Siedlecki et al., 2014), although these associations have rarely been examined within the context of a natural disaster. Cobo-Rendón et al. (2020), for example, found that perceived social support is consistently and positively related to emotional well-being. In terms of affect, Siedlecki et al. (2014) found that perceived social support was a significant predictor for NA, but not for PA in older adults. In contrast, Lee et al. (2022) reported a significant association between perceived social support and PA in older adults.

The stress-buffering hypothesis (Cohen & Wills, 1985) posits that in addition to being directly associated with well-being, social support could also have a buffering effect on psychological well-being when disaster strikes. Cohen and Wills (1985) note that in two phases of the stressor-illness chain, social support can be protective. The first is in the prevention of the appraisal of the event as

stressful; the second is the reduction or alteration of the physiological stress response and the positive adjustment of behavioral responses. There is evidence that disaster-related social support buffered PTSD and depressive symptoms in the face of Hurricane Katrina (Arnberg et al., 2012; McGuire et al., 2018).

However, most of the research on the stress-buffering hypothesis is cross-sectional and social support is typically measured only after the disaster, limiting conclusions about causation (Sasaki et al., 2019). In line with this, Sasaki et al. (2019) note that it remains unclear whether social support is protective via stress-buffering effects or through main effects. Social support has a main effect on mental health if the effect exists regardless of exposure to stress or adversity (Cohen & Wills, 1985). Social support has a buffering effect on mental health if social support and stress exposure do not merely have independent effects on mental health. Rather, for social support to have a buffering effect, the negative impact of the adversity (e.g., disaster exposure) should be less among individuals with high levels of social support than individuals with low levels of social support. Sasaki et al. (2019) contend that it can be difficult to discriminate between main effect and buffering effect models, particularly in studies that measure social support only postdisaster, because of potential selection bias and the possibility of reverse causality.

Following Sasaki et al. (2019), we examine the effects of predisaster perceived social support on affect. In addition to examining main effects, we test the stress-buffering hypothesis by investigating whether social support modifies the effects of exposure on positive and negative affect. There is evidence that predisaster social support may strengthen disaster preparedness (Lowe et al., 2010; Sasaki et al., 2019), serving as a resource making older adults more prepared to deal with a disaster. Lowe et al. (2010), for example, found evidence that predisaster perceived social support had an indirect positive effect on postdisaster mental health through three pathways: better predisaster mental health, higher postdisaster perceived social support, and a lower amount of experienced disaster stressors.

Current Study

Among the people affected by Hurricane Sandy were older residents of New Jersey participating in a longitudinal panel since 2006. Data from this panel provide a unique opportunity to investigate the long-term impact of perceived social support on affect, controlling for predisaster affect. Because perceived social support was assessed prior to the disaster, these data provide the opportunity to understand the main and buffering effects that social support has when disaster strikes.

Our analyses address the following research questions and hypotheses:

1. *What is the association between the degree of negative exposure to Hurricane Sandy and positive and negative affect 4 years after the hurricane?* We hypothesize that, on average, higher reported peritraumatic stress, personal and property damage, poststorm hardship, and neighborhood damage are associated with higher NA and lower PA after Hurricane Sandy, and that this association remains when controlling for prehurricane levels of positive and negative affect.
2. *To what extent is the* association *between the degree of negative exposure to Hurricane Sandy and positive and negative affect in older adults moderated by perceived predisaster social support?* In line with the stress-buffering hypothesis, we hypothesize that the associations between hurricane exposure and positive and negative affect are weaker for older adults who report higher social support prehurricane.

Method

Participants

We analyzed data from the Ongoing Research on Aging in New Jersey: Bettering Opportunities for Wellness in Life (ORANJ BOWL) panel. ORANJ BOWL is a longitudinal panel initiated in 2006 in order to identify factors influencing successful aging. People eligible to be included in the panel were: between the ages of 50 and 74, residents of New Jersey, and able to participate in a 1-hr English-language telephone interview. Participants were recruited using cold calling and list-assisted random-digit-dialing and invited to participate in a telephone interview (Wave 1, N = 5,688). The response rate was 59%, and the cooperation rate was 73% (Pruchno et al., 2010). Lavrakas (2008) contends that the cooperation rate (the ratio of all cases interviewed out of all eligible units ever contacted) is a better indicator of actual participation than the response rate (the ratio of all cases interviewed out of all eligible sample units in the study). Wave 2 (2007–2008) included data personality data collected from the first 1,594 respondents; these data are not used in the current analyses. In 2011, Wave 3 data were collected using a postal questionnaire to which 3,387 people responded. Wave 4 data were collected in 2014, about 18 months after Hurricane Sandy (N = 3,609), and Wave 5 took place about 4 years after the hurricane (N = 3,076). Participants completed Waves 4 and 5 either with help from an interviewer or on their own using Qualtrics. In the analyses that follow, we analyzed data from Waves 1, 3, 4, and 5. Our analyses included participants who had data for both positive and negative affect at Waves 3 and 5 (N = 2,442). Compared to those who were not included in the analysis (N = 3,246), participants who were included were younger, had a higher education level, and greater income. Details regarding attrition from ORANJ BOWL are found in Pruchno et al. (2010) and Heid et al. (2021).

Measures

Positive and negative affect were measured at Waves 3 and 5 with the Philadelphia Geriatric Center Affect Rating Scale (PGC-ARS; Lawton et al., 1992). The PGC-ARS consists of two scales: the PA scale and the NA scale. Each scale has five items. The items represent the frequency of experiencing an emotion during the past week and is answered on a 5-point Likert-type scale, ranging from 0 (never) to 4 (nearly always). The PA scale includes the items happy, content, warm-hearted, energetic, and interested. The NA scale includes annoyed, irritated, sad, worried, and depressed. Respondents indicated how often during the past week they experienced each emotion. PA and NA scores were computed by summing responses to the five items (range 0–20) on each scale, with higher scores representing greater positive and negative affect. Cronbach's alpha for NA was 0.84 (Wave 3) and 0.81 (Wave 5); Cronbach's alpha for PA, was 0.86 (Wave 3) and 0.83 (Wave 5).

Peritraumatic stress was assessed at Wave 4 using two questions: "Did you feel that you were in immediate physical danger during Hurricane Sandy?" and "Were you distressed or fearful during Hurricane Sandy?" Similar questions were asked by Heid et al. (2016) and Bell et al. (2017). Response options for each question were no (0), a little (1), and a lot (2). Responses were summed (range 0–4).

Personal and property loss was assessed at Wave 4. Participants reported whether they experienced: (a) physical injury, (b) a need for medical attention, (c) home damage, (d) family or close friends injured or killed, (e) loss of utilities, and (f) damage to a personal automobile as a result of Hurricane Sandy. A similar approach was used by Liebermann-Cribbin et al. (2017) and Schwartz et al. (2017). Responses were summed, and capped at three, because only five participants experienced four or more of these stressors (range 0–3)

Poststorm hardship was assessed at Wave 5. Participants reported whether, because of Hurricane Sandy, they had: (a) stopped working, (b) left their home, (c) had mold problems at home, and/or (d) lost income. Similar questions were asked by Lowe et al. (2015) and Wilson-Genderson et al. (2018). Responses were summed and capped at two, because only four participants experienced three or more of these stressors (range 0–2).

Neighborhood damage during the storm was measured at Wave 5. Participants indicated whether their neighborhood suffered any of the following damages during Hurricane Sandy: (a) fallen trees, (b) downed power lines, (c) disrupted public transportation, (d) damaged homes, (e) streets flooded, and (f) nondrinkable water. These questions are similar to those used by Frankenberg et al. (2012) and were recorded as yes (1) or no (0). Items were summed to create a scale score (range 0–6).

Social support was measured at Wave 1 and at Wave 5 using four questions: "How often do you feel there is someone you can count on to listen to you when you need to talk?" "How often do you feel that someone is available to give you good advice about a problem?" "How often do you feel that someone shows you love and affection?" and "How often do you feel that there is someone you can count on to provide you with emotional support in talking over problems or helping you make a difficult decision?" Responses ranged from none of the time (1) to all of the time (5). A scale score was computed by summing responses to the four items. To arrive at a meaningful zero-point we subtracted four from all scores, yielding a range of 0–16. Cronbach's alpha was 0.88.

Demographic covariates

At Wave 1, participants reported their gender (0 = male, 1 = female), education level, and income. Educational level was categorized into three categories: low (1 [less than high school]), moderate (2 [high school graduate or General Educational Development, some college or 2-year college degree]), and high (3 [4 or more years of college]). Income categories included: less than $14,999 (a), $15,000–$29,999 (b), $30,000–$49,999 (c), $50,000–$79,999 (d), $80,000–$149,999 (e), and more than $150,000 (f). We transformed this variable into a continuous variable, by assigning the median income to the categories and dividing this by 10 to represent $10K increments. Age was recorded at Wave 1 and adjusted at Wave 3.

Additional variables for Inverse Propensity Score weighting

In addition to demographics, we used Wave 1 information about self-rated health, medical conditions, and functional ability to adjust for selective attrition (see analytic strategy). Self-rated health was based on the question "How would you rate your overall health at the present time?" Responses were: excellent (6), very good (5), good (4), fair (3), poor (2), and very poor (1). Number of medical conditions was a count of self-reports regarding whether a physician had diagnosed: arthritis, hypertension/high blood pressure, heart condition/disease, cancer, diabetes, osteopenia, a stroke, liver disease, lung or breathing problems, Parkinson disease, Multiple Sclerosis, migraine headaches, and HIV/AIDS. Functional ability was assessed by asking participants how difficult (not at all difficult = 5; only a little difficult = 4; somewhat difficult = 3; very difficult = 2; and cannot do it at all = 1) they found it to do nine activities, including walking a quarter-mile, standing for about 2 hr, reaching overhead, and grasping small objects.

Analytic Strategy

We used SPSS version 28 for analyses. We calculated descriptive statistics for all variables and examined bivariate correlations among study variables. We first estimated the associations between each type of exposure separately

and posthurricane PA (Models 1–4) and NA (Models 9–12) using linear regression. We then adjusted these regression models for prehurricane affect (Wave 3) to determine whether hurricane exposure had any effect net from predisaster PA (Models 5–8) and NA (Models 13–16). For all models, we adjusted for age, gender, income, and education.

We used linear regression models with interaction terms to test whether the effect of exposure on positive and negative affect differed between individuals with higher versus lower social support. Next, we estimated separate regression models with interaction terms for each exposure variable (exposure × social support), adjusted for prehurricane affect (Wave 3), age, gender, income, and education, for both PA (Models 17–20) and NA (Models 21–24). To avoid small regression coefficients, we transformed the social support variable into a-score in the interaction models.

To adjust for selective attrition, we applied Inverse Propensity Score weighting to all regression models (IPW; Weuve et al., 2012). We first obtained the individual propensity to be included in our analysis (N = 2,442) using logistic regression analysis with Wave 1 gender, income, education, social support, functional ability, chronic diseases, and self-rated health and Wave 3 age as predictors. All characteristics except income and chronic diseases were independently associated with attrition. Based on the propensity scores, we then calculated stabilized IPW regression weights according to guidelines in the literature (Thoemmes & Ong, 2016). We included self-rated health, functional ability, and chronic diseases to refine the propensity scores and did not include these variables as control variables in the models.

Results

Table 1 presents descriptive statistics for the 2,442 people included in the analyses. The average age of the sample at Wave 3 was 64.86 years. At Wave 1, women constituted a majority of the sample and participants had relatively high levels of education and income. More than half of the participants at least obtained a bachelor's degree, and almost three-quarters of the participants had an income of $50K or more. Also, at Wave 1, participants had relatively high levels of functional ability and were in good health. Participants reported high levels of perceived social support prior to the hurricane (Wave 1). On average, participants reported relatively low NA and high PA at Wave 3, as well as Wave 5. For the exposure variables, poststorm hardship exposure was relatively low compared to peritraumatic stress, personal and property damage, and neighborhood damage. Table 1 shows the statistics.

Correlations (reported in Table 2) among the exposure variables range between 0.17 and 0.39, indicating that they are largely distinct types of exposure. The correlations between positive and negative affect are 61 at Wave 3 and 0.54 at Wave 5.

Types of Exposure and Affect

Table 3 reports findings from the IPW weighted regression analysis examining the relationships among the exposure variables and positive and negative affect, not controlling for prehurricane affect (Models 1–4 and 9–12) and controlling for prehurricane affect (Models 5–8 and 13–16). When controlling for prehurricane PA, the only statistically significant association was found between personal and property damage and PA (Model 6: b = 0.19, p = .02). This regression coefficient indicates that per unit increase of personal and property damage, there was a 0.19 increased score of PA. When controlling for prehurricane NA we found statistically significant positive associations between peritraumatic stress and NA (Model 13: b = 0.14, p = .01). and between poststorm hardship and NA (Model 15: b = 0.40, p < .01). Point estimates for other associations were weaker and not statistically significant. IPW weighted results were similar to nonweighted results.

Moderation Analysis

Table 4 presents findings on the extent to which social support moderated the relationship between disaster exposure and positive and negative affect, controlling for prehurricane affect. None of the interactions were statistically significant. However, the main effect of social support on affect was significant for all models. Social support had a positive association with PA and a negative association with NA. IPW weighted results were similar to nonweighted results.

Post hoc Analysis

Because the association between personal and property damage and PA was in the unexpected direction, we carried out two post hoc analyses. First, we examined whether the relationship between personal and property damage and PA was curvilinear. This was not the case; the squared effect of personal and property damage was nonsignificant in all models. Second, we investigated whether persons with relatively high personal and property damage had been more likely to apply for relief funds provided by the Federal Emergency Management Agency (FEMA) and file a claim with their insurance company. Such claims could have led to improvements in the quality of their property and might therefore explain the positive association with predisaster affect. Chi-Square tests revealed that groups reporting personal and property damage were more likely to have applied for FEMA relief funds (χ^2 (3, 2301) = 220,52, p < .001) and insurance claims (χ^2 (3, 2299) = 390,14, p < .00). While we did not have information about whether these claims had actually been paid, we surmise that people who experienced damages, had their damages repaired or were able to move. Because social support was measured at Wave 1 and not at the wave closest before Hurricane Sandy

Table 1. Characteristics of the Study Sample ($N = 2,442$)

Variable (range)	Wave	*N*	% Missing	*M*/% (*SD*)
Age	3	2,442	0	64.84 (6.77)
Gender	1	2,422	0	
Male		865		35.4
Female		1,577		64.6
Education	1	2,440	0.1	
Low		42		1.7
Medium		1,135		46.5
High		1,263		51.8
Annual income (× 1,000 dollar)	1	2,196	10.1	99.14 (60.86)
Less than $15K		56		2.6
$15K–$30K		161		7.3
$30K–$50K		350		15.9
$50K–$80K		511		23.3
$80K–$150K		697		31.7
More than $150K		421		19.2
Functional ability	1	2,442	0	41.41 (5.08)
Number of chronic diseases	1	2,417	1	1.77 (1.38)
Self-rated health	1	2,441	<.01	4.72 (.98)
PGC-ARS: Negative affect (0–20)	3	2,442	0	7.5 (3.36)
PGC-ARS: Positive affect (0–20)	3	2,442	0	14.59 (3.61)
PGC-ARS: Negative affect (0–20)	5	2,442	0	7.04 (3.11)
PGC-ARS: Positive affect (0–20)	5	2,442	0	15.14 (3.42)
Hurricane exposure				
Peritraumatic stress (0–4)	4	2,356	3.5	0.88 (1.01)
Personal and property damage (0–3)	4	2,366	3.1	0.61 (.78)
Poststorm hardship (0–2)	5	2,399	1.8	0.17 (.42)
Neighborhood damage (0–6)	5	2,265	7.2	2.66 (1.74)
Social support (0–16)	1	2,437	0.2	13.05 (3.11)

Note: PGC-ARS = Philadelphia Geriatric Center Affect Rating Scale; *SD* = standard deviation.

(Wave 3), we investigated post hoc whether social support remained stable over time between Wave 1 and Wave 5. A paired sample *t*-test showed that there was a small but significant decline in social support ($t[2, 428] = 6.79$, $p < .001$) between social support at Wave 1 ($M = 13.06$, standard deviation [*SD*] = 0.06) and at Wave 5 ($M = 12.61$, $SD = 0.07$). However, because the average decline was small, we contend that baseline support is a reasonable proxy for the support available during the hurricane.

Discussion

In line with the first hypothesis, our analyses reveal that both peritrauma stress and poststorm hardship have statistically significant associations with NA 4 years after the hurricane. Higher levels of peritraumatic stress and poststorm hardship were associated with more NA. However, personal and property damage and neighborhood damage were not associated with NA. Contrary to expectations, disaster exposure was not meaningfully associated with PA. Surprisingly, personal and property damage was positively associated with PA, but post hoc analyses reveal that people experiencing these damages had applied for relief funds from FEMA or their insurance company, which may explain the association with PA.

Our findings partially align with the existing literature and show that a natural disaster can have a long-lasting negative effect on mental health (Goldmann & Galea, 2014; Makwana, 2019; Schultz et al., 2013). However, this was confirmed only for NA. The explanation for this may lie in the conceptual difference between the behavioral activation system and behavioral inhibition system and their associations with positive and negative affect (Watson et al., 1999). The behavioral inhibition system is activated by threat or punishment and is related to NA and avoidance behavior. The behavioral activation system, on the other hand, is related to rewarding interactions with the outside world and is associated with PA and approach behavior (Vogel et al., 2013; Watson et al., 1999). In this light, it appears reasonable to assume that postdisaster hardships such as mold problems or displacement signal threat or punishment and activate the behavioral inhibition system and with that NA. A similar reasoning can be applied to peritraumatic stress, which signals threats that may trigger the behavioral inhibition system. In contrast, the

Table 2. Bivariate Correlations Among All Major Study Variables

	Peritraumatic stress	Personal and property damage	Poststorm hardship	Neighborhood damage	Social support	Wave 3 Positive affect	Wave 3 Negative affect	Wave 5 Positive affect	Wave 5 Negative affect
Peritraumatic stress	1								
Personal and property damage	0.29***	1							
Poststorm hardship	0.17***	0.33***	1						
Neighborhood damage	0.29***	0.39***	0.23***	1					
Social support	−0.05*	0.02	−0.02	0.01	1				
Wave 3 Positive affect	−0.07***	0.01	0.01	−0.02	0.36***	1			
Wave 3 Negative affect	0.13***	0.01	0.03	0.04	−0.28***	−0.61***	1		
Wave 5 Positive affect	−0.04	0.05*	−0.002	0.01	0.34***	0.63***	−0.42***	1	
Wave 5 Negative affect	0.13***	−0.01	0.07**	0.06**	−0.24***	−0.40***	0.60***	−0.54***	1

Note:
*$p < .05$;
**$p < .01$;
***$p < .001$.

behavioral activation system related to PA may not be triggered by these two types of exposure, because they do not serve as signals for potential rewarding outcomes. Moreover, damages and injuries inflicted by the hurricane are likely to have been resolved after 4 years, and no longer hamper pleasurable interactions or approach behaviors with the outside world which underlie PA. It could even be that, due to the rebuilding of property (e.g., using FEMA funds), the quality of damaged neighborhoods may have increased, facilitating pleasurable interactions with the outside world. This reasoning may also partly explain why we found that more personal and property damage was associated with higher rather than lower PA. This finding is consistent with the concept of posttraumatic growth (Tedeschi & Calhoun, 1996).

Another explanation for our inability to find evidence for an association between the four types of hurricane exposure with PA and property damage and neighborhood damage with NA is that participants in our sample had relatively high levels of income and education. It is well established that people with a higher socio-economic position, have better access to resources, such as social support and social networks (Weyers et al., 2008). Indeed, in our sample, education and income level were positively associated with social support. This may in part account for the lack of evidence for these associations in our data.

Our findings, like those of Wilson-Genderson et al. (2018), suggest that type of disaster exposure matters. Like the earlier study, our results indicate that it is peritraumatic stress and poststorm hardship that impact NA, and not personal and property damage or damage to the neighborhood. Findings also align with research showing that peritraumatic stress and poststorm hardship are associated with depression and PTSD (Boden et al., 2015; Goldmann & Galea, 2014; Wilson-Genderson, 2018). Our findings add to this knowledge by showing that peritraumatic stress and poststorm hardship have a long-term impact on NA. This is consistent with Bovin and Marx (2011) who showed that fear, anger, sadness, and disgust are primary peritraumatic stress reactions (and not the lack or absence of positive emotions). Furthermore, it appears that poststorm stressors have a long-lasting effect on NA, while personal, property, and neighborhood damage do not. This may be because damages and injuries are repaired or healed 4 years postdisaster, but posthurricane stressors are likely to still be disruptive on the long-term.

Our second hypothesis, which predicted the effect of disaster exposure on affect to be weaker in participants with higher social support, was not supported by our analyses. These findings do not support the buffering hypothesis formulated by Cohen and Wills (1985) and add to the debate about whether social support promotes mental health via a main effect or a stress-buffering effect (Sasaki et al., 2019). Our findings align with the main

Table 3. IPW Weighted Associations Between Types of Hurricane Exposure and Positive and Negative Affect, for Each Exposure Type Separately

	Positive affect				Negative affect			
	Models 1–4[a]		Models 5–8[b]		Models 9–12[a]		Models 13–16[b]	
	b (*SE*)	95% CI	*b* (*SE*)	95% CI	*b* (*SE*)	95% CI	*b* (*SE*)	95% CI
Peritraumatic Stress	−0.12 (0.08)	(−0.28, 0.04)	0.01 (0.07)	(−0.12, 0.14)	0.34 (0.07)***	(0.20, 0.48)	0.14 (0.06)*	(0.03, 0.26)
Personal and property damage	0.21 (0.10)*	(0.01, 0.40)	0.19 (0.08)*	(0.03, 0.34)	−0.06 (0.09)	(−0.24, 0.11)	−0.11 (0.07)	(−0.24, 0.03)
Poststorm hardship	−0.02 (0.18)	(−0.38, 0.34)	−0.04 (0.14)	(−0.31, 0.24)	0.51 (0.17)**	(0.18, 0.85)	0.40 (0.13)**	(0.14, 0.66)
Neighborhood damage	0.05 (0.05)	(−0.05, 0.14)	0.06 (0.04)	(−0.01, 0.13)	0.10 (0.04)*	(0.02, 0.18)	0.04 (0.03)	(−0.03, 0.11)

Note: CI = confidence interval; IPW = Inverse Propensity Score weighting; *SE* = standard error.
[a]Models 1–4 and 9–12 adjusted for age, gender, income and education, but not for prehurricane affect.
[b]Models 5–8 and 13–16 adjusted for age, gender, income, education, and prehurricane affect.
$^*p < .05$;
$^{**}p < .01$;
$^{***}p < .001$.

effect hypothesis and illustrate that predisaster perceived social support was positively associated with PA and negatively associated with NA. Social support did not moderate the effect of hurricane exposure on either positive or negative affect. Findings add to the literature by using a longitudinal design that controlled for predisaster affect and measured the perception of available social support before the disaster. An explanation for our finding may be that the social support questions were too general. They did not assess support for a specific event such as a natural disaster and did not include instrumental support or support received, which may be crucial in the context of disaster. This line of reasoning is consistent with Thoits (2011), who argued that instrumental social support related to a stressor is likely to have a buffering effect on mental health and perceived "every day" social support is more likely to serve as a main effect on mental health. As such, our measure of social support may not be sufficient to capture the type and intensity of specific support that might be needed during a disaster. However, the broad indicator of social support was able to show positive effects on positive and negative affect in general, which is in line with the main effect hypotheses.

Again, it is also possible that in part the characteristics of our participants account for our inability to find evidence for the stress-buffering hypothesis. Participants in our sample were privileged economically and in terms of health, and the average impact of Hurricane Sandy was relatively low. It may be possible that social support does play a significant role in buffering the impact of a disaster in a less privileged population.

Implications

These data carry practical implications and indicate that interventions focused on preventing or reducing peritraumatic stress during a disaster and minimizing poststorm stressors may benefit older adults. Good and timely evacuation protocols, that make sure that people are not in the affected area during a storm, may prevent people from feeling threatened or stressed during a natural disaster. Moreover, in the aftermath of a disaster, it may not be enough just to rebuild the damages, but additional efforts should be made to target and help survivors of a natural disaster cope with poststorm stressors. In this light, policy makers, mental health workers, and/or others should be aware that disaster exposure has the potential to impact the well-being of older adults many years after the disaster. As such, the short-term interventions typically offered following a disaster may be insufficient. Finally, our results indicate that social support is an important protective factor for positive and negative affect in general, but not specific for survivors of a natural disaster. Therefore, enhancing social support for older adults should be a focus of general mental health improvement programs. Specific to the context of a natural disaster, more research

Table 4. IPW Weighted Main and Interaction Effects Between Types of Hurricane Exposure and Social Support and Positive and Negative Affect, for Each Exposure Type Separately

	Positive affect			Negative affect		
	Models 17–20[a]			Models 21–24[a]		
	b (*SE*)	95% CI	*p*	*b* (*SE*)	95% CI	*p*
Peritraumatic stress	0.04 (0.06)	(−0.08, 0.17)	.49	0.14 (0.06)*	(0.03, 0.25)	.02
Social support	0.34 (0.10)***	(0.15, 0.53)	<.001	−0.22 (0.09)*	(−0.39, −0.05)	.01
Social support × peritraumatic stress	0.06 (0.06)	(−0.05, 0.18)	.30	0.01 (0.05)	(−0.10, 0.11)	.92
Personal and property damage	0.17 (0.08)*	(0.02, 0.32)	.03	−0.10 (0.07)	(−0.24, 0.03)	.13
Social support	0.47 (0.09)***	(0.30, 0.64)	<.001	−0.20 (0.08)**	(−0.35, −0.05)	.009
Social support × personal and property damage	−0.12 (0.09)	(−0.29, 0.05)	.16	−0.03 (0.08)	(−0.18, 0.12)	.66
Poststorm hardship	−0.06 (0.14)	(−0.33, 0.21)	.66	0.39 (0.12)**	(0.14, 0.63)	.002
Social support	0.47 (0.08)***	(−0.33, 0.59)	<.001	−0.26 (0.07)***	(−0.39, −0.12)	<.001
Social support × poststorm hardship	−0.24 (0.16)	(−0.55, 0.08)	.14	−0.11 (0.16)	(−0.43, 0.20)	.48
Neighborhood damage	0.06 (0.04)	(−0.01, 0.13)	.10	0.04 (0.03)	(−0.02, 0.11)	.21
Social support	0.34 (0.12)**	(0.12, 0.57)	.003	−0.19 (0.11)	(−0.42, 0.03)	.09
Social support × neighborhood damage	0.03 (0.04)	(−0.04, 0.10)	.40	−0.02 (0.04)	(−0.09, 0.05)	.53

Note: CI = confidence interval; IPW = Inverse Propensity Score weighting; *SE* = standard error.
[a]Models 17–20 and 21–24 adjusted for age, gender, income, education, and prehurricane affect.
*$p < .05$;
**$p < .01$;
***$p < .001$.

is needed to identify the essential buffering elements of social support for a disaster. This research could inform which elements of social support should be incorporated in mental health programs in the aftermath of a disaster. Although it is remarkable that we still find an effect of disaster exposure and social support on positive and negative affect years after the disaster, these effects appear relatively modest. However, because the PGC-ARS lacks norms and clinical cutoffs, it is difficult to understand the extent to which conclusions about clinical relevance can be made.

Strengths and Limitations

Strengths of this study include (a) a large population-based sample of older respondents that included people with sufficient variability in disaster exposure; (b) longitudinal assessments both before and after the disaster, (c) a focus on both positive and negative affect, and (d) information about social support preceding the disaster. A notable limitation of this study is that the hurricane exposure measures were self-reported and assessed approximately 18 months after the disaster, which may have introduced recall bias. Second, the measure of social support included only four items and measured social support broadly. Moreover, this measure showed relatively little variation in our sample, and the mean of social support was remarkably high, which may have affected the results by possible ceiling effects. Further research could focus on different dimensions of social support: emotional, affectionate, informational, instrumental, and interactional (Sherbourne & Steward, 1991) when addressing its potential buffering effect on mental health in the context of a natural disaster. Third, there may have been other relevant characteristics that could influence the impact of disaster exposure on affect, that were beyond the scope of this study. For example, physical health could have been negatively influenced by the hurricane and may therefore partly explain the relationship between disaster exposure and affective well-being. Future research could focus on possible mediators that may shed more light on the possible pathways by which exposure and mental health are associated. Besides this, social support variables measured more closely in time to the disaster, or measuring different aspects such as instrumental support or a sense of belonging may have yielded different results. Finally, participants in our sample were relatively highly educated and affluent compared to the general U.S. population. It is likely that due to their privileged position, they could have been better able to avoid the worst effects of Hurricane Sandy, for example, through relocation or funds to rebuild their homes or community. Moreover, the attrition of participants may have resulted in an underrepresentation of people with a low education level and poor health. Despite IPW weighting for these factors, the results could still not be fully representative for all older adults in the United States. It is reasonable to assume that for less privileged people, the negative effects of a disaster are even greater.

Conclusions

Our findings add to the current literature by showing that different types of disaster-exposure differentially impact positive and negative affect in older adults, confirming that type of exposure matters in natural-disaster research. Peritraumatic stress and poststorm hardship should be important targets of interventions to prevent long-term mental health problems. Finally, our findings indicate that social support in general is an important factor for well-being, yet we could not confirm that it could serve as a disaster preparedness resource and that could protect against the effects of disaster exposure on positive and negative affect.

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Conflict of Interest

None declared.

Ethical Approval

This study was granted by the Rowan University IRB.

Author Contributions

B. Wolters planned the study, performed the statistical analyses, and authored the manuscript. A. Kok planned the study, helped with the statistical analyses, and coauthored the manuscript. M. Huisman planned the study and coauthored the manuscript. F. Cartwright supervised data collection activities and coauthored the manuscript. R. Pruchno planned the study, supervised the project, and coauthored the manuscript.

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