BRIEF REPORT

The Mental Health Impact of Hurricane Maria on Puerto Ricans in Puerto Rico and Florida

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ABSTRACT

Objectives: The aim of this study was to compare the effect of Hurricane Maria on internalizing and posttraumatic stress disorders (PTSD) among Puerto Ricans who moved to Florida after the storm versus those who stayed on the island.

Methods: In March through April 2018 (6 months after Hurricane Maria), an online survey was used to assess the effects of the storm on mental health. A sample of 213 displaced Puerto Ricans living in urban and rural/suburban areas in Florida, as well as urban and rural areas of Puerto Rico, participated in the study.

Results: Rates of PTSD were high in both sites (Florida, 65.7%; Puerto Rico, 43.6%); however, participants in Florida were far more likely than those in Puerto Rico to meet diagnostic criteria for PTSD (OR, 2.94; 95% CI, 1.67-5.26). Among participants in both Florida and Puerto Rico, those living in urban areas were more likely than those in rural/suburban areas to meet criteria for PTSD and generalized anxiety disorder.

Conclusions: Results suggest that post-Hurricane Maria adjustment and adaptation may have been more psychologically taxing for Puerto Ricans who moved to Florida than it was for those who remained on the island, and more difficult for those in urban areas than it was for those in suburban or rural areas. (*Disaster Med Public Health Preparedness.* 2019;page 1 of 4)

Key Words: Puerto Rico, Hurricane Maria, depression, generalized anxiety, PTSD, trauma, cultural adjustment

Puerto Rico was impacted by several hurricanes in 2017. On September 6, 2017, Hurricane Irma passed just north of the island and knocked out power to more than 1 million people. Two weeks later, Hurricane Maria struck Puerto Rico directly as a category 4 hurricane. The devastation left by the storm led to a mass migration of Puerto Ricans to Florida and other US states. It is estimated that in the 10 weeks following the hurricane more than 200 000 Puerto Ricans relocated to Florida.[1] Most of these new arrivals settled in and around the Miami and Orlando metropolitan areas, while others moved to other parts of Florida.[2] Projections[1,2] indicate that the aftereffects of Maria could lead to close to 500 000 additional Puerto Ricans moving to Florida by 2020.

Many Puerto Ricans who relocated to the US mainland following the storm received 6-month US Federal Emergency Management Agency vouchers to pay for apartments or hotels.[3] Many of those who stayed on the island were left without power for several months, and many homes were deemed unlivable. Beyond population health consequences, major hurricanes often inflict damage to people's mental health and lead to increased risk for outcomes such as anxiety, depression, and posttraumatic stress disorder (PTSD).[4] Posttraumatic stress symptoms include intrusive re-experiencing (not being able to stop having recurring memories or thoughts of the hurricane and its aftermath) and hypervigilance (not being able to relax or calm down).[5]

METHODS

Sampling Strategy

Our sampling strategy was guided by word-of-mouth outreach to community leaders and community centers in South and Central Florida and in various parts of Puerto Rico, as well as through social media groups for post-Maria Puerto Ricans. The survey was available online through Qualtrics and could be completed via smartphone or computer. A respondent-driven sampling approach[6] was used, where each participant was asked to refer up to 3 additional respondents. We started with 38 "seed" (original) participants, and these seeds referred 175 additional participants. Although our Florida seed participants were in South and Central Florida, referral participants lived in various parts of the state.

Participants

Inclusion criteria specified that participants be 18 or older and have been living in Puerto Rico during Hurricane Maria. A sample of 213 participants from urban and rural/suburban areas in Florida (n = 101), as well as urban and rural areas in Puerto Rico (n = 110), completed the study measures. Two participants did not specify their location and were not included in our analyses. The median participant age was 36 years (interquartile range, 27 to 46 years; range, 18 to 81).

Measures

Depression

The Center for Epidemiologic Studies Depression Scale (CESD) Boston Form[7] was used to measure depressive symptoms. This 10-item measure asks participants to rate 10 symptoms that they may have experienced within the past week. Response options ranged from 0 (rarely or none of the time) to 3 (most or all of the time). The CESD also provides cutoff scores. Individuals with scores of 16 or higher are considered to be clinically depressed.[8] Cronbach α for CESD scores in the present sample was 0.71.

Anxiety

The Generalized Anxiety Disorder Scale[9] (GAD-7) is a 7-item measure where each item is rated on a scale from 0 (not at all) to 3 (almost every day). Scores above 15 are considered indicative of severe anxiety. Cronbach α for anxiety scores in the present sample was 0.92.

Posttraumatic Stress

The PTSD Checklist Civilian Version (PCL-C), adapted to refer to Hurricane Maria, is a self-report rating scale with 17 items. Each item asks whether a PTSD symptom has bothered the respondent in the past month and is answered on a scale ranging from 1 (not at all) to 5 (extremely). The PCL-C includes 2 subscales: intrusive re-experiencing and hypervigilance. Using summed scores across these 2 subscales, scores of 35 are indicative of PTSD diagnoses for civilian populations. No α coefficient is reported because this instrument is a checklist.

Analytic Plan

Major cities in Florida (Miami, Fort Lauderdale, Orlando, Jacksonville, Tampa, Naples, Fort Myers) and Puerto Rico (San Juan, Bayamón, Carolina, Ponce, Caguas, Guaynabo, Mayagüez, Trujillo Alto) were coded as urban, and all other areas were coded as rural/suburban. We conducted our analyses as multivariate regression models using Mplus[10] 7.4 so that cases with missing data could be included in analysis. Site (1 = Florida, 2 = Puerto Rico) was coded such that positive effects indicated higher mean scores in Puerto Rico. "Urbanicity" (0 = urban, 1 = rural/suburban) was coded such that positive effects indicated higher mean scores in rural/suburban areas. We first estimated linear regression models with site and urbanicity as predictors of depressive symptoms, anxiety symptoms, PTSD intrusive reexperiencing, and PTSD hypervigilance (see Table 1). Next, we estimated binary logistic regression analyses with clinical versus nonclinical levels of anxiety, depression, and PTSD as criterion variables and with site or urbanicity as the predictor. Participant age and gender were included as control variables in all analyses.

RESULTS

Continuous Scores

Analyses indicated a statistically significant link between urbanicity and anxiety ($\beta = .18$, $P < .03$), an association approaching statistical significance for urbanicity with depressive symptoms ($\beta = .14$, $P = .10$), statistically significant associations of both site ($\beta = -.23$, $P < .003$) and urbanicity ($\beta = .25$, $P < .002$) with PTSD intrusive reexperiencing, and an association approaching statistical significance between site and PTSD hypervigilance ($\beta = -.13$, $P < .09$). See Table 1 for means and standard deviations.

Clinical Significance Cutoffs

We first report results for site (Puerto Rico versus Florida) and then report results for urbanicity. There was no statistically significant difference in clinically significant anxiety by site (OR, 1.17; 95% CI, 0.65-2.11; $P = 66$. Clinically significant depression also did not differ by site (OR, 1.67; 95% CI, 0.97-2.86; $P = .11$). However, participants in Florida (65.7%) were statistically significantly more likely than those in Puerto Rico (43.6%) to meet criteria for PTSD (OR, 2.94; 95% CI, 1.67-5.26; $P < .005$) (see Table 2).

TABLE 1

Mean Symptom Scores by Site and Urbanicity						
	Site			Urbanicity		
Variable	Florida, mean (SD)	Puerto Rico, mean (SD)	β	Urban, mean (SD)	Rural/Suburban, mean (SD)	β
Depressive symptoms	15.17 (5.28)	14.02 (5.29)	−.08	14.07 (5.15)	15.72 (5.89)	.14[a]
Anxiety symptoms	12.81 (5.26)	12.44 (5.37)	.00	12.29 (5.48)	14.24 (5.37)	.18*
PTSD intrusive reexperiencing	20.21 (8.06)	16.17 (6.88)	−.23**	16.63 (6.17)	21.19 (9.20)	.25**
PTSD hypervigilance	18.24 (9.11)	15.55 (7.38)	−.13[a]	16.03 (7.07)	18.81 (10.31)	.13

[a]$P < .10$; *$P < .05$; **$P < .01$.

TABLE 2

Percentages of Participants with Clinically Significant Symptom Criteria						
	Site			**Urbanicity**		
Variable	Florida, %	Puerto Rico, %	OR (95% CI)	Urban, %	Rural/Suburban, %	OR (95% CI)
Depressive symptoms	46.5	32.7	1.67 (0.97-2.86)	34.1	50.0	1.97[a] (0.98-3.95)
Anxiety symptoms	25.0	27.0	1.17 (0.65-2.11)	23.5	41.4	**2.25 (1.21-4.16)**
PTSD	65.7	43.6	**2.94 (1.67-5.26)**	48.8	66.7	**2.35 (1.29-4.28)**

Odds ratios adjusted for respondent age and gender. Odds ratios and 95% confidence intervals in bold are statistically significant at $P < .05$.
[a]P value greater than .05 but less than .10.

In terms of rural/suburban versus urban comparisons, a statistically significantly greater proportion of Puerto Ricans in rural/suburban areas reported clinical levels of anxiety (urban, 23.5%; rural, 41.4%; OR, 2.25; 95% CI, 1.21-4.16; $P < .03$) and PTSD (urban, 48.8%; rural, 66.7%; OR, 2.35; 95% CI, 1.29-4.28; $P < .03$). Marginal differences were also observed for depression (urban, 34.1%; rural, 50.0%; OR, 1.97; 95% CI, 0.98-3.95; $P = .058$).

DISCUSSION

Hurricane Maria was one of the costliest natural disasters in US history—and the first category 4 hurricane to strike Puerto Rico directly. The storm led to an unprecedented migration off the island in the weeks and months following the storm—primarily to South and Central Florida.

Our goal in the present study was to assess the mental health characteristics of Puerto Ricans in Florida and Puerto Rico 6 months after Hurricane Maria. With a sample of participants residing in urban and rural/suburban areas in Florida and in Puerto Rico, we found that those who migrated to Florida reported more severe PTSD symptoms and were more likely to meet criteria for a PTSD diagnosis. Further, across both Florida and Puerto Rico, individuals residing outside of major cities were more likely to meet clinical criteria for depression and PTSD. These results may be due to decreased access to resources (including employment) in more isolated and less urban areas. Additionally, individuals who left Puerto Rico may have been those who suffered the greatest personal and property losses during and after the storm. Although rates of clinically significant symptoms were lower in Puerto Rico and in urban areas, it should be noted that rates were high for the sample as a whole. For example, in Puerto Rico, one-third of participants met criteria for clinical depression and nearly half met criteria for PTSD. The rates of clinically diagnosable depression, anxiety, and PTSD in the present sample (see Table 2) were considerably higher than those reported among Puerto Rican community samples several years prior to Hurricane Maria[11] (major depression, 19.4%; generalized anxiety, 7.3%; PTSD, 6.8%).

These results underscore the need for disaster-related mental health services not only to treat those individuals residing at the disaster site, but also to attend to those who migrated elsewhere following the disaster. Indeed, scholars contend that climate-related migration may become even more common in the future.[12]

Study Limitations

Our results should be interpreted in light of some limitations. First, the sample size was fairly small. Second, although online surveys are convenient, it is not possible to verify the identity of the person completing the survey. Third, because population-based sampling is not feasible with migrant communities, we used a nonprobability sampling approach that may not fully represent the populations of Puerto Ricans in Florida and on the island. Lastly, because participants were referred through social networks, we may have missed individuals who were isolated.

Future Directions

Despite these and other limitations, our study indicates that mental health challenges are prominent among Hurricane Maria survivors, especially those who relocated to Florida and those living outside of major cities. It is important to direct mental health services toward people who experienced the hurricane—especially those who left their homes and migrated to the US mainland.

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