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Hurricane-Related Stressors' Impact on Postpartum Maternal Mental Health and Care-  
Seeking in Puerto Rico

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Hurricane-Related Stressors' Impact on Postpartum Maternal Mental Health and Care-Seeking in Puerto Rico

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An abstract of  
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Rollins School of Public Health of Emory University  
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2020

## Abstract

### Hurricane-Related Stressors' Impact on Postpartum Maternal Mental Health and Care-Seeking in Puerto Rico

By Meredith A. Dixon

**Objective:** The aim of this study was to examine how experiences during the 2017 hurricanes in Puerto Rico influenced postpartum mental health and care-seeking, as well as whether these associations were modified by hurricane preparation or availability of support in the aftermath of the hurricanes.

**Methods:** This study utilized data from the Pregnancy Risk Assessment Monitoring System - Zika Postpartum Emergency Response (PRAMS-ZPER) 2.0 telephone follow-up survey, which was aimed at sampling all women who lived in Puerto Rico and delivered live-born babies during November and December 2017.

**Results:** While women were more likely to have a postpartum visit in the aftermath of hurricanes Maria and Irma, there was also an increase in the prevalence of poor maternal mental health. There were no notable factors associated with having a postpartum checkup. In contrast, many hurricane-related stressors were discovered to have significant associations with postpartum maternal mental health conditions. For example, the prevalence of mothers who reported postpartum feelings of depression or anxiety was 1.93 times as high among women who also reported trouble getting services or aid from the government after the hurricanes compared to those who did not (95% CI: 1.48 – 2.52). Additionally, the prevalence of mothers reporting postpartum feelings of depression or anxiety was also higher among women who reported: being injured or becoming ill, walking through debris or floodwater, living in temporary housing, losing personal belongings, being separated from loved ones, having trouble dealing with insurance or relief agencies, experiencing trouble getting clean drinking water, having trouble getting enough food to eat, feeling unsafe because of lack of order and security, having to move to another municipality, experiencing the destruction of their home, or having to change doctors.

**Conclusion:** The specific hurricane-related events that were affiliated with worse postpartum mental health outcomes were factors undermining the physical well-being and safety of the mothers. The findings of this work support the idea that basic needs such as food, water, safety, and shelter are associated with mental health outcomes among new mothers in the wake of natural disasters.

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## Background

On September 6, 2017, Hurricane Irma passed about 60 miles north of Puerto Rico, causing 30-foot waves, destruction of homes, loss of power to a million residents, and three deaths (1, 2). Only two weeks after Hurricane Irma, Hurricane Maria made landfall on Puerto Rico, on September 20, 2017. The hurricane caused a widespread loss of power, and it isolated most of the population from each other, “as a result of collapsed bridges, inoperable roads, and almost total lack of telecommunications” (3). Although the official death count from Puerto Rico was only 64, a study in the *New England Journal of Medicine* estimated 4,645 excess deaths due to the hurricane, “equivalent to a 62% increase in the mortality rate as compared with the same period in 2016” (4). In addition to knowing the excess deaths caused by the hurricanes, it is also important to understand how they may have affected certain aspects of maternal and child health. Because “their well-being determines the health of the next generation,” women and children are prioritized both in the Healthy People 2020 goals for the United States and in the Sustainable Development Goals globally (5, 6).

In an aptly named article in *The Lancet* entitled “No Health Without Mental Health,” the authors note that “about 14% of the global burden of disease has been attributed to neuropsychiatric disorders” (7). In particular, perinatal mental illness (PMI) specifically affects women during pregnancy and the postpartum period, with prevalence rates for depression approaching 20% (8). Maternal mental health affects not only the mother but also the child’s health (9, 10), and knowing how to improve it has the potential to improve health outcomes for many in a given population. Screening, early detection, and effective management are critical tools for intervention (8). However, in

addition to professional efforts to improve PMI, peer support networks can also be very important in improving mental health through combatting isolation in women affected by PMI (11). It is especially imperative to know how to improve PMI outcomes in the wake of natural disasters, which increase the prevalence of mental health conditions.

Natural disasters have increased exponentially in the past thirty years (12), and public health preparedness programs must be adapted in the wake of climate change's impact on the frequency of these events (13). Already, "a significant evolution in disaster planning has occurred within the past decade," and greater ethical concerns have been taken into consideration with efforts to engage the public around moral norms (14). Sadly, health outcomes following natural disasters tend to differ based on the wealth of a country. Specifically for hurricanes, "among high-amplitude storms (Saffir-Simpson category 4 or 5), the expected mortality rate was 0.72 deaths per 100,000 people (95% confidence interval [CI]: 0.16–1.28) for nations in the highest tertile of per capita gross domestic product (GDP) compared with 25.93 deaths per 100,000 people (95% CI: 13.30–38.55) for nations with low per capita GDP" (15). With higher death rates in these lower income countries, it might be expected that PMI rates would be higher also, as compared to higher income countries.

When it comes to mental health in the aftermath of natural disasters, post-traumatic stress syndrome (PTSD) and depression have been shown to have significant increases among affected populations (16). Specific to maternal mental health, studies among women exposed to the 1998 Quebec Ice Storm have shown that "both objective degree of exposure to the storm and the mothers' subjective distress have strong and persistent effects on child development" (17), but the effect may depend on when during

gestation the exposure occurred and on the sex of the child (18). Even in the absence of a direct link to poor child development, mental health outcomes among mothers should be a public health priority, especially in light of natural disasters.

The aim of this study was to examine how experiences during the 2017 hurricanes influenced postpartum maternal mental health and care-seeking in Puerto Rico, and whether these relationships were modified by preparation for the hurricanes or availability of support in the aftermath of the hurricanes.

## Methods

This study utilized data from the Pregnancy Risk Assessment Monitoring System - Zika Postpartum Emergency Response (PRAMS-ZPER) 2.0, which was aimed at sampling all women who lived in Puerto Rico and delivered live-born babies during November and December 2017. Since 99.17% of the births in Puerto Rico occur in the hospital setting, hospital-based data collection was employed via delivery logs in hospitals with 100 or more births per year. Two hospitals were not included due to their maternity wards suffering damages from the hurricane, and one hospital refused to participate. Thus, the overall sampling took place in 30 of 33 Puerto Rican hospitals, which accounted for 96.2% of all births in Puerto Rico during the study period. Delivery dates were randomly selected and all women who delivered on those dates were invited to participate, with surveys being offered in English or Spanish. From February—March of 2018, the women who participated in the hospital survey were invited to participate in a telephone follow-up survey. The data for the present analyses were obtained from the telephone follow-up survey. This project was classified as non-human subjects research by Emory University and did not require IRB review.

Hurricane experiences were measured using two questions: one that asked, “I’m going to read a list of things that could happen because of a hurricane or disaster. For each one, please tell me if you experienced it due to the hurricanes,” and by a second question that asked, “Around the time of your baby’s birth, did any of the following things happen due to the situation caused by the hurricane?” Exposures were analyzed separately to better understand the impact of each of these hurricane-related stressors on maternal care-seeking and mental health (Table 1).

Maternal care-seeking was ascertained through a question that asked whether the participants had received a postpartum checkup for themselves. Maternal mental health was assessed using questions that ascertained whether participants had been diagnosed with either depression or anxiety since their baby was born; whether they reported being down, depressed, or hopeless always or often; whether they reported having little interest or little pleasure in doing things they usually enjoyed always or often; or whether they indicated that they felt they needed mental health services. Respondents were then categorized into those who responded affirmatively to any of these questions and those who did not (19). Since there may be differences in the effect of hurricane-related stressors by both hurricane preparation and the availability of help and support from disaster relief efforts, these factors were considered for potential effect measure modification.

Data were analyzed using SAS survey procedures, and log-binomial regression was used to estimate prevalence ratios. Maternal age and education were chosen as confounders, since they appeared as variables possibly affecting both the exposure and the outcome in the DAG drawn *a priori*. In adjusted models, maternal age and education were included as ordinal covariates. Age was categorized into seven 5-year groups, and education was categorized into 8 levels, ranging from 8<sup>th</sup> grade equivalence to professional or doctoral degree.

## Results

### *Sample Characteristics*

Among 1,545 women initially selected, 1,482 (96%) completed the in-hospital survey. When invited to take part in the follow-up telephone survey three to four months later, 1,230 women participated (83% of those eligible) (19). Two of those mothers were excluded from this analysis, because they indicated that their babies were no longer alive, bringing the total analytic sample size to 1,228. With regards to age, over 30% of mothers were between the ages of 20 and 24 ( $n = 387$ ). Almost 25% of mothers had a high school diploma or GED as their highest level of education ( $n = 303$ ), while over 20% of mothers had a bachelor's degree as their highest level of education ( $n = 273$ ). Nearly all ( $n=1,195$ ) mothers indicated that they had gone without electricity for one week or longer due to the hurricanes, and 743 mothers (about 60%) reported feeling unsafe due to lack of order and security. In addition, 512 mothers (over 40%) said they had trouble getting clean drinking water after the hurricanes, and 428 mothers (about 35%) said they had trouble getting enough food to eat. Among the women in the total analytic sample, nearly 80% indicated that they had gotten postpartum checkups for themselves, and approximately 16% of new mothers reported experiencing poor mental health as described above (Table 1).

### *Potential Effect Measure Modification*

We hypothesized that preparation for or support after the hurricanes could attenuate the association between exposure to hurricane stressors and their subsequent impact on postpartum maternal mental health and care-seeking. As can be seen in the lower half of Table 2, some types of support in the wake of the hurricanes were fairly

ubiquitous, including resources received in the hospital after delivery and personal support networks that could provide money to borrow or someone with whom to talk about problems. Since most mothers received these types of support, they were not tested as effect measure modifiers, as the statistical power in the non-receiving groups would have been too low to detect differences had there been any.

With regards to preparation for the hurricanes, there appeared to be sufficient variability to test for effect measure modification, for all types of preparation except for the presence on a three-day emergency supply, which almost 95% of the mothers said that they had in place before the hurricanes. When considering all other types of preparation, a dichotomous variable was created, coded *yes* for any preparation other than the three-day emergency supply and *no* otherwise. There was no evidence to suggest that preparation for the hurricanes modified any of the relationships between the hurricane experiences and either maternal care seeking or maternal mental health.

Similarly, with regards to aid and disaster relief in the aftermath of the hurricanes, there appeared to be sufficient variability to test for effect measure modification, for all types of aid except for the receipt of food and water, which about 85% of the mothers said that they received. When considering all other types of aid, a dichotomous variable was created, coded *yes* for any aid received other than food or water and *no* otherwise. There was no evidence to suggest that availability of support after the hurricanes modified any of the relationships between the hurricane experiences and either maternal care seeking or maternal mental health. Whether no effect measure modification existed or whether there was simply not enough statistical power to detect it cannot be known with certainty.

### *Measures of Association*

The impact of each hurricane-related stressor on maternal care-seeking and mental health, adjusting for maternal age and education level are shown in Table 3. There were no notable factors that were associated with having a postpartum checkup. In contrast, many hurricane-related stressors were found to be associated with postpartum maternal mental health. For example, the prevalence of reporting postpartum feelings of depression or anxiety was 1.93 times as high among women who reported having trouble getting services or aid from the government after the hurricanes compared to those who did not (95% CI: 1.48 – 2.52). Additionally, the prevalence of reporting postpartum feelings of depression or anxiety was also higher among women who reported experiencing the following events *due to the hurricanes*: being injured or becoming ill, walking through debris or floodwater, living in temporary housing, losing personal belongings, being separated from loved ones, having trouble dealing with insurance or relief agencies, experiencing trouble getting clean drinking water, having trouble getting enough food to eat, feeling unsafe because of lack of order and security, having to move to another municipality, experiencing the destruction of their home, or having to change doctors.

## Discussion

Nearly 80% of study participants indicated that they had gotten postpartum checkups for themselves. In both 2016 and 2017, the aggregate data from all PRAMS sites across the United States indicated that the prevalence of postpartum checkups was 89.4% and 90.3%, respectively (20). However, the prevalence of postpartum checkups in Puerto Rico from the first ZPER survey (ZPER 1.0 – which took place in 2016-2017) was less than 70% (21). Therefore, it seems that perhaps more mothers in Puerto Rico received postpartum visits in 2017-2018 than in 2016-2017, even in spite of the hurricanes. Additionally, approximately 16% of study participants reported experiencing poor postpartum mental health after hurricanes Irma and Maria. For comparison, 12.8% and 12.5% of mothers from all PRAMS sites reported postpartum depressive symptoms in 2016 and 2017, respectively (20). The prevalence of poor postpartum mental health in the aftermath of hurricanes Irma and Maria is higher than that of the United States, but also exceeds the prevalence of 14% identified in Puerto Rico during the first ZPER survey just one year before (21).

Although we did not find a relationship between hurricane related stressors and postpartum visits, many of these stressors were associated with postpartum maternal mental health. Specifically, the hurricane stressors that were associated with worse postpartum mental health outcomes were factors that undermined the physical well-being and safety of the mothers, such as destruction of homes, loss of belongings, and trouble getting food and water. These findings support the notion that basic needs such as food, water, safety, and shelter are associated with mental health outcomes among new mothers in the wake of natural disasters. Indeed, “the dimensions related to the mental health of

women are multifactorial and beyond only psychological variables” (22). Some researchers have even proposed that safety needs come before physiologic needs with regards to stressful event-induced mental disorders (23).

Additionally, preparation for the hurricanes and aid received from disaster relief did not impact the strength of the relationship between hurricane-related stressors and poor postpartum mental health. It is possible that neither the preparations nor the relief that was received were enough help to meet basic needs for shelter, nutrition, financial security, and safety.

Peer-support networks can be very valuable in combatting isolation associated with PMI (11), but, since a vast majority of the women in this study reported having someone to loan them \$50, to help them if they were sick, and to talk to about their problems, it was not possible to ascertain whether these personal support networks modified associations between hurricane stressors and postpartum feelings of depression or anxiety. The high prevalence of peer support among study participants, especially after a natural disaster, is both notable and encouraging.

### *Strengths and Limitations*

The timing of this study was coincidental but ideal. The ZPER 2.0 survey had already been planned to commence in 2017, with a goal of assessing Zika virus awareness and preventive measures. Given the public health challenges that the hurricanes presented, the protocol was adapted to include hurricane-related questions, which allowed the PRAMS team to gather valuable information regarding pregnancy and childbirth in the midst of natural disasters.

The representative nature of the study is also a strength. Given that nearly all mothers in Puerto Rico deliver their babies in hospitals, and that there were high participation rates among both hospitals and sampled women, the study population is likely to be highly representative of the mothers who gave birth in Puerto Rico in November and December 2017.

This study is not without limitations. Unfortunately, we were unable to exclude mothers with prevalent mental health conditions prior to delivery, which makes it challenging to make casual inference from these analyses. There is the potential for differential recall bias since both the exposures and outcomes of interest were collected via self-report and at the same time. It is possible that mothers who were experiencing depressive or anxious symptoms might have recalled and reported hurricane stressors differently than mothers who were not experiencing depressive or anxious symptoms. This could have led not only to differential information bias, but also to dependent errors, for which an appropriate bias analysis method does not exist.

#### *Future Directions*

For future investigations of the association between natural disasters and postpartum maternal mental health, it will be important to collect mental health history information to allow for exclusion of mothers with prevalent mental health issues at baseline. Additionally, it will be preferable to measure the exposure of interest before the outcome has occurred and include objective measures of the exposure and/or outcome. Due to the random nature of natural disasters, it is challenging to plan ahead for prospective studies of this nature.

With regards to public health implications, measuring the devastating consequences of natural disasters goes far beyond measuring mortality. After a hurricane, emphasis should be placed not only on tracking physical health but on monitoring mental health, as well, especially among pregnant and postpartum women, in order to ensure screening, early detection, and effective management of PMI. Further research is also needed to study peer-support networks and their value in combatting isolation associated with PMI in the wake of natural disasters.

Furthermore, it is important to acknowledge the possible disparities that exist when it comes to natural disaster response efforts and the associated health outcomes. Although Puerto Rico is not officially a state, it is an unincorporated territory of the United States, and its people are U.S. citizens by law. Though they are citizens, the people of Puerto Rico are not represented in the U.S. Congress by any voting members (24). In addition to the high mortality related to the 2017 hurricanes, it is unsettling to observe the high numbers of mothers from this study who reported trouble getting their basic needs met, such as access to clean drinking water or enough food to eat. When coupling that with the strong observed association between not having those needs met and poor postpartum maternal mental health outcomes, the devastation caused not only by the hurricanes themselves but by the delay or lack of appropriate response efforts comes into question(2). Future research could look closer at disparities that exist with regards to natural disaster response efforts and their consequences.

While women were more likely to have a postpartum visit in the aftermath of hurricanes Maria and Irma, there was also an increase in the prevalence of poor maternal mental health. Although specific hurricane-related events were not associated with

maternal care seeking, factors that undermined the physical well-being and safety of the mothers did impact maternal postpartum mental health. The findings of this work support the idea that basic needs such as food, water, safety, and shelter are associated with mental health outcomes among new mothers in the wake of natural disasters.

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**Table 1. Puerto Rico residents with a recent birth, stratified by whether or not they had a post-partum visit and whether or not they reported feelings of depression and/or anxiety — Pregnancy Risk Assessment Monitoring System Zika Postpartum Emergency Response Telephone Survey 2.0, Puerto Rico, 2017-2018**

<b>Characteristics<sup>a,b</sup></b>	<b>Total Study Population (N = 1,228)</b>	<b>Women who had a post-partum checkup (n = 969)</b>	<b>Women who did not have a post-partum checkup (n = 240)</b>	<b>Women reporting feelings of depression and/or anxiety (n = 194)</b>	<b>Women not reporting feelings of depression and/or anxiety (n = 1,029)</b>
<b>Age, years</b>					
<= 17	38 (2.3 - 3.8%)	29 (2.1 - 3.8%)	9 (1.5 - 6.1%)	12 (2.8 - 9.4%)	25 (1.7 - 3.2%)
18-19	91 (6.1 - 8.4%)	61 (5.0 - 7.4%)	29 (8.2 - 15.4%)	15 (4.2 - 11.4%)	75 (5.9 - 8.4%)
20-24	387 (29.2 - 33.5%)	273 (25.7 - 30.2%)	104 (37.6 - 49.4%)	57 (23.0 - 35.3%)	328 (29.4 - 34.1%)
25-29	312 (23.5 - 27.4%)	257 (24.3 - 29.0%)	53 (17.4 - 26.7%)	44 (17.5 - 28.7%)	268 (23.9 - 28.2%)
30-34	243 (18.2 - 21.7%)	210 (19.7 - 23.9%)	29 (8.3 - 16.1%)	36 (13.0 - 23.4%)	207 (18.4 - 22.3%)
35-39	130 (9.3 - 11.9%)	113 (10.2 - 13.2%)	15 (3.3 - 9.0%)	22 (7.2 - 15.1%)	108 (9.2 - 12.0%)
40+	27 (1.6 - 3.0%)	26 (2.0 - 3.6%)	1 (0.0 - 1.3%)	8 (1.7 - 7.3%)	18 (1.1 - 2.5%)
<b>Maternal Education</b>					
8th grade	17 (0.9 - 1.9%)	9 (0.4 - 1.4%)	8 (1.2 - 5.9%)	4 (0.2 - 4.1%)	13 (0.7 - 1.8%)
9th-12th grade	95 (6.6 - 8.9%)	58 (4.8 - 7.3%)	36 (10.9 - 18.7%)	16 (4.5 - 12.0%)	78 (6.3 - 8.9%)
High school	303 (22.6 - 26.4%)	213 (19.7 - 24.0%)	88 (31.1 - 41.9%)	50 (19.3 - 31.1%)	252 (22.3 - 26.5%)
Some college	249 (18.6 - 21.9%)	196 (18.3 - 22.1%)	48 (15.3 - 24.7%)	41 (16.3 - 25.8%)	206 (18.2 - 21.8%)
Associate's degree	188 (13.7 - 16.7%)	152 (13.7 - 17.3%)	32 (9.8 - 17.5%)	28 (10.4 - 18.8%)	159 (13.6 - 17.0%)
Bachelor's degree	273 (20.6 - 24.1%)	245 (23.2 - 27.5%)	23 (5.8 - 13.3%)	42 (16.9 - 26.5%)	231 (20.6 - 24.6%)
Master's degree	80 (5.5 - 7.6%)	74 (6.4 - 9.1%)	4 (0.2 - 2.9%)	12 (3.2 - 9.7%)	68 (5.4 - 7.8%)
Doctoral degree	23 (1.3 - 2.7%)	22 (1.5 - 3.3%)	1 (0.0 - 1.2%)	1 (0.0 - 1.3%)	22 (1.5 - 3.1%)
<b>Hurricane stressors</b>					
Life was in danger	472 (36.2 - 40.4%)	374 (36.1 - 41.0%)	91 (31.7 - 42.9%)	87 (38.0 - 50.4%)	385 (35.2 - 39.9%)
Injured or became ill	122 (8.7 - 11.3%)	89 (7.8 - 10.7%)	29 (8.6 - 16.3%)	28 (10.2 - 19.4%)	94 (7.8 - 10.6%)
Family injured or ill	135 (9.7 - 12.4%)	104 (9.3 - 12.2%)	29 (8.3 - 16.3%)	29 (10.5 - 19.0%)	106 (9.0 - 11.9%)
Debris or floodwater	363 (27.3 - 31.4%)	286 (26.8 - 31.6%)	70 (24.7 - 34.6%)	81 (34.6 - 47.9%)	282 (25.1 - 29.7%)
Without electricity	1,195 (96.8 - 98.1%)	943 (96.6 - 98.2%)	233 (95.4 - 99.2%)	190 (96.1 - 99.7%)	1,005 (97.8 - 99.0%)

Someone died	51 (3.3 - 5.1%)	40 (3.1 - 5.1%)	11 (2.2 - 7.6%)	8 (1.7 - 6.6%)	43 (3.3 - 5.3%)
Temporary housing	420 (32.3 - 36.5%)	330 (31.7 - 36.6%)	82 (29.5 - 40.1%)	84 (37.3 - 50.2%)	336 (30.6 - 35.3%)
Lost belongings	466 (35.7 - 39.9%)	355 (34.0 - 38.8%)	103 (38.3 - 48.4%)	90 (39.4 - 52.0%)	376 (34.3 - 39.0%)
Separated from family	371 (28.1 - 32.2%)	286 (27.0 - 31.7%)	79 (28.3 - 38.3%)	76 (32.9 - 45.0%)	295 (26.5 - 31.0%)
Trouble getting aid	291 (22.0 - 25.5%)	219 (20.6 - 24.7%)	64 (21.9 - 31.5%)	72 (31.2 - 43.9%)	219 (19.5 - 23.1%)
Trouble with insurance	230 (17.1 - 20.4%)	177 (16.3 - 20.1%)	48 (15.3 - 25.3%)	50 (20.5 - 31.6%)	180 (15.7 - 19.3%)
Trouble getting food	428 (32.8 - 36.8%)	335 (32.2 - 36.9%)	84 (29.4 - 40.5%)	90 (40.3 - 52.6%)	338 (30.7 - 35.2%)
Felt unsafe	743 (58.3 - 62.7%)	598 (59.2 - 64.2%)	133 (49.5 - 61.1%)	144 (68.9 - 80.1%)	599 (56.0 - 61.0%)
Had to move	156 (11.2 - 14.0%)	120 (10.6 - 13.8%)	31 (9.2 - 17.1%)	38 (13.9 - 24.4%)	118 (10.0 - 12.8%)
Home was destroyed	56 (3.6 - 5.3%)	42 (3.3 - 5.2%)	14 (3.2 - 8.3%)	9 (1.8 - 7.3%)	47 (3.6 - 5.5%)
Missed prenatal appts.	455 (34.6 - 38.8%)	348 (33.1 - 37.9%)	102 (36.5 - 48.5%)	82 (34.7 - 47.8%)	373 (33.9 - 38.7%)
Had to change doctors	43 (2.9 - 4.5%)	33 (2.6 - 4.5%)	10 (1.9 - 6.8%)	15 (4.7 - 11.2%)	28 (2.0 - 3.7%)
Doctor not at birth	51 (3.2 - 5.0%)	36 (2.7 - 4.6%)	15 (3.1 - 9.6%)	9 (1.8 - 7.7%)	42 (3.1 - 5.0%)
Birth at diff. hospital	68 (4.7 - 6.7%)	50 (4.1 - 6.5%)	18 (4.4 - 11.0%)	12 (3.8 - 9.8%)	56 (4.4 - 6.7%)
Hurricane Preparation:					
Meeting place	564 (43.7 - 48.0%)	446 (43.5 - 48.5%)	109 (39.5 - 51.0%)	89 (40.2 - 53.1%)	475 (43.5 - 48.4%)
Practiced what to do	449 (34.0 - 38.3%)	359 (34.2 - 39.1%)	80 (27.5 - 37.7%)	73 (31.0 - 43.8%)	376 (33.6 - 38.5%)
Plan – keeping in touch	551 (42.6 - 47.0%)	452 (44.0 - 49.2%)	90 (31.8 - 42.6%)	90 (39.7 - 52.9%)	461 (42.4 - 47.1%)
Evacuation plan	572 (44.1 - 48.6%)	465 (45.3 - 50.5%)	100 (35.8 - 46.5%)	93 (41.0 - 54.5%)	479 (43.9 - 48.7%)
Evac. plan for children	461 (35.0 - 39.5%)	367 (35.1 - 40.2%)	91 (31.9 - 42.7%)	82 (35.4 - 48.5%)	379 (34.1 - 38.9%)
Documents - safe place	789 (62.0 - 66.2%)	629 (62.3 - 67.1%)	151 (57.7 - 68.4%)	118 (54.3 - 66.0%)	671 (62.8 - 67.4%)
3-days' supplies	1,152 (92.7 - 94.9%)	916 (93.4 - 95.7%)	219 (88.0 - 94.4%)	184 (91.8 - 97.7%)	968 (92.8 - 95.2%)
Ready to leave quickly	878 (69.7 - 73.6%)	693 (69.4 - 74.0%)	172 (67.2 - 76.9%)	135 (63.7 - 75.6%)	743 (70.2 - 74.6%)
Received this type of aid:					
Food	1,044 (83.5 - 86.6%)	816 (82.5 - 86.1%)	210 (83.7 - 91.1%)	161 (78.5 - 87.7%)	883 (84.2 - 87.4%)
Water	1,043 (83.4 - 86.5%)	814 (82.2 - 85.8%)	210 (83.8 - 91.1%)	163 (79.4 - 88.6%)	880 (83.8 - 87.1%)
Shelter	207 (15.2 - 18.5%)	154 (14.0 - 17.7%)	49 (16.1 - 25.0%)	53 (21.0 - 32.4%)	154 (13.3 - 16.8%)
Clothing	152 (11.0 - 13.8%)	108 (9.6 - 12.7%)	42 (13.0 - 21.9%)	28 (9.5 - 18.9%)	124 (10.6 - 13.6%)
Medications	156 (11.2 - 14.0%)	122 (10.8 - 14.2%)	32 (9.2 - 16.6%)	30 (10.8 - 20.2%)	126 (10.5 - 13.6%)
Financial assistance	184 (13.6 - 16.6%)	148 (13.7 - 17.2%)	34 (10.0 - 18.2%)	41 (16.2 - 25.9%)	143 (12.4 - 15.7%)

Transportation services	48 (3.1 - 4.8%)	35 (2.7 - 4.5%)	12 (2.5 - 7.6%)	12 (3.1 - 9.4%)	36 (2.6 - 4.4%)
Sources of electricity	450 (34.4 - 38.6%)	351 (33.7 - 38.7%)	91 (31.6 - 42.4%)	73 (30.9 - 42.3%)	377 (34.3 - 39.0%)
Received in hospital:					
Enough drinking water	1,038 (82.8 - 85.9%)	823 (83.0 - 86.4%)	196 (77.2 - 86.2%)	159 (76.9 - 86.5%)	879 (83.4 - 87.1%)
A place to bathe	1,209 (98.0 - 99.0%)	957 (98.2 - 99.3%)	233 (95.6 - 99.1%)	194 (100.0%)	1,015 (98.1 - 99.2%)
Electricity in room	1,212 (98.2 - 99.2%)	959 (98.4 - 99.5%)	234 (96.0 - 99.3%)	194 (100.0%)	1,018 (98.4 - 99.4%)
Enough food	1,196 (96.6 - 98.0%)	949 (97.2 - 98.6%)	229 (93.0 - 97.7%)	191 (96.8 - 100%)	1,005 (96.8 - 98.3%)
Lactation specialist	974 (77.0 - 80.6%)	777 (77.6 - 81.7%)	183 (70.9 - 80.6%)	156 (74.1 - 83.6%)	818 (77.1 - 81.2%)
Help caring for baby	936 (74.1 - 77.6%)	745 (74.6 - 78.5%)	175 (67.5 - 77.5%)	155 (74.1 - 83.6%)	781 (73.7 - 77.6%)
Would have if needed:					
Someone to loan \$50	1,027 (82.0 - 85.2%)	824 (83.2 - 86.8%)	187 (73.1 - 82.3%)	158 (76.6 - 86.3%)	869 (82.6 - 86.1%)
Someone to help if sick	1,145 (92.2 - 94.4%)	912 (92.9 - 95.3%)	217 (87.2 - 93.9%)	177 (87.5 - 94.6%)	968 (93.0 - 95.3%)
Someone to talk to	1,161 (93.5 - 95.5%)	925 (94.3 - 96.5%)	218 (87.3 - 94.4%)	174 (85.1 - 93.4%)	987 (95.0 - 96.9%)

Abbreviations: GED, general equivalence degree; appts, appointments; diff, different; evac, evacuation.

<sup>a</sup>Values may not sum to the total due to missing data.

<sup>b</sup>Data are expressed as No. (%) unless otherwise indicated. Counts are unweighted, and percentages are weighted to account for sampling.

**Table 2. Associations between hurricane stressors and maternal care-seeking and postpartum mental health<sup>a</sup>—Pregnancy Risk Assessment Monitoring System Zika Postpartum Emergency Response Telephone Survey 2.0, Puerto Rico, 2017-2018**

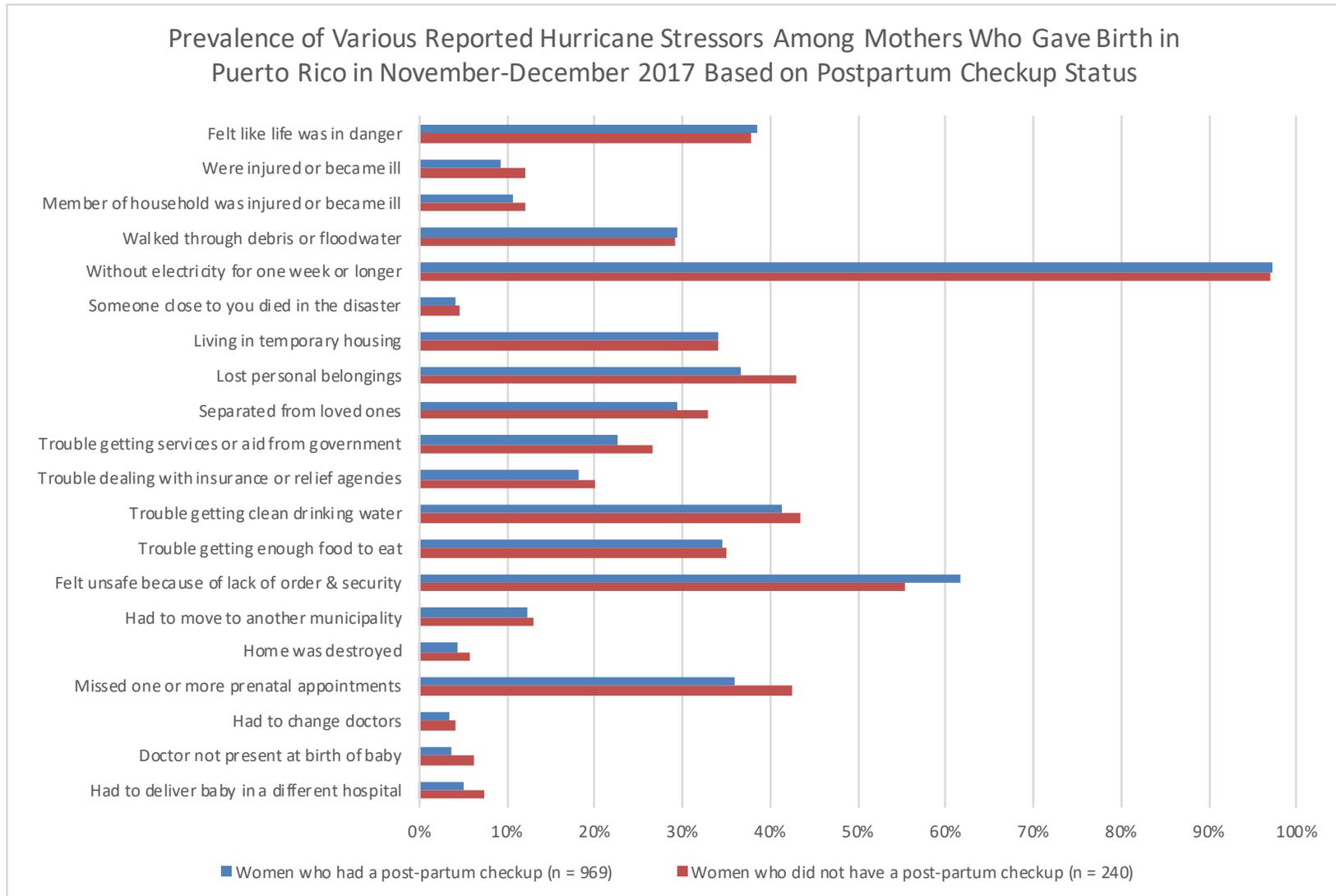
<b>Hurricane Stressors</b>	<b>Adjusted Prevalence Ratio (95% CI) for Maternal Care-seeking<sup>b</sup></b>	<b>Adjusted Prevalence Ratio (95% CI) for Poor Postpartum Mental Health<sup>c</sup></b>
Felt like life was in danger	1.00 (0.98 - 1.03)	1.26 (0.99 - 1.60)
Were injured or became ill	0.97 (0.93 - 1.02)	1.54 (1.09 - 2.16)
Member of household was injured or became ill	0.98 (0.94 - 1.02)	1.38 (0.98 - 1.95)
Walked through debris or floodwater	1.00 (0.97 - 1.03)	1.67 (1.27 - 2.20)
Without electricity for one week or longer	0.97 (0.90 - 1.05)	0.81 (0.34 - 1.91)
Someone close to you died in the disaster	0.98 (0.92 - 1.04)	0.97 (0.50 - 1.87)
Living in temporary housing	0.99 (0.96 - 1.02)	1.48 (1.13 - 1.93)
Lost personal belongings	0.98 (0.96 - 1.01)	1.35 (1.04 - 1.75)
Separated from loved ones	0.98 (0.96 - 1.01)	1.47 (1.15 - 1.88)
Trouble getting services or aid from government	0.98 (0.95 - 1.01)	1.93 (1.48 - 2.52)
Trouble dealing with insurance or relief agencies	0.98 (0.94 - 1.01)	1.53 (1.14 - 2.03)
Trouble getting clean drinking water	0.99 (0.96 - 1.01)	1.63 (1.24 - 2.15)
Trouble getting enough food to eat	0.99 (0.97 - 1.02)	1.62 (1.26 - 2.07)
Felt unsafe because of lack of order & security	1.00 (0.98 - 1.03)	1.96 (1.46 - 2.63)
Had to move to another municipality	0.98 (0.94 - 1.02)	1.69 (1.23 - 2.32)
Home was destroyed	0.96 (0.91 - 1.01)	1.78 (1.13 - 2.80)
Missed one or more prenatal appointments	0.97 (0.95 - 1.00)	1.19 (0.90 - 1.55)
Had to change doctors	0.99 (0.92 - 1.06)	2.22 (1.43 - 3.46)
Doctor not present at birth of baby	0.96 (0.89 - 1.04)	1.12 (0.60 - 2.06)
Had to deliver baby in a different hospital	0.96 (0.90 - 1.03)	1.20 (0.72 - 2.02)

<sup>a</sup>Adjusted for maternal age and maternal education.

<sup>b</sup>Women who had a post-partum checkup (n = 969) vs. those who did not (n=240)

<sup>c</sup>Women who reported feelings of depression and/or anxiety (n = 194) vs. those who did not (n = 1029)

**Figure 1. Prevalence of Hurricane Stressors Based on Postpartum Checkup Status.**



**Figure 2. Prevalence of Hurricane Stressors Based on Postpartum Mental Health Status.**

