Prevalence of Self-Reported Postpartum Depressive Symptoms and Related Factors in Women living in Puerto Rico (2017–2020)

Marianela Rodríguez-Reynaldo, PhD*; Zilkia Rivera-Orraca, PhD†;
Naydi Pérez-Ríos, MS‡; Karen G. Martínez-González, MD, MSc†

Objective: The objective of this article is to address the lack of data on self-reported postpartum depression among women in Puerto Rico with a live birth.

Methods: We examined data from the Puerto Rico Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire to evaluate self-reported postpartum depressive symptoms (SRPPDS) among women with a live birth.

Results: The prevalence of SRPPDS among women in Puerto Rico with a live birth was similar to that reported by other PRAMS sites. Overall, 9.67% of respondents reported having SRPPDS, and it did not vary by marital status, maternal age, maternal education, or income (P > .05). Risk factors that were significantly more prevalent among women who reported SRPPDS during the study period included 1) depression and anxiety before pregnancy, 2) depression and anxiety during pregnancy, and 3) smoking around the time of the interview, and 4) exposure to disaster-related stressors after Hurricane Maria.

Conclusion: Our findings show that women in Puerto Rico who had live births have similar rates of SRPPDS compared to those in other areas of the U.S.; however, specific risk factors for this population include exposure to disasters.

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Key words: Perinatal mental health, Postpartum depression, Latino health, Social determinants, PR-PRAMS

The prevalence of postpartum depression has been estimated to be 10% to 15% in non-Latina White women (1). However, a higher risk has been reported for women from other sociodemographic backgrounds, particularly women of color (2–6). For Latinas on the U.S. mainland, the prevalence of postpartum depression is 30% to 40% (7).

One of the known risk factors for perinatal depression is a history of adverse life events or trauma. Latina women have been reported to have a high prevalence of traumatic events (7,8). Some other risk factors associated with postpartum depression, such as prenatal depression, prenatal anxiety, and socioeconomic status, have not been as well studied in Latinas as in other ethnic groups (9–12).

For women in Puerto Rico (PR) with live births, the past years have been riddled with disaster-related trauma. In addition to an economic recession and a Zika epidemic, PR was devastated by 2 major hurricanes in 2017, followed by a series of earthquakes. Puerto Rican women are also disproportionately exposed to other risk factors for perinatal mental health disorders, including higher rates of adverse obstetric outcomes, with the cesarean-section birth rate at 47% (13) and the premature birth rate at 11.5% (3). The maternal mortality rate in PR in 2016 was 31.9 deaths per 1,000 live births (14,15). The rates of domestic violence are also staggering, with 6,725 cases reported in 2019 (16). Puerto Rican women also have a higher probability of both being the head of a household and of living under the poverty level (17,18).

The objective of this article is to address the lack of data on self-reported postpartum depression among women living in PR. We gathered data using a questionnaire from the Puerto Rico Pregnancy Risk Assessment Monitoring System (PR-PRAMS) to evaluate self-reported postpartum depression symptoms (SRPPDS) and assess associated risk factors in this Latina subpopulation. Our findings contribute to a more comprehensive understanding of this population's needs and will serve as a foundation for improving the services currently offered during the perinatal period.

Materials and Methods

We performed a secondary data analysis using data from the PR-PRAMS (19). Developed in 1987, the PRAMS is a national surveillance project that has been and continues to be conducted by the Centers for Disease Control and Prevention (CDC) in collaboration with state and territory health departments. The PR Department of Health has conducted PRAMS data collection since 2016. The PRAMS provides an ongoing, site-specific, population-based surveillance system for selected maternal behaviors before,

*Department of Obstetrics and Gynecology, †Department of Psychiatry, ‡Hispanic Alliance for Clinical and Translational Research (ALLIANCE), University of Puerto Rico Medical Sciences Campus, San Juan, PR

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Address correspondence to: Karen G. Martínez-González, University of Puerto Rico Medical Sciences Campus, Department of Psychiatry, PO Box 365067, San Juan, PR 00936. Email: karen.martinez4@upr.edu

during, and the first few months after pregnancy to identify high-risk women and infants for adverse health outcomes and monitor progress toward improving maternal and infant health (20). Women with a recent live birth (within the past 2 months), identified through birth certificate records, are selected to participate. They are mailed a self-administered questionnaire that focusses on maternal and infant health behaviors and experiences around the time of their pregnancy. Non-respondents were followed up with additional mailings and telephone interviews up to 6 months postpartum. More information about the study recruitment can be found on the CDC website (21). The University of Puerto Rico Medical Sciences Campus Human Research Subjects Protection Office provided Institutional Review Board approval through protocol number A39102220.

Sample

For this study, we used all the PR-PRAMS data available for 2017 through 2020. The total number of participants was 3,820 (n = 1,008 in 2017, n = 942 in 2018, n = 943 in 2019, and n = 927 in 2020). All the data included in the PR-PRAMS databases were used for the analysis presented in this paper, and no participants were excluded. In addition to the standard PRAMS questions, supplemental modules of questions were added in certain years, including a Zika-exposure module (2017), a hurricane-exposure module (2018), and a pain-medication-use module (2019).

Variables

Our dependent variable was SRPPDS, as measured by PRAMS using a modified version of the Patient Health Questionnaire-2 (PHQ-2)22. The 2 questions on the PHQ-2 were presented on a 5-point Likert scale as follows: (1) "Since your new baby was born, how often have you felt down, depressed, or hopeless?"; and (2) "Since your new baby was born, how often have you had little interest or little pleasure in doing things?" Respondents could choose from 5 response options: (1) "always," (2) "often," (3) "sometimes," (4) "rarely," and (5) "never." Respondents were classified as possibly having SRPPDS if they reported "sometimes" on either question or selected "always" or "often" for either item. Participants who answered "rarely" or "never" on both questions and did not select any of the other response categories were considered unlikely to have SRPPDS.

To evaluate possible risk factors for SRPPDS, we used variables described in a previous PRAMS article (22) and questions from modules administered specifically to the PR sample. We included, as possible risk factors, the PRAMS questions about having depression either 3 months before pregnancy or during pregnancy. These questions ask subjects to report whether they had depression or anxiety as a health condition either 3 months before or during their most recent pregnancy.

Statistical analysis methods

For this study, the data were weighted using the standard procedure for the PRAMS datasets, including site-specific birth weight, the sampling stratum, and the final population count (21). Descriptive statistics were used to characterize SRPPDS based on frequencies and proportions. Using Pearson's chi-square analysis by year, previously described risk factors for SRPPDS were compared between those women who reported SRPPDS versus those who did not. Disaster-related exposures were also evaluated as risk factors in the 2018 cohort, using chi-square analysis. Crude and adjusted logistic regression analysis was performed to determine the most significant risk factors associated with SRPPDS for each year. As documented in the literature, marital status, age, education, and income were added as potential confounders for the adjusted odds ratios (ORs) (22). Statistical significance was set at $P = .05$. All analyses were performed using Stata, version 16 (StataCorp LLC) (23).

Results

Our data show that the prevalence of self-reported postpartum depression symptoms among women in Puerto Rico with a live birth was similar to those at other PRAMS sites. The rates of SRPPDS in PR ranged from 14.8% in 2017 to 10.8% in 2018, 11.7% in 2019, and 11.3% in 2020 (Figure 1). For depressive symptoms 3 months before pregnancy, our data showed a prevalence that ranged from 5.40% to 6.93%. For depressive symptoms during pregnancy, data from the PR site showed a prevalence that ranged from 9.20% to 10.50% (Figure 1).

Across all years, risk factors more prevalent among women with SRPPDS included depression or anxiety before or during pregnancy, smoking around the time of the interview, and having endured the death of an infant at some point prior to the time of the interview (Table 2). For each cohort from 2017 through 2020, the above-mentioned risk factors have shown statistically significant differences between women who reported postpartum depression and those who did not.

Figure 1. Prevalence of self-reported depressive symptoms of women in Puerto Rico having a live birth at 3 months before pregnancy, during pregnancy, and postpartum compared to all PRAMS site for the period of 2017–2020.

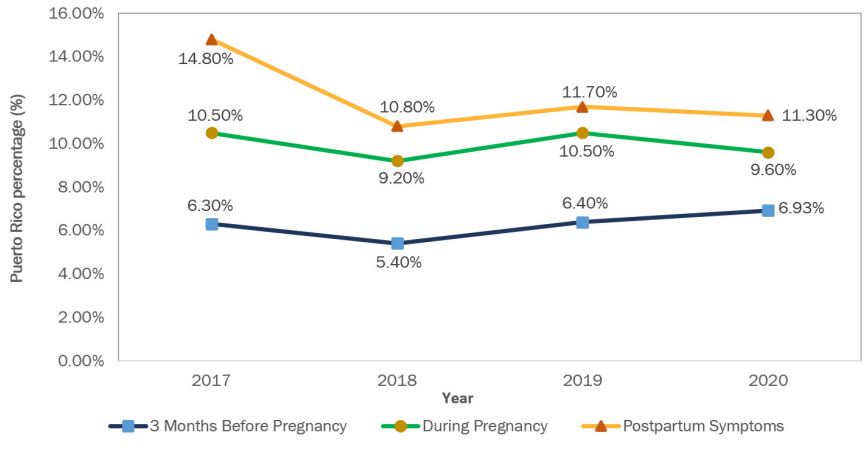


Table 1. Overall characteristics of women in Puerto Rico with a live birth: PRAMS period of 2017–2020

Characteristic	Self-reported postpartum depression symptoms			*P* value
	Total % (95% CI)	Yes % (95% CI)	No % (95% CI)	
Sociodemographic				
Marital status				.121
Married	32.63 (30.77 – 34.56)	28.53 (23.53 – 34.12)	33.17 (31.18 – 35.23)	
Other	67.37 (65.44 – 69.23)	71.47 (65.88 – 76.47)	66.83 (64.77 – 68.82)	
Maternal age				.970
≤ 17 years	3.00 (2.36 – 3.80)	2.29 (1.01 – 5.10)	3.09 (2.41 – 3.96)	
18–19 years	5.39 (4.55 – 6.37)	6.26 (3.92 – 9.86)	5.27 (4.40 – 6.32)	
20–24 years	30.20 (28.37 – 32.10)	30.04 (24.89 – 35.76)	30.23 (28.28 – 32.25)	
25–29 years	28.54 (26.75 – 30.40)	27.32 (22.37 – 32.91)	28.70 (26.79 – 30.68)	
30–34 years	20.03 (18.45 – 21.70)	20.57 (16.23 – 25.71)	19.95 (18.28 – 21.74)	
35–39 years	10.65 (9.46 – 11.98)	11.03 (7.92 – 15.17)	10.60 (9.33 – 12.03)	
40+ years	2.19 (1.69 – 2.85)	2.49 (1.20 – 5.08)	2.15 (1.63 – 2.85)	
Maternal education				.458
≤ 8th grade	1.79 (1.31 – 2.45)	2.90 (1.36 – 6.07)	1.65 (1.17 – 2.32)	
9th–12th grade	7.52 (6.49 – 8.70)	8.57 (5.70 – 12.67)	7.38 (6.30 – 8.63)	
High school	24.84 (23.11 – 26.67)	24.63 (19.83 – 30.16)	24.87 (23.03 – 26.81)	
Some college	32.87 (31.01 – 34.78)	29.49 (24.51 – 35.02)	33.31 (31.32 – 35.36)	
Bachelor's degree	32.98 (31.10 – 34.91)	34.41 (29.05 – 40.21)	32.79 (30.80 – 34.84)	
Before pregnancy				
Income (12 months before)				.787
$0-16,000	57.40 (55.30 – 59.47)	58.50 (52.38 – 64.37)	57.25 (55.02 – 59.46)	
$16,001-20,000	12.62 (11.29 – 14.09)	11.88 (8.51 – 16.34)	12.72 (11.29 – 14.30)	
$20,001-24,000	5.38 (4.52 – 6.39)	4.36 (2.49 – 7.52)	5.51 (4.59 – 6.61)	
$24,001-28,000	3.43 (2.75 – 4.28)	3.36 (1.73 – 6.42)	3.44 (2.72 – 4.36)	
$28,001-32,000	2.99 (2.36 – 3.78)	1.70 (0.68 – 4.16)	3.16 (2.48 – 4.03)	
$32,001-40,000	4.50 (3.71 – 5.44)	4.01 (2.22 – 7.12)	4.56 (3.72 – 5.59)	
$40,001-48,000	2.67 (2.09 – 3.41)	1.98 (0.88 – 4.39)	2.76 (2.13 – 3.57)	
$48,001-57,000	2.00 (1.49 – 2.67)	2.51 (1.22 – 5.12)	1.93 (1.40 – 2.65)	
$57,001-60,000	1.84 (1.33 – 2.54)	1.68 (0.58 – 4.78)	1.86 (1.32 – 2.60)	
$60,001-73,000	2.08 (1.55 – 2.80)	2.73 (1.28 – 5.73)	2.00 (1.45 – 2.75)	
$73,001-85,000	1.55 (1.09 – 2.20)	1.87 (0.71 – 4.84)	1.51 (1.04 – 2.20)	
$85,001 or more	3.54 (2.82 – 4.43)	5.42 (3.23 – 8.97)	3.29 (2.55 – 4.22)	
Feeling Down/ Depressed				.505
No	68.05 (65.73 – 70.28)	65.97 (59.07 – 72.25)	68.33 (65.86 – 70.70)	
Yes	31.95 (29.72 – 34.27)	34.03 (27.75 – 40.93)	31.67 (29.30 – 34.14)	
Depression				≤.001*
No	94.19 (93.17 – 95.06)	82.19 (77.26 – 86.25)	95.77 (94.81 – 96.56)	
Yes	5.81 (4.94 – 6.83)	17.81 (13.75 – 22.74)	4.23 (3.45 – 5.19)	
Anxiety				≤.001*
No	86.16 (84.72 – 87.49)	70.53 (64.92 – 75.58)	88.22 (86.78 – 89.53)	
Yes	13.84 (12.51 – 15.28)	29.47 (24.42 – 35.08)	11.78 (10.47 – 13.22)	
Abused in the 12 months before pregnancy				≤.001*
No	99.07 (98.55 – 99.40)	96.37 (93.06 – 98.13)	99.42 (98.96 – 99.68)	
Yes	0.93 (0.60 – 1.45)	3.63 (1.87 – 6.94)	0.58 (0.32 – 1.01)	
During pregnancy				
Insurance paid by job				.604
No	70.77 (68.88 – 72.59)	72.12 (66.49 – 77.13)	70.59 (68.58 – 72.53)	
Yes	29.23 (27.41 – 31.12)	27.88 (22.87 – 33.51)	29.41 (27.47 – 31.42)	
Insurance paid by parent				.730
No	94.91 (93.94 – 95.74)	95.36 (91.99 – 97.35)	94.86 (93.81 – 95.73)	
Yes	5.09 (4.26 – 6.06)	4.64 (2.65 – 8.01)	5.14 (4.27 – 6.19)	
Insurance paid by Medicaid				.596
No	34.38 (32.47 – 36.34)	32.94 (27.59 – 38.77)	34.57 (32.54 – 36.66)	
Yes	65.62 (63.66 – 67.53)	67.06 (61.23 – 72.41)	65.43 (63.34 – 67.46)	
Insurance paid by state (TRICARE or military)				.016*
No	99.26 (98.81 – 99.54)	98.06 (95.47 – 99.18)	99.42 (98.97 – 99.67)	
Yes	0.74 (0.46 – 1.19)	1.94 (0.82 – 4.53)	0.58 (0.33 – 1.03)	
Insurance paid by other				.841
No	97.81 (97.12 – 98.34)	97.64 (94.97 – 98.91)	97.83 (97.10 – 98.39)	
Yes	2.19 (1.66 – 2.88)	2.36 (1.09 – 5.03)	2.17 (1.61 – 2.90)	

Characteristic	Self-reported postpartum depression symptoms			*P* value
	Total % (95% CI)	Yes % (95% CI)	No % (95% CI)	
Depression				≤.001*
No	90.33 (89.06 – 91.47)	75.22 (69.79 – 79.96)	92.31 (91.07 – 93.40)	
Yes	9.67 (8.53 – 10.94)	24.78 (20.04 – 30.21)	7.69 (6.60 – 8.93)	
Anxiety				≤.001*
No	84.06 (82.54 – 85.48)	67.54 (61.80 – 72.80)	86.23 (84.69 – 87.64)	
Yes	15.94 (14.52 – 17.46)	32.46 (27.20 – 38.20)	13.77 (12.36 – 15.31)	
Abused during pregnancy by partner				≤.001*
No	98.56 (97.93 – 99.00)	94.97 (91.31 – 97.13)	99.04 (98.45 – 99.40)	
Yes	1.44 (1.00 – 2.07)	5.03 (2.87 – 8.69)	0.96 (0.60 – 1.55)	
Smoked during the last 3 months of pregnancy				≤.001*
No	98.94 (98.45 – 99.27)	95.73 (92.55 – 97.59)	99.35 (98.94 – 99.61)	
Yes	1.06 (0.73 – 1.55)	4.27 (2.41 – 7.45)	0.65 (0.39 – 1.06)	
Health Related				
Healthcare provider talked about depression				.014*
No	48.62 (46.59 – 50.66)	55.64 (49.67 – 61.44)	47.70 (45.54 – 49.88)	
Yes	51.38 (49.34 – 53.41)	44.36 (38.56 – 50.33)	52.30 (50.12 – 54.46)	
Smoked at interview				≤.001*
No	97.34 (96.60 – 97.92)	92.90 (89.20 – 95.40)	97.92 (97.21 – 98.45)	
Yes	2.66 (2.08 – 3.40)	7.10 (4.60 – 10.80)	2.08 (1.55 – 2.79)	
Infant had died prior to interview				≤.001*
No	99.72 (99.57 – 99.82)	98.70 (97.38 – 99.36)	99.86 (99.78 – 99.91)	
Yes	0.28 (0.18 – 0.43)	1.30 (0.64 – 2.62)	0.14 (0.09 – 0.22)	

Abbreviations: PRAMS, Pregnancy Risk Assessment Monitoring System; TRICARE, Treatment, Retired, Invalid, Care for Active and Retired Employees

Even though the overall rates for SRPPDS and for depression before and during pregnancy were comparable across the 4 years, we did see some distinct trends when analyzing only women with SRPPDS. Among women with SRPPDS, depression before pregnancy increased from 15.03% in 2017 to 23.65% in 2020; over the same period, anxiety before pregnancy rose from 25.43% to 40.77%. Similarly, depression during pregnancy and anxiety during pregnancy also increased from 2017 through 2020.

The proportion of women with SRPPDS who reported talking with a health worker decreased over time. In 2017, 48.42% of the participating women reported talking to a healthcare provider about having SRPPDS, whereas in 2020, only 44.21% reported doing so.

Factors that remained relatively stable across cohorts included smoking in the last 3 months of pregnancy, smoking around the time of the interview, and experiencing abuse by a partner during the 12 months before pregnancy. However, during this period, having a history of abuse before pregnancy was related to SRPPDS only in the 2017 and 2018 cohorts, and abuse during pregnancy and smoking during pregnancy were related to SRPPDS in all the cohorts except for that of 2020. For the variable of being abused by a partner during pregnancy, we see that the proportion of women having postpartum depression significantly increased in 2017 compared to 2018 and 2019. In addition, it is important to highlight that for the 2018 cohort, in the aftermath of 2 major hurricane events (Hurricanes Irma and Maria) in PR, the proportions of women with anxiety before pregnancy and with depression and anxiety during pregnancy were higher in the group with SRPPDS than in the same group in 2017 (Table 2).

Using the specific disaster-related module for the 2018 cohort, we observed that factors related to disaster exposures were significantly more prevalent among women who reported SRPPDS (Table 3). For example, reporting losing personal belongings (P = .012), walking in debris or floodwater (P = .047), trouble getting food because the stores were closed (P = .045), having no cash to get food (P = .002), and being worried about finding baby formula (P = .026) were significantly more prevalent in women who presented SRPPDS than in those that did not.

The most significant risk factors associated with SRPPDS in the logistic regression analysis across all the cohorts were symptoms of depression or anxiety before or during the pregnancy and smoking around the time of the interview (Table 4). After adjusting for marital status, age, education, and income for the year 2017, women who reported having depression symptoms before pregnancy had 4.51 times the odds (95% CI, 2.02 – 10.05) of reporting postpartum depression symptoms compared to women who did not report having depression symptoms before pregnancy. For the 2020 cohort, this probability was higher (OR: 8.35; 95% CI, 3.74 – 18.61). Similarly, for women reporting anxiety before pregnancy, the likelihood of having SRPPDS increased from 2.86 times (95% CI, 1.52 – 5.38) in the 2017 cohort to 4.97 times (95% CI, 2.76 – 8.95) times in the 2020 cohort, after adjusting for selected sociodemographic variables. This trend was also observed for the women reporting depression or anxiety during pregnancy (Table 4).

Having a healthcare provider discuss depression was associated with a 46% lower likelihood of SRPPDS in the 2019 cohort compared to women who did not have such discussions. Variables related to abuse by a partner were difficult to assess due to their relatively low prevalence in some of the cohorts. However, in the 2019 cohort, after adjusting for marital status, age, education,

Table 2. Related risk factors of self-reported postpartum depression symptoms by year for women in Puerto Rico with a live birth

Characteristic	Self-reported Postpartum Depression Symptoms											
	2017			2018			2019			2020		
	Yes % 95% CI	No % 95% CI	*P* value	Yes % 95% CI	No % 95% CI	*P* value	Yes % 95% CI	No % 95% CI	*P* value	Yes % 95% CI	No % 95% CI	*P* value
Depression before pregnancy	15.35% (9.04–24.86)	4.13% (2.70–6.25)	≤.001*	14.97% (8.08–26.06)	3.69% (2.36–5.71)	≤.001*	17.68% (10.39–28.45)	4.41% (2.99–6.48)	≤.001*	23.65% (15.04–5.16)	4.74% (3.20–6.96)	≤.001*
Anxiety before pregnancy	25.43% (17.12–36.02)	12.26% (9.67–15.42)	.002*	28.59% (18.64–41.16)	9.55% (7.31–12.38)	≤.001*	24.13% (15.61–35.35)	11.96% (9.53–14.90)	.004*	40.77% (29.87–52.67)	13.72% (11.04–16.92)	≤.001*
Healthcare provider talked about depression	48.42% (37.53–59.46)	52.59% (48.13–57.01)	.496	46.92% (34.67–59.55)	51.91% (47.5–56.24)	.467	38.21% (27.53–50.17)	54.35% (50.14–58.50)	.012*	44.21% (33.01–56.03)	50.29% (46.02–54.55)	.342
Depression during pregnancy	20.65% (13.16–30.89)	9.41% (7.08–12.42)	.003*	22.46% (13.73–34.52)	7.79% (5.74–10.48)	≤.001*	23.00% (14.59–34.31)	7.49% (5.54–10.05)	≤.001*	33.66% (23.46–45.64)	6.38% (4.60–8.79)	≤.001*
Anxiety during pregnancy	26.06% (17.61–36.74)	13.88% (11.13–17.19)	.005*	34.35% (23.51–47.11)	10.19% (7.88–13.08)	≤.001*	25.86% (16.95–37.35)	16.22% (13.34–19.58)	.045*	44.59% (33.36–56.39)	15.11% (12.32–18.39)	≤.001*
Abused during pregnancy by partner	4.58% (1.53–12.87)	0.95% (0.36–2.52)	.020*	7.10% (2.55–18.27)	1.46% (0.67–3.17)	.008*	6.79% (2.63–16.41)	0.70% (0.25–1.92)	≤.001*	1.57% (0.22–10.38)	0.71% (0.24–2.07)	.472
Abused in 12 months before pregnancy	4.14% (1.33–12.15)	0.56% (0.16–1.95)	.006*	5.10% (1.52–15.78)	0.50% (0.14–1.86)	.002*	2.01% (0.34–11.09)	0.29% (0.07–1.22)	.054	3.34% (0.83–12.44)	0.98% (0.39–2.43)	.122
Smoked last 3 months of pregnancy	5.02% (1.89–12.67)	1.00% (0.42–2.36)	.007*	3.08% (0.76–11.64)	0.57% (0.20–1.60)	2.97%	.033* (0.74–11.14)	0.72% (0.28–1.83)	.070	6.20% (2.26–15.88)	0.36% (0.11–1.18)	≤.001*
Smoked at interview	6.03% (2.54–13.62)	2.75% (1.62–4.65)	.118	7.14% (2.90–16.56)	1.90% (1.03–3.47)	.010*	7.09% (2.92–16.24)	2.10% (1.17–3.73)	.017*	8.19% (3.54–17.85)	1.71% (0.88–3.32)	.002*
Infant had died prior to interview	0.50% (0.15–1.62)	0.08% (0.03–0.23)	.010*	0.60% (0.19–1.88)	0.15% (0.07–0.35)	.042*	2.06% (0.45–8.90)	0.11% (0.04–0.06)	≤.001*	2.07% (1.00–4.23)	0.22% (0.10–0.46)	≤.001*

*Statistical significance was determined using design-based *P* values ≤ .05 for the comparison of postpartum depression with the selected characteristics by study year.

and income, women who reported being abused by their partner during pregnancy had significantly higher odds of SRPPDS (OR: 9.94; 95% CI, 1.96 – 50.44). Women reporting such abuse in the 12 months before pregnancy had 11 times higher odds of SRPPDS (95% CI, 0.98 – 129.40) than women who did not experience abuse. Still, this increase was significant only for those who reported experiencing abuse during their pregnancy. Having endured the death of an infant at some point prior to the time of the interview, was also a variable that predicted SRPPDS in all the cohorts except for that of 2018. However, after adjustment, women in the 2019 cohort who reported the death of their infant by the time of the interview had 30.11 times higher odds (95% CI, 5.08 – 178.67) of having SRPPDS compared to women who did not report such a death (Table 2).

Discussion

This study aimed to identify risk factors associated with SRPPDS among women in PR having a live birth from 2017 through 2020. In a 2018 study that presented the composite prevalence of SRPPDS across PRAMS sites, this prevalence was 13.20%, falling within the range of 9.7% to 23.5% (22). Compared to the cohorts of other PRAMS sites, the PR cohort had similar rates of SRPPDS but lower rates of depression before pregnancy as well as lower rates during pregnancy (22). We identified 3 significant risk factors related to SRPPDS that were consistent throughout the years studied. These were self-reported depression and anxiety before and during pregnancy, smoking around the time of the interview, and having endured the death of an infant at some point prior to

Table 3. Differences in disaster-related exposures of women in Puerto Rico with a live birth in the year 2018 by self-reported postpartum depression symptom category

Disaster-related exposure	Self-reported postpartum depression symptoms		*P* value
	Yes (%)	No (%)	
Felt unsafe			.071
Yes	82.76 (68.62–91.34)	69.41 (63.65–74.61)	
No	17.24 (8.66–31.38)	30.59 (25.39–36.35)	
Lost personal belongings			.012*
Yes	53.87 (38.67–68.38)	33.46 (28.07–39.32)	
No	46.13 (31.62–61.33)	66.54 (60.68–71.93)	
Walked through debris/ floodwater			.047*
Yes	47.48 (32.84–62.56)	31.69 (26.37–37.54)	
No	52.52 (37.44–67.16)	68.31 (62.46–73.63)	
Were injured/became ill			.167
Yes	17.59 (8.79–32.10)	10.32 (7.18–14.61)	
No	82.41 (67.90–91.21)	89.68 (85.39–92.82)	
Had trouble getting food: stores closed			.045*
Yes	63.06 (47.42–76.37)	46.17 (40.26–52.19)	
No	36.94 (23.63–52.58)	53.83 (47.81–59.74)	
Had trouble getting food: no cash			.002*
Yes	65.74 (50.29–78.44)	40.06 (34.37–46.04)	
No	34.26 (21.56–49.71)	59.94 (53.96–65.63)	
Had trouble getting food: no SNAP			.057
Yes	44.09 (29.86–59.37)	29.30 (24.20–34.98)	
No	55.91 (40.63–70.14)	70.70 (65.02–75.80)	
Had trouble getting clean water			.061
Yes	66.43 (50.66–79.23)	50.59 (44.61–56.56)	
No	33.57 (20.77–49.34)	49.41 (43.44–55.39)	
Worried about not having formula			.026*
Yes	46.41 (31.68–61.80)	28.85 (23.79–34.49)	
No	53.59 (38.20–68.32)	71.15 (65.51–76.21)	

Abbreviation: SNAP, Supplemental Nutrition Assistance Program
Data only from PRAMS 2018 (after Hurricane Maria). *Significance was determined using design-based P values ≤ .05 for the comparison of postpartum depression with the selected characteristics by study year.

the interview. We also found some specific risk factors for women in PR when evaluating the data for exposure to disaster.

The most robust associations with SRPPDS are depression and anxiety before and during pregnancy. While these findings are not surprising, they highlight the importance of screening for depression and anxiety when caring for pregnant and postpartum women. Various professional organizations such as the American Academy of Pediatrics (24), the American College of Obstetricians and Gynecology (25), and the United States Preventive Services Task Force (26) have issued recommendations for screening for depression during pregnancy and postpartum. However, there are still disparities present throughout the U.S. A 2020 review by the CDC (22) revealed that PR had the lowest prevalence rate of screening for depression during perinatal (51.3%) and postpartum care visits (50.7%) of the 31 sites surveyed. In the present study, the proportion of women who talked to a healthcare provider about depression declined each year. This trend goes against the recommendations for care and emphasizes the critical need to reinforce provider awareness of mental health screening and education.

Comparable to previous reports, we observed a significant association between SRPPDS and smoking. In a cohort of Puerto Rican and Dominican women in Western Massachusetts, the failure to discontinue cigarette smoking at the onset of pregnancy was associated with a higher risk of depressive symptoms in early pregnancy (27). Our study found that smoking around the time of the interview and during the last 3 months of pregnancy was associated with experiencing SRPPDS. This finding underscores the need to increase awareness of how smoking during pregnancy affects maternal mental health. Smoking should be consistently included as a risk factor for postpartum depression.

Experiencing the death of an infant was significantly associated with SRPPDS. This finding is consistent with that of a previous study that indicated that perinatal loss significantly predicts self-reported depression (28). To minimize risk, providers should be made aware of resources for mental health support after a woman experiences the death of her infant. Our findings also emphasize the role of exposure to partner abuse as a possible contributor to SRPPDS. The positive association between interpersonal partner violence and postpartum depression has been widely documented (29–31).

One of the most interesting associations found was between hurricane-related exposures and SRPPDS. A recent publication evaluated this association in the PR-PRAMS cohort. Hurricane experiences were associated with an increased prevalence of postpartum depression, with "feeling unsafe" and "having difficulty getting food" presenting the strongest associations (32), which is consistent with our findings. Anxiety before and during pregnancy and depression during pregnancy increased in 2018, the year after

Table 4. Adjusted logistic regression analysis of selected risk factors and self-reported postpartum depression symptoms by year of women in Puerto Rico with a live birth

Risk factor	2017		2018		2019		2020	
	Adjusted‡ OR (95% CI)	*P* value	Adjusted‡ OR (95% CI)	*P* value	Adjusted‡ OR (95% CI)	*P* value	Adjusted‡ OR (95% CI)	*P* value
Healthcare Provider Practices								
Healthcare provider talked about depression	0.72 (0.42–1.25)	.245	0.71 (0.41–1.25)§	.237	0.54 (0.30–0.97)	.039*	0.87 (0.49–1.55)	.640
Depression during pregnancy	2.38 (1.15–4.93)§	.020*	3.37 (1.52–7.47)	.003*	4.33 (2.09–8.96)	≤.001*	11.26 (5.68–22.30)§	≤.001*
Maternal Mental Health before Pregnancy								
Depression before pregnancy	4.51 (2.02–10.07)§	≤.001*	4.97 (1.90–12.96)	≤.001*	5.09 (2.21–11.73)§	≤.001*	8.35 (3.74–18.61)	≤.001*
Anxiety before pregnancy	2.86 (1.52–5.38)	≤.001*	4.27 (2.11–8.62)	≤.001*	2.46 (1.23–4.92)	.011*	4.97 (2.76–8.95)§	≤.001*
Abused in 12 months before pregnancy	6.21 (–)§		8.22 (1.35–50.16)§	.023*	11.27 (0.98–129.04)	.052	2.76 (0.43–17.76)	.286
Maternal Mental Health During Pregnancy								
Anxiety during pregnancy	2.49 (1.34–4.63)	.004*	4.89 (2.44–9.80)	≤.001*	1.72 (0.90–3.29)§	.103	4.62 (2.59–8.25)	≤.001*
Abused during pregnancy by partner	7.00 (–)§		6.86 (1.70–27.62)§	.007*	9.94 (1.96–50.44)§	.006*	2.00 (0.09–43.08)§	.659
Smoked last 3 months of pregnancy	5.37 (1.20–23.93)	.028*	5.18 (0.99–27.17)	.052	4.77 (0.64–35.55)	.127	28.02 (5.37–146.15) §	≤.001*
Other risk factors at the time of the interview								
Smoked at interview	3.07 (0.91 – 10.37)	.071	3.78 (1.13 – 12.65)	.031*	5.23 (1.38 – 19.76)	.015*	5.41 (1.86 – 15.75)	.002*
Infant had died prior to interview	5.58 (1.02 – 30.40)§	.047*	4.26 (0.86 – 21.01)§	.075	30.11 (5.08 – 178.67)§	≤.001*	13.41 (3.98 – 45.17)	≤.001*

Abbreviation: OR, odds ratio
‡OR (95% CI) was adjusted by marital status, age, education, and income.
§The goodness-of-fit test showed that this adjustment was not the best model for this risk factor.

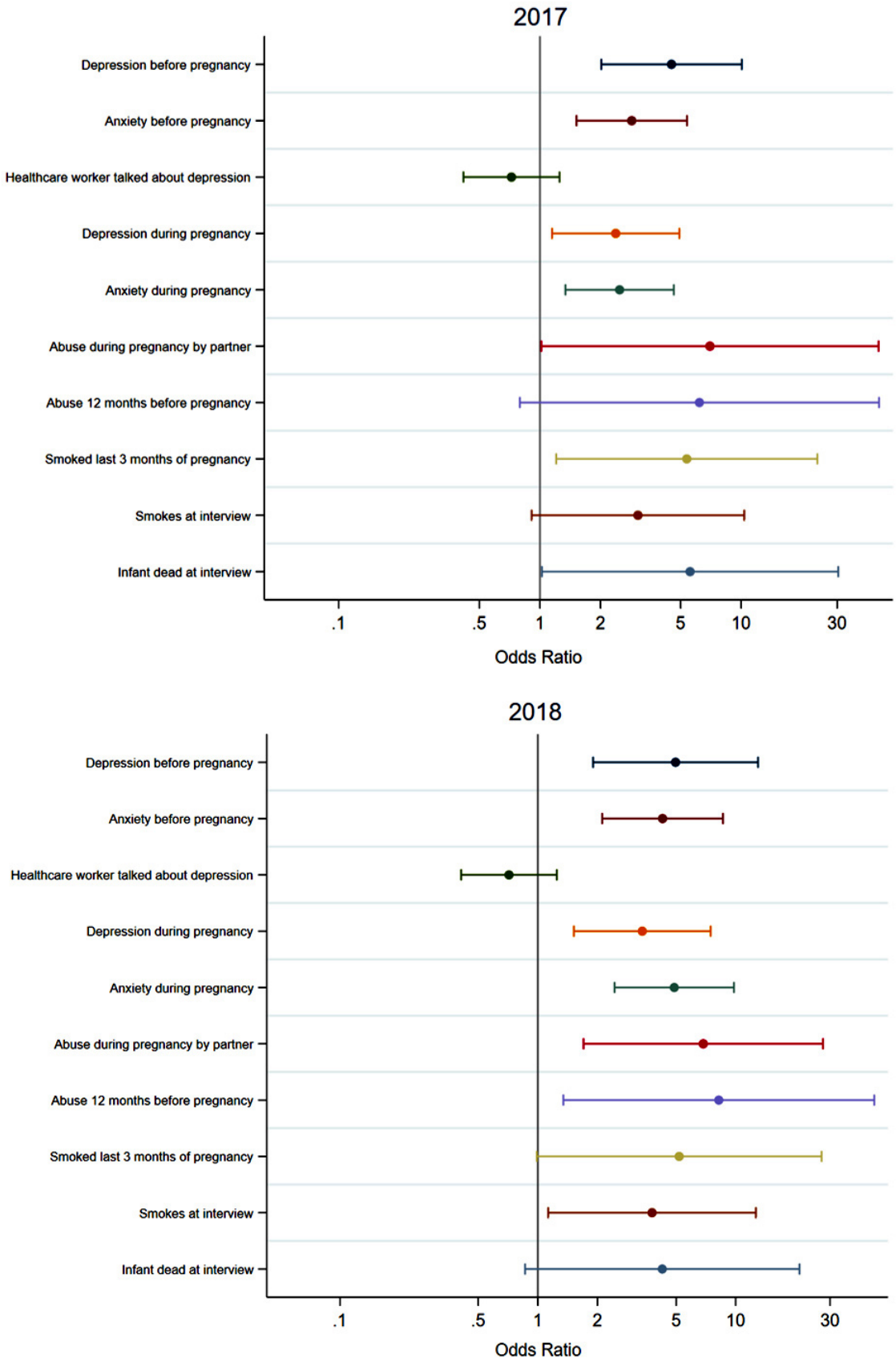
the 2 major hurricanes mentioned above hit the island. These findings highlight the importance of disaster preparedness and response programs for pregnant and postpartum women and should guide future efforts to mitigate postpartum depression after natural disasters.

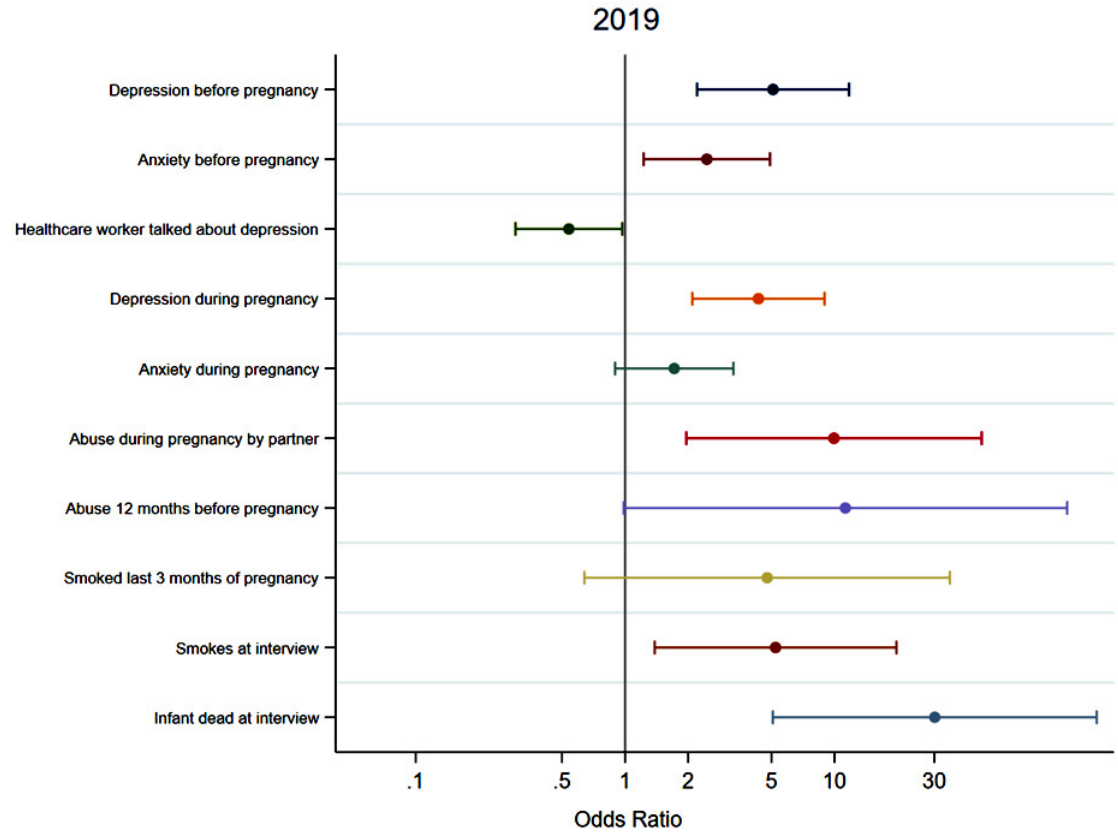
While the data presented expand the knowledge of perinatal mental health in PR, there are possible limitations to consider. The PRAMS data were self-reported and collected via interviews of women in PR with a live birth. These data may not be representative of other perinatal populations on the island, and recall bias could have skewed the results for the periods before and during pregnancy. In addition, there are more comprehensive perinatal mental health screening tools than the PHQ-2 that may be better suited to determine the prevalence of symptoms related to depression before, during, and after pregnancy.

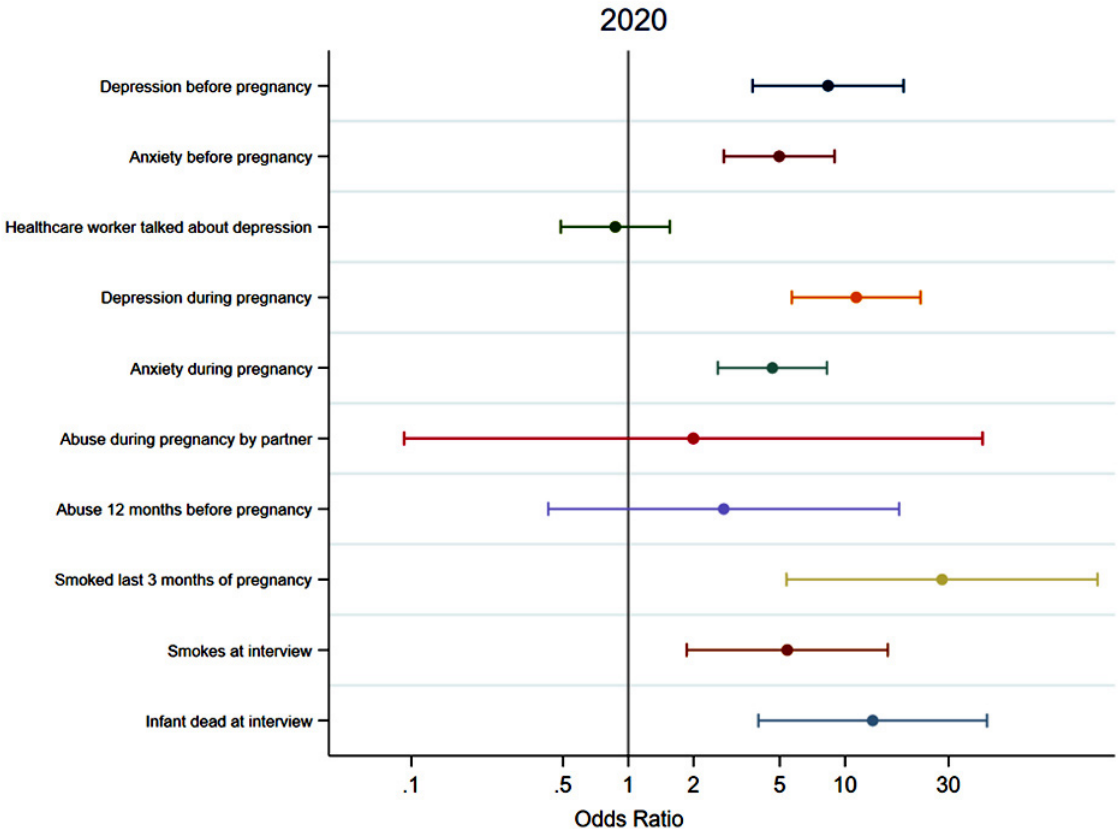
Conclusions

To provide comprehensive perinatal care, providers must understand the risk factors associated with mental health symptoms. This is the first study to present data on SRPPDS among Puerto Rican women living on the island. While the rates of SRPPDS in this sample are comparable to those reported by PRAMS sites in the continental U.S., differences in the factors associated with self-reported symptoms were identified. Our findings highlight the importance of reinforcing preparedness and response protocols while considering the unique physical and emotional needs of pregnant and postpartum women. Due to the adverse effects related to untreated mental health disorders, professionals who have direct contact with mothers and women of reproductive age should know how to screen for and identify

Figure 2. Boxplot of odds ratios of evaluated risk factors for self-reported postpartum depressive symptoms in PR-PRAMS by year of survey.




2019
Depression before pregnancy
Anxiety before pregnancy
Healthcare worker talked about depression
Depression during pregnancy
Anxiety during pregnancy
Abuse during pregnancy by partner
Abuse 12 months before pregnancy
Smoked last 3 months of pregnancy
Smokes at interview
Infant dead at interview
.1
.5
1
2
5
10
30
Odds Ratio


2020
Depression before pregnancy
Anxiety before pregnancy
Healthcare worker talked about depression
Depression during pregnancy
Anxiety during pregnancy
Abuse during pregnancy by partner
Abuse 12 months before pregnancy
Smoked last 3 months of pregnancy
Smokes at interview
Infant dead at interview
.1
.5
1
2
5
10
30
Odds Ratio

these disorders. More studies on risk factors in diverse populations should be conducted to support the timely identification of at-risk women and their referral for treatment during the perinatal period.

Resumen

Objetivos: El objetivo de este artículo es abordar la falta de datos sobre la depresión posparto auto informada entre mujeres en Puerto Rico con un nacido vivo. Métodos: Examinamos los datos del cuestionario del Sistema de Monitoreo de Evaluación de Riesgos del Embarazo de Puerto Rico (PRAMS) para evaluar los síntomas depresivos posparto (SRPPDS) auto informados entre mujeres hispanas con un nacido vivo. Resultados: La prevalencia de SRPPDS entre mujeres hispanas en Puerto Rico con un nacido vivo fue similar a la reportada por otros sitios de PRAMS. En general, el 9,67% de los encuestados informaron tener SRPPDS, y no varió según el estado civil, la edad materna, la educación materna o los ingresos (P > 0,05). Los factores de riesgo que fueron significativamente más frecuentes entre las mujeres que informaron SRPPDS durante el período de estudio incluyeron 1) depresión y ansiedad antes del embarazo, 2) depresión y ansiedad durante el embarazo, y 3) tabaquismo en el momento de la entrevista, y 4) exposición a factores estresantes relacionados con el desastre después del huracán María. Conclusiones: Nuestros hallazgos muestran que las mujeres hispanas en Puerto Rico que tuvieron nacidos vivos tienen tasas similares de SRPPDS en comparación con las de otras áreas de los EE. UU.; sin embargo, los factores de riesgo específicos para esta población incluyen la exposición a desastres.

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