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Short communication

Vulnerability and resilience to pandemic-related stress among U.S. women pregnant at the start of the COVID-19 pandemic

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ABSTRACT

Rationale: Women pregnant during the COVID-19 pandemic are experiencing moderate to high levels of emotional distress, which has previously been shown to be attributable to two types of pandemic-related pregnancy stress: stress associated with feeling unprepared for birth due to the pandemic (Preparedness Stress) and stress related to fears of perinatal COVID-19 infection (Perinatal Infection Stress). *Objective.* Given the well-documented harms associated with elevated prenatal stress and the critical importance of developing appropriately targeted interventions, we investigated factors predictive of pandemic-related pregnancy stress. *Method.* Between April 25 and May 15, 2020, 4,451 pregnant women in the U.S. were recruited via social media to complete an online questionnaire that included sociodemographic, medical, and COVID-19 situational factors, as well as the Pandemic-Related Pregnancy Stress Scale (PREPS). Binary logistic regression was used to calculate odds ratios for high stress. *Results.* Nearly 30% of participants reported high Preparedness Stress; a similar proportion reported high Perinatal Infection Stress. Abuse history, chronic illness, income loss due to the pandemic, perceived risk of having had COVID-19, alterations to prenatal appointments, high-risk pregnancy, and being a woman of color were associated with greater levels of one or both types of stress. Access to outdoor space, older age, and engagement in healthy behaviors were protective against stress. *Conclusions.* Practices that may alleviate pandemic-related stress such as minimizing disruptions to prenatal care, ensuring access to outdoor space, and motivating engagement in health behaviors are of vital importance. Particular attention is needed for more vulnerable populations including women of color, women with a history of abuse, and those with high-risk pregnancy. Research focused on the short and longer-term impact of pandemic-related pregnancy stress on maternal mental and physical health, perinatal outcomes, and child development is critical to identify these effects and marshal appropriate resources to reduce them.

1. Introduction

Experiencing a natural disaster or state of emergency during pregnancy is known to contribute to elevated emotional distress (Brooks et al., 2020; Glynn et al., 2001), a well-documented risk factor in pregnancy for adverse maternal and infant outcomes, including preterm birth, low birth weight, maternal mood disorders, and infant developmental delays (Field, 2017; Ibrahim and Lobel, 2020; Lee, 2014). Emerging evidence from around the world indicates that women pregnant during the current COVID-19 pandemic are experiencing moderate to high levels of psychological distress (Saccone et al., 2020; Taubman –

Ben-Ari et al., 2020; Wu et al., 2020). This finding is a likely the result of the social, economic, and healthcare disruptions that are affecting pregnant women and their families as well as uncertainty regarding the effect of COVID-19 on the fetus (Caparros-Gonzalez and Alderdice, 2020; Kelly et al., 2020; Lebel et al., 2020).

Previous research has identified several risk factors for elevated maternal stress, including primiparity, younger age, history of abuse, unplanned pregnancy, financial strain, being a woman of color, and pregnancy complications (see reviews by Bayrampour et al., 2018; Ibrahim and Lobel, 2020). Nonetheless, the specific factors contributing to women's elevated pandemic related stress have not been

well-identified. Recent research identified two major pandemic-related stress domains for pregnant women in the U.S., Poland, Israel, and Germany: stress associated with feeling unprepared for birth due to the COVID-19 pandemic and stress related to fears of perinatal COVID-19 infection (Kołodziej-Zaleska et al., Under review; Preis et al., 2020a; Schaal et al., under review; Yirmiya et al., under review). Both pandemic-related 'Preparedness Stress' and 'Perinatal Infection Stress' predict elevated anxiety symptoms, even after controlling for other predictive factors (Preis et al., 2020a,b).

Given the risks associated with elevated prenatal psychological stress and anxiety, and the critical importance of developing evidence-based, appropriately targeted interventions, we investigated which sociodemographic, medical, and situational factors are most associated with greater pandemic-related pregnancy stress among pregnant women in the U.S. and which appear to be protective.

2. Method

Between April 25 and May 15, 2020 (six to nine weeks after the announcement of COVID-19 as a global pandemic by the World Health Organization), 4,451 pregnant women in the U.S. 18+ years of age were recruited through social media to participate in the COVID-19 Pregnancy Experiences (COPE) Study. Facebook-paid advertisements targeted women in the U.S. with pregnancy-related interests. In addition, research assistants posted an identical advertisement for the study on various pregnancy-related social media groups and pages (i.e., Facebook, Instagram, and Reddit). The advertisement included a request to share pregnancy-related experiences during the COVID-19 pandemic. Participants completed the questionnaire through Qualtrics, secure survey software, qualifying them for entry into a raffle for a $100 gift certificate awarded to one in every 100 participants. The study was approved by the Institutional Review Board of Stony Brook University.

The study questionnaire included sociodemographic factors (e.g., age, race/ethnicity), medical factors (e.g., parity, chronic illness), COVID-19 situational factors (e.g., COVID-19 related income loss, being diagnosed with COVID-19), and the Pandemic-Related Pregnancy Stress Scale (PREPS) (Preis et al., 2020b). The PREPS is a recently validated instrument that includes two internally consistent, pandemic-specific prenatal stress factors: Preparedness Stress and Perinatal Infection Stress. Preparedness Stress relates to feeling unprepared for birth or postpartum due to the pandemic. It is comprised of seven items such as "I am worried that the pandemic could ruin my birth plans." Perinatal Infection Stress refers to concerns related to infection to oneself or the fetus/baby. It is comprised of five items such as "I am worried that my baby could get COVID-19 at the hospital after birth." The Preparedness Stress and Perinatal Infection Stress factors are internally consistent (αs = 0.81 and 0.86, respectively) and are moderately correlated ($r = 0.59$, $p < 0.001$). Scores for each PREPS scale are calculated as mean item response on a scale from 1 = *Very little* to 5 = *Very much*.

We used binary logistic regression to calculate unadjusted and adjusted odds for high levels of Preparedness Stress and Perinatal Infection Stress. Cut-off scores (≥4 on the 1–5 response scale) were used to identify women most likely to suffer from moderate or severe levels of stress and to enhance the interpretability of study results. The unadjusted model reveals bivariate associations among predictors and stress outcomes, whereas the adjusted, multivariate models identify the independent association of each predictor after controlling for all other predictors.

3. Results

Participants were on average 30.8 ± 4.7 years old, with an average gestational age of 27 weeks. Participants were from all 50 states, and approximately half were primiparas (n = 2,270, 51.0%). Approximately four-fifths of the sample (n = 3,651; 82%) identified themselves as Non-Hispanic/Latino and White; one-fifth (n = 800; 18%) identified as

Hispanic/Latino (n = 420, 9.4%), Black/African American (n = 206; 4.6%), Asian American (n = 128; 2.9%), Native American (n = 105; 2.4%), or Other (n = 134, 3.0%) (numbers and percentages exceed 4,451 and 100% because some women endorsed multiple racial/ethnic categories). Fifty-three women (1.2%) reported being diagnosed with COVID-19 during pregnancy, and one-third (n = 1,483, 33.3%) thought they might have contracted COVID-19 during pregnancy but were not diagnosed. Nearly half of the sample (n = 2,037, 45.8%) lost income due to the pandemic, and 53.4% (n = 2,376) reported having prenatal appointments cancelled or rescheduled due to the pandemic. A large majority (n = 4,002, 89.9%) reported having access to outdoor space "whenever I want" or "sometimes" (versus rarely), and over half of the women (n = 2,492, 56.0%) reported that they were involved in healthy activities (e.g., "eat well, take vitamins, exercise, sleep enough"), scoring at least 4 on the 1 = *Very little* to 5 = *Very much* response scale for this item.

Nearly 30% of participants reported high levels of Preparedness Stress (27.2%) and Perinatal Infection Stress (29.1%), with 17.9% of the sample reporting high levels of both. As can be seen in Table 1, in the unadjusted model, Preparedness Stress was predicted by an assortment of sociodemographic, medical, and COVID-related situational factors and Perinatal Infection Stress was predicted by a slightly different constellation of factors. Common risk factors across the unadjusted models predicting Preparedness Stress and Perinatal Infection Stress included sociodemographic vulnerability (e.g., experiencing previous abuse, below average financial status, being a woman of color, not having private insurance) and medical vulnerability (e.g., chronic illness, high-risk pregnancy status). Having access to outdoor space and engaging in healthy prenatal behaviors were associated with lower odds of both types of stress in the unadjusted models.

In the adjusted model, high Preparedness Stress was independently predicted by nine factors: previous abuse, primiparity, unplanned pregnancy, self-reported high-risk pregnancy status, multiple pregnancy, chronic illness, COVID-19 related income loss, perceiving that one had been infected, and experiencing alterations of prenatal care (AORs = 1.19–1.78). Older age, healthy behaviors, and access to outdoor space were each independently protective against high levels of this type of stress (AORs = 0.63–0.94).

In the adjusted model, high Perinatal Infection Stress was independently predicted by nine factors: being a woman of color, lack of a marital or cohabiting relationship, previous abuse, previous pregnancy loss, self-reported high-risk pregnancy status, chronic illness, COVID-19 related income loss, perceiving that one had been infected, and experiencing alterations to prenatal care (AORs = 1.19–1.53). Older age and access to outdoor space were protective against Perinatal Infection Stress (AORs = 0.67–0.98).

Neither gestational age, fertility treatment (endorsed by 10.6% of the sample), psychiatric medication use (endorsed by 12.1% of the sample), nor diagnosis of COVID-19 during pregnancy were significant predictors of high stress in the unadjusted or adjusted models, indicating that high stress was equally common for women irrespective of these characteristics.

4. Discussion

In the current study, nearly a third of women pregnant during the outbreak of the COVID-19 pandemic experienced elevated levels of stress related to feeling unprepared for birth or being worried about perinatal infection. These high levels of stress appear to be especially common among particular groups of women, including those identified by prior research as vulnerable to high maternal stress: primiparas, women with high risk or unplanned pregnancy, and survivors of abuse (see review by Ibrahim and Lobel, 2020). Although comprising a relatively small portion of the study sample, it is notable that woman of color also reported higher pandemic-related stress. This type of stress coupled with the stressful nature of racial discrimination is an especially

Table 1
Binary multivariate logistic regression predicting high levels of Pandemic-related Pregnancy Stress ($N = 4,451$).

	Preparedness Stress				Perinatal Infection Stress			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	OR	95% *CI*	AOR	95% *CI*	OR	95% *CI*	AOR	95% *CI*
Sociodemographic factors								
Maternal age	0.93***	(0.92,0.94)	0.94***	(0.93,0.96)	0.98*	(0.97,0.99)	0.98*	(0.96,0.99)
Women of color[a]	1.40***	(1.20,1.64)	1.09	(0.91,1.29)	1.61***	(1.37,1.89)	1.40***	(1.18,1.66)
Not married/cohabiting	2.00***	(1.62,2.48)	1.14	(0.88,1.47)	1.79***	(1.44,2.23)	1.32*	(1.02,1.70)
Financial insecurity	1.87***	(1.59,2.20)	1.05	(0.85,1.30)	1.50***	(1.27,1.77)	0.92	(0.74,1.15)
Medicaid or uninsured	1.67***	(1.41,1.97)	1.09	(0.86,1.33)	1.54***	(1.30,1.83)	1.09	(0.89,1.38)
Previously abused	1.77***	(1.51,2.07)	1.32***	(1.11,1.85)	1.56***	(1.33,1.84)	1.23*	(1.03,1.47)
Medical factors								
Primiparity	1.67***	(1.47,1.89)	1.70***	(1.47,1.97)	1.01	(0.88,1.15)	1.01	(0.88,1.17)
Gestational age	1.00	(0.99,1.01)	1.00	(0.99,1.01)	1.00	(0.99,1.01)	0.99	(0.98,1.00)
Previous pregnancy loss	0.99	(0.86,1.13)	1.05	(0.91,1.22)	1.26***	(1.10,1.44)	1.19*	(1.03,1.38)
Unplanned pregnancy	1.61***	(1.40,1.86)	1.26 **	(1.06,1.49)	1.30***	(1.12,1.51)	1.02	(0.86,1.21)
Fertility treatment	1.05	(0.86,1.28)	1.18	(0.94,1.47)	1.04	(0.84,1.28)	1.08	(0.86,1.36)
High risk[b]	1.42***	(1.25,1.61)	1.40***	(1.21,1.63)	1.56***	(1.37,1.79)	1.45***	(1.24,1.68)
Multiples	1.73*	(1.14,2.63)	1.65*	(1.06,2.60)	1.30	(0.84,2.02)	1.09	(0.69,1.73)
Chronic illness	1.63***	(1.43,1.87)	1.43***	(1.23,1.67)	1.42***	(1.23,1.64)	1.21**	(1.04,1.42)
Psychiatric medication	1.16	(0.96,1.40)	1.00	(0.82,1.23)	1.11	(0.91,1.35)	1.06	(0.86,1.30)
Healthy behaviors	0.76***	(0.71,0.82)	0.81***	(0.75,0.87)	0.93*	(0.86,0.99)	1.02	(0.94,1.10)
COVID-19 situational factors								
COVID-19 related income loss	1.45***	(1.28,1.65)	1.19*	(1.04,1.37)	1.46***	(1.28,1.66)	1.28**	(1.11,1.47)
Outdoor space accessible	0.44***	(0.36,0.53)	0.63***	(0.51,0.78)	0.53***	(0.43,0.64)	0.67***	(0.54,0.83)
Proximity to someone with COVID-19	1.23*	(1.01,1.48)	1.03	(0.83,1.27)	0.98	(0.80,1.20)	0.81	(0.65,1.01)
Patient with COVID-19 dx	1.28	(0.74,2.24)	1.21	(0.67,2.21)	0.97	(0.53,1.77)	0.98	(0.53,1.89)
Perceived risk having had COVID-19	1.27***	(1.18,1.36)	1.54***	(1.33,1.77)	1.28***	(1.19,1.38)	1.53***	(1.32,1.76)
Appointment altered	1.79***	(1.57,2.03)	1.78***	(1.55,2.04)	1.54***	(1.35,1.76)	1.49***	(1.30,1.71)
			$R^2 = 0.15$				$R^2 = 0.08$	

Note. Adjusted odds ratios control for all other variables in the regression model.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ *CI* = Confidence Interval; OR = Odds Ratio.
[a] Included all women who endorsed a racial or ethnic identity other than White-Non-Hispanic.
[b] Women who reported being high risk and those who were unsure were grouped together.

detrimental combination for pregnant woman of color who are at significantly greater risk of adverse perinatal outcomes affected by stress (Rosenthal & Lobel, 2011, 2020).

Apart from confirming the factors previously established as contributors to prenatal stress, we also identified risk factors that are unique to the pandemic, including experiencing pandemic-related income loss, believing one is infected with COVID-19, and experiencing alterations of prenatal care. At the same time, more than two-thirds of the sample did not experience high levels of pandemic-related stress, and we were able to identify factors that appear to be protective against this type of stress, such as having access to the outdoors and practicing healthy behaviors (Table 1). These findings corroborate two recent studies that found that physical activity increases resilience among women in Canada (Lebel et al., 2020) and the UK (Davenport et al., 2020) pregnant during the COVID-19 pandemic.

Study findings suggest several practices that may be useful to reduce prenatal stress during the pandemic. Minimizing disruptions of prenatal care, perhaps with effective use of telehealth appointments, maybe one promising means to reduce women's stress. Regular communication with health care providers has been shown to reduce distress in pregnant women and result in better self-care (Nicoloro-SantaBarbara et al., 2017). Policies to make safe out-of-hospital births more accessible, such as those recently proposed by New York State (New York State COVID-19 Maternity Task Force, 2020), may help alleviate stress associated with fears of hospital-related perinatal infection, and as a secondary benefit, may reduce demands on hospitals already burdened by the current pandemic. Increasing the frequency of prenatal SARS-COV-2 and antibody testing, as well increasing education and awareness about COVID-19 and proper prevention (e.g., hygiene, social distancing), may also be helpful in reducing stress related to concerns over infection. Study findings, as well as other recent research (Davenport et al., 2020), also provide strong evidence to advocate for and promote women's access to the outdoors and to emphasize the value of practicing healthy

behaviors, not merely for their physical health value, but also as a way to reduce stress. Routine physical and emotional abuse screening is also more important than ever to protect women who may be sheltering in place with violent partners (Froimson et al., 2020), and as suggested here, to reduce pandemic-related pregnancy stress. This type of screening should be accompanied by referrals to evidence-based interventions and resources (Flanagan et al., 2018; US Preventive Services Task Force, 2018).

Further research focused on the short and longer-term impacts of pandemic-related stress in the perinatal population is imperative. Longitudinal studies investigating outcomes of prenatal and postpartum pandemic-related stress on maternal mental and physical health, perinatal outcomes, and child development could identify critical stress mechanisms and determine whether vulnerability is associated with the timing and chronicity of maternal stress. Ideally, this research would enroll women during the pre-conceptional period, although such research is logistically challenging. Examining interactions between the two types of pandemic stress in health-related decision making such as where to give birth (in hospital versus out of hospital) is an additional important line of investigation. Further study of factors that promote resilience in the context of COVID-19 pregnancies could also lead to the development of interventions. Additionally, the influence of stress on infection and inflammatory processes highlights a need to investigate the interaction of pandemic-related perinatal stress with COVID-19 infection (Acabchuk et al., 2017; Cohen, 2020; Simons et al., 2017).

5. Limitations

Recruitment methods, which excluded women without access to internet and social media, are a limitation of the study, as is the underrepresentation of young women and women of color compared to the U.S. population. These limitations may reduce the generalizability of results. Study findings nonetheless offer important insights into the

impact of the pandemic on pregnant women and offer a compelling basis for further systematic research in this area. Studies assessing the experiences of women of color are especially critical because stress-related burdens and health inequities affecting women of color have increased during the COVID-19 pandemic and may be exacerbating existing disparities in reproductive health outcomes pandemic (Goldfarb et al., 2020; Onwuzurike et al., 2020). Additional studies identifying resilience factors such as social support and access to mental health resources, as well as epidemiological and clinical studies are urgently needed.

6. Conclusions

The present study contributes to our understanding of the experiences of pregnant women during the COVID-19 pandemic and the overall literature on the experience of stress during pregnancy. It provides insight into which women are at greatest risk of elevated stress and how their stress might be alleviated. Such work is critical to the welfare of women and their offspring, especially during periods of global challenges to health and well-being.

Credit author statement

Heidi Preis, Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing- Original Draft, Visualization, Supervision, Project Administration, and Funding acquisition. Brittain Mahaffey, Conceptualization, Methodology, Writing- Review & Editing, and Funding acquisition. Cassandra Heiselman, Data Curation, Writing-Review & Editing. Marci Lobel, Conceptualization, Methodology, Writing- Review & Editing, Supervision and Funding acquisition.

Disclosure

The authors report no conflicts of interest.

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