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Title

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Permalink

Journal

Women & Health, 62(8)

ISSN

0363-0242

Authors

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Publication Date

2022-09-14

DOI

10.1080/03630242.2022.2125139

Peer reviewed

Perceived stress and COVID-19-related stressors: the moderating role of social support during pregnancy

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Abstract

Recent evidence on perceived stress during the COVID-19 pandemic shows that birthing people experienced stress from pandemic-related stressors. While psychosocial stress is a significant predictor of adverse birth outcomes, social support can reduce stress levels during pregnancy. This study examined social support moderation of relationships between COVID-19-related stressors and perceived stress during pregnancy. The analysis included data from publicly insured pregnant participants who were enrolled in a randomized control trial of two enhanced prenatal care models in Fresno, California, and completed a third-trimester questionnaire between April and August 2020 (n = 77). Multivariate linear regression was used to estimate the associations between perceived stress and COVID-19-related stressors and social support moderation. COVID-19-related stressors related to childcare and tension at home remained significantly associated with perceived stress adjusting for sociodemographic characteristics and other COVID-19-related stressors. Social support moderated the relationship between perceived stress and loss of childcare (β = 2.4, 95%CI = 0.5 - 4.3, p = 0.014). Overall, social support moderated the association between COVID-19 stressors and perceived stress. While social support is commonly conceptualized as protective, the finding of greater stress around childcare among individuals reporting greater social support suggests complexity for leveraging these support networks during the pandemic.

Keywords

Stress; COVID-19 pandemic; social support; pregnancy

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Introduction

Psychosocial stress during pregnancy is a significant predictor of adverse maternal and infant outcomes that contribute to infant mortality and poor health later in life among infants. Studies have shown that psychosocial stress is associated with maternal depression and anxiety, preterm birth, and low birth weight infants (Staneva et al. 2015; Ding et al. 2021; Wainstock et al. 2013). Determinants of psychosocial stress vary and stem from individual-level factors such as financial strain and area-level stressors such as neighborhood crime (Shannon et al. 2020; Eick et al. 2020). Psychosocial stress is more prevalent among low-income birthing people, who often experience co-occurring medical, social, and structural risk factors contributing to elevated risk for adverse birth outcomes (Shaw, Herbers, and Cutuli 2019).

The impact of the COVID-19 pandemic on maternal stress has been reported globally. Recent research on perceived stress during the pandemic shows patterns of moderate to high stress among birthing people, indicating that stressors stemming from the COVID-19 pandemic may relate to overall stress during pregnancy (Medina-Jimenez et al. 2020; Jiang et al. 2021; Stepowicz et al. 2020; Preis et al. 2020). An emerging body of literature exploring pregnancy experiences during the COVID-19 pandemic suggests that factors such as statewide stay-at-home orders, food insecurity, lack of access to childcare, and financial issues are prevalent sources of stress (Barbosa-Leiker et al. 2021). Further, the pandemic introduced considerable pregnancy-related worries about changes in birth plans, prenatal care, and labor and delivery care (Atmuri et al. 2021; Wheeler, Misra, and Giurgescu 2021). Studies also show that birthing people reported that social support, a protective factor against adverse birth outcomes, was negatively impacted during the pandemic (Barbosa-Leiker et al. 2021; Atmuri et al. 2021).

Numerous studies have found that emotional and instrumental (i.e., practical) support from partners and family members are associated with better maternal health and birth outcomes (Giurgescu et al. 2018; Surkan et al. 2019; Hawkins et al. 2021). The benefits of social support as a buffer to stressors during pregnancy have also been documented (Razurel et al. 2013; Martin-West 2019; Navarrete, Nieto, and Lara 2021). For instance, in a study of intimate partner violence and depressive symptoms during pregnancy, the impact of intimate partner violence was reduced among women with greater availability of social support (Navarrete, Nieto, and Lara 2021). However, little is known regarding the extent to which social support buffers against the deleterious impacts of COVID-19-related stressors on overall stress during pregnancy, despite emerging evidence that the pandemic may negatively impact social support and heighten exposure to stressors. In this study, we assessed these relationships in a sample drawn from an ongoing randomized trial of enhanced prenatal care, which offered a racially diverse cohort of low-income birthing people in the third trimester of pregnancy during the height of the COVID-19 pandemic. This study adds to the literature by focusing on a vulnerable population in the US and quantitatively assesses the impacts of the COVID-19 pandemic and social support on perceived stress.

Methods

Study design and sample

The EMBRACE (Engaging Mothers and Babies-Reimagining Antenatal Care for Everyone) Study is a prospective comparative effectiveness trial that is assessing the impact of two enhanced prenatal care models (i.e., group and individual care with wrap-around support services) on adverse birth outcomes, mental health, and experiences of care among low-income birthing people in the Central Valley region of California. Upon enrollment, participants are allocated to group or individual prenatal care based on their due date and a randomized schedule. Inclusion criteria are eligibility for Medicaid, less than 24 weeks gestation, Spanish or English speaking, and receipt of prenatal care at a participating site. EMBRACE participants complete three interviewer-administered questionnaires – one each at baseline, during their third trimester, and at 3-months postpartum.

The study sample for this analysis is drawn from 101 participants who were recruited into the study prior to the COVID-19 outbreak, completed a baseline questionnaire at that time, and reached their third trimester of pregnancy during the early phases of the COVID-19 pandemic (N = 79). Baseline data was collected between November 2019 and March 2020, while data for the third-trimester assessments was collected between April and September of 2020. The state of California issued a statewide stay-at-home order in March 2020. In Fresno County, California the stay-at-home order went into effect in May 2020. The baseline questionnaire included items relating to sociodemographic characteristics such as age, race/ethnicity, education, and employment status. Perceived stress, social support, COVID-19-related experiences (e.g., job or income loss, food insecurity, loss of childcare, COVID-19 diagnosis) and experiences of prenatal care (e.g., respectful care, prenatal care satisfaction) were measured during the third trimester. Of the 79 participants with third trimester survey data, we excluded two participants with missing data on perceived stress. The final analytic sample therefore consisted of 77 participants.

Ethical Considerations

All participant's enrolled in the study provided informed consent for the use of their de-identified data. This study received institutional approval for human subjects' research from the California State University, Fresno Committee for the Protection of Human Subjects (Protocol #: 922) and the University of California, San Francisco Human Research Protection Program (IRB #: 19-28319).

Measures

Outcome: Perceived stress

The outcome of interest was perceived stress in the prior month during the third trimester (hereafter perceived stress during pregnancy), measured using the 10-item Perceived Stress Scale (PSS, Cohen & Williamson, 1988). The PSS has been used in prior studies of chronic stress among diverse pregnant people and demonstrates high reliability (Glynn et al. 2008; Cohen, Kamarck, and Mermelstein 1983; Solivan et al. 2015; Mann et al. 2010). Perceived stress was included as a continuous variable and scores ranged from 0 – 33 (mean =

12.4, standard deviation (SD) 7.4). Internal consistency for in this sample was satisfactory (Cronbach's α = .83).

Predictors: COVID-19-related stressors

The third trimester survey included four items to measure stressors stemming from COVID-19, adapted from the University of Michigan COVID-19 survey (Moyer et al. 2020). Participants were asked to state the extent to which they agreed with four statements: "I have felt stressed about food running out or being unavailable," "I have felt stressed about losing a job or a decrease in income," "I have felt stressed about the loss of childcare or taking care of children at home," and "I have felt stressed about tension or conflict between household members." We modeled each item as a numeric variable ranging from 1 (strongly disagree) to 5 (strongly agree). The sample mean scores for COVID-19-related food insecurity, job loss, loss of childcare, and tension at home were 2.7 (SD=1.5), 3.2 (SD=1.8), 2.4 (SD=1.7), and 1.9 (SD=1.4), respectively. To measure pregnancy-related worry during COVID-19 we created a 7-item scale adapted from the Cambridge Worry asked scale (Green et al. 2003) in which we participants to rate, on a scale from 1 (not a worry) – 10 (a major worry), the extent to which they were worried about several different issues (e.g., "The possibility that your baby will get COVID-19"). Green et al. (2003) reported high reliability and validity for the Cambridge Worry scale in their diverse sample of pregnant women. The internal consistency in this sample was satisfactory (Cronbach's α = .81). All COVID-19-related stressor scores were treated as continuous variables and ranged from 1-10 (Mean = 5.3 (SD=2.3)).

Perceived social support

We measured during the third trimester as the availability of social support using the 8-item modified-Medical Outcomes Survey social support survey (mMOS-SSS, (Moser et al. 2012)). The mMOS-SSS includes two subscales (4-items) measuring the availability of general emotional (e.g., caring, empathy) and tangible/instrumental (e.g., material aid) support. The mMOS-SSS scores are numeric and range from 0 – 100, with higher scores indicating higher social support. Social support scores in our sample ranged from 15.6 – 100 (M = 82, SD = 20.7). The internal in this sample was satisfactory (Cronbach's α=0.93). The mMOS-SSS has been used in other studies of diverse pregnant people with high validity and reliability (Giurgescu et al. 2017; Campos et al. 2008). Given that social support scores were high in this sample, social support scores were dichotomized at the median of 85 for interaction models to reduce the influence of outliers (Kolker et al. 2022).

Sociodemographic covariates

We adjusted for a set of covariates we believe could confound the relationship between COVID-19 related stressors and perceived stress (Eick et al. 2020; Woods et al. 2010). Sociodemographic covariates measured at study enrollment included age (15-24, 25-34, 35+), education (less than high school, high school graduate, education beyond high school), race/ethnicity (white, Latina, Black, and other (Biracial, Asian, American Indian/ Alaska Native)), relationship status (married/living with a partner, significantly involved but not living with a partner, single), and country of birth (US versus elsewhere (foreign

born)). We measured household income dependents as the number of individuals (including participants) that depend on the household income (1-2, 3-4, 5+).

Statistical Analysis

We began the analysis by assessing the distribution of sociodemographic characteristics in the sample. To estimate the association between perceived stress during pregnancy and COVID-19-related stressors, we used linear regression models before and after adjustment for covariates. We reported the unstandardized regression coefficients and confidence intervals for each COVID-19-related stressor. We estimated linear regression models with social support interaction terms for each stressor to test the moderating effect of social support on the association between perceived stress and COVID-19-related stressors. In adjusted models, we used a backward stepwise elimination approach, retaining significant (p < 0.05) COVID-19-related stressor variables and interaction terms (Vittinghoff et al. 2012). All analyses were performed using STATA version 16 (StataCorp, College Station, TX).

Results

The sample characteristics are presented in Table 1. About half (50.7%) of the participants were between 25-34 years old. The majority were Latinx (62.3%) and married or living with a partner (74.0%). Less than half (42.9%) had more than a high school education, and about 30% reported being foreign-born. About half (48.1%) of the participants reported having 3-4 income dependents in their households, while approximately 28.6% reported residing in a household with 1-2 income dependents and 23.4% with 5 or more income dependents.

The unadjusted analyses revealed that COVID-19-related stressors stemming from job loss, loss of childcare, tension in the home, and pregnancy worry due to the pandemic were associated with increased perceived stress during pregnancy (Table 2). However, stressors related to food insecurity due to the pandemic were not found to be associated with perceived stress during pregnancy. Most of the covariates were not associated with overall stress except for foreign-born status, which was associated with lower perceived stress during pregnancy (β= −4.8, 95% Ci = (−8.3, −1.3), p = 0.008).

In Table 3, we present the results of adjusted models for each COVID-19-related stressor (model 1), all COVID-19-related stressors (model 2), and social support interactions with all COVID-19-related stressors (model 3). All three models adjust for covariates. In model 1, adjusting for covariates, COVID-19 stressors related to job loss (β = 1.3, 95% CI = 0.3-2.3, p = 0.009), stressors related to loss of childcare (β = 1.7, 95% CI = 0.7 −2.8, p = 0.001), stressors related to tension at home (β=2.6, 95% CI = 1.5 - 3.8, p < 0.001) and COVID-19 worry (β= 0.7, 95% CI = 0.3 −1.8, p =0.008) were significantly associated with increased perceived stress during pregnancy. After adjusting for all COVID-19-related stressors, loss of childcare (β=1.0, 95% CI = 0.1 - 2.1, p = 0.05) and tension at home stemming from the pandemic were associated with increased perceived stress (β = 2.1, 95%CI = 0.9 - 3.4, p = 0.001). In model 3, social support moderated the association between perceived stress and stressors related to loss of childcare due to the pandemic (β = 2.4, 95%CI = 0.5 - 4.3, p = 0.014). As Figure 1 shows, the association between perceived stress and stressors related to loss of childcare due to the pandemic was stronger among participants with the

highest perceived support. There were no significant interactions between social support and stressors related to food insecurity, job loss, tension at home or COVID-19 pregnancy worry.

Discussion

The purpose of this study was to describe the associations of COVID-19-related stressors and perceived stress during pregnancy and assess the extent to which social support moderates these associations. Overall, we found that stress related to job loss, loss of childcare, tension at home, and worries about pregnancy during the pandemic were associated with overall stress among this sample of low-income birthing people. However, after adjusting for all COVID-19-related stressors, only tension at home due to the pandemic was significantly associated with overall stress, indicating that the association between the other COVID-19-related stressors and overall perceived stress are interrelated.

Although perceived stress was lower among participants reporting the highest social support, the impact of stressors related to childcare (e.g., taking care of children at home or losing childcare) during the pandemic was stronger among those with the highest perceived support compared to participants with lower support. This finding departs from conceptualizations of social support as a protective factor that mitigates the impact of life stressors. There are a few possible contextual explanations for these findings. First, although individuals may perceive greater availability of social support in their networks, conditions stemming from the pandemic may have limited their ability to access support. For instance, Barbosa-Leiker et al. (2021) found that pregnant people were less likely to report physically connecting with others to cope with COVID-19 stressors compared to people who had recently given birth. If similar trends are occurring among participants in this study, it may be that those with high support are perceiving greater impact from some COVID-19-related stressors because they are not accessing their support systems in ways that they would have in the absence of the pandemic.

Another explanation may be that individuals with greater availability of support also have a larger number of social ties that result in more obligations to provide support to others, which may supersede one's willingness or ability to ask for support. As Berkman et al. (2000) show, social support is shaped by many contextual factors including network structure and characteristics of network ties. Future studies should consider these attributes when describing the buffering role of social support during pregnancy.

There are important limitations to our analysis. First, our participants, on average, had lower levels of perceived stress and higher levels of social support compared to other studies of birthing people (Stepowicz et al. 2020). Thus, the findings may not be generalizable to groups with higher perceived stress. It is also important to note that the support measure used in this study captured availability of support but did not capture sources of support or perceived adequacy of support. In addition, this study only considers perceived stress at a single time point (the month prior during the third trimester) to capture the context of the COVID-19 pandemic. Experiences of stressors and stress levels may vary over the course of a pregnancy during the COVID-19 pandemic, as perceived stress has been shown to decrease throughout pregnancy (Goletzke et al. 2017). Future studies should consider measuring

perceived stress and associations with social support at various times during pregnancy and postpartum. Lastly, this study included a small sample of pregnant people with low-incomes and studies with larger samples are needed to confirm these findings.

Despite these limitations, this study offers an examination of how COVID-19-related stressors and social support impacted perceived stress during pregnancy. As studies of birthing people's experiences during the COVID-19 pandemic continue to emerge, elucidating the role of protective factors will become an increasingly important area of research. The findings from this study offer preliminary explorations of the association between perceived stress and social support as a moderator of stressors during the COVID-19 pandemic. It provides evidence that the moderating effect of social support on stressors during pregnancy is complex, and additional research is needed in order to mitigate pregnancy risk.

Funding Acknowledgements:

Appendix

Appendix

Appendix Table 1.

Standardized and unstandardized coefficients for unadjusted associations between perceived stress, COVID-19-related stressors, social support and sociodemographic characteristics.

	Standardized β	Unstandardized β	95% CI	p-value
COVID-19-related stressors				
Food insecurity	0.2	0.7	−0.4 - 1.8	0.182
Job loss	0.1	1.4	0.5 - 2.3	0.003
Loss of childcare	0.2	1.8	0.9 - 2.7	**< 0.001**
Tension at home	0.2	2.3	1.2 - 3.4	**< 0.001**
COVID-19 worry	0.3	0.9	0.4 - 1.9	**0.002**
Perceived social support				
Highest social support (ref = lowest)	0.2	−0.1	−0.1 - 0.02	0.142
Age (ref = 35+ years)				
18-24	0.3	2.3	−3.6 - 8.1	0.446
25-34	0.4	3.1	−2.6 - 8.9	0.277
Race/Ethnicity (ref= White)				
Latinx	−0.02	−3.0	−7.9 - 1.8	0.216
Black	−0.06	3.2	−4.2 - 10.5	0.397
Other (Asian, biracial, NA/AI)	0.1	−1.2	−7.2 - 4.9	0.699

	Standardized β	Unstandardized β	95% CI	p-value
Relationship Status (ref = Single)				
Married/living with partner	0.3	−3.5	−6.1 - 6.9	0.907
Significantly involved but not living with partner	0.3	0.3	−8.7 - 1.7	0.184
Education (ref = < High school)				
High school graduate	0.2	0.6	−3.8 - 5.0	0.788
> High school	0.2	3.4	−0.6 -7.3	0.092
Foreign-born	−0.3	−4.8	−8.3 - −1.3	**0.008**
Income dependents (ref = 1 - 2)				
3 - 4	0.1	−0.1	−4.1 - 3.9	0.950
5+	−0.04	−2.1	−6.8 - 2.6	0.369

AI/AN: American Indian/Alaska Native. β: The beta coefficient estimates the difference in Perceived Stress Scale scores compared to each reference group, or in the presence of each COVID-19-related stressor. CI: Confidence interval.

Appendix Table 2.

Standardized and Unstandardized coefficients for adjusted linear regression estimates of the association between perceived stress, COVID-19-related stressors, and social support during pregnancy.

	Model 1[a]			Model 2[b]			Model 3[c]		
	β*	β (CI)	p-value	β*	β (CI)	p-value	β*	β (CI)	p-value
COVID-19-related stressors									
Food insecurity	0.3	0.6 (−0.6 - 1.8)	0.31	--	--		0.2	−0.4 (−1.5 - 0.7)	0.51
Job loss	0.1	1.3 (0.3 - 2.3)	**0.009**	--	--		−0.2	−0.5 (−1.6 - 0.7)	0.42
Loss of childcare	0.2	1.7 (0.7 - 2.8)	**0.001**	0.1	1.0 (0.1 - 2.1)	**0.050**	0.2	−0.3 (−1.8 - 1.2)	0.65
Tension at home	0.2	2.6 (1.5 - 3.8)	**< 0.001**	0.2	2.1 (0.9 - 3.4)	**0.001**	0.1	2.0 (0.7 - 3.3)	**0.003**
COVID-19 worry	0.3	0.7 (0.3 - 1.8)	**0.008**	--	--		0.2	0.6 (−0.2 - 1.4)	0.16
Perceived social support									
Highest support (ref = lowest)							−0.1	−8.0 (−13.5 - −2.6)	**0.005**
Perceived social support (ref = lowest) x COVID-19 stressor									
Food insecurity x Highest social support							--	--	
Job loss x Highest social support							--	--	
Loss of childcare x Highest social support							−0.03	2.4 (0.5 - 4.3)	**0.014**
Tension at home x Highest social support							--	--	
COVID-19 worry x Highest social support							--	--	

*β: standardized regression coefficients. β: unstandardized regression coefficient estimating relationship change in perceived stress and COVID-19 related stressors.CI: Confidence Interval.

[a]Model 1 adjusts for each COVID-19 related stressor and covariates (age, race/ethnicity, education, relationship status, nativity, and household income dependents).

[b]Model 2 adjusts for covariates and all COVID-19-related stressors.

[c]Model 3 adjusts all COVID-19 stressors, sociodemographic factors and social support. Stepwise backwards elimination was used to eliminate main effects and interaction terms that did not meet criteria in Models 2 and 3 respectively.

References

Atmuri Kiran, Sarkar Mahbub, Obudu Efe, and Kumar Arunaz. 2021. "Perspectives of Pregnant Women during the COVID-19 Pandemic: A Qualitative Study." Women and Birth. 10.1016/j.wombi.2021.03.008.

Barbosa-Leiker Celestina, Smith Crystal Lederhos, Crespi Erica J., Brooks Olivia, Burduli Ekaterina, Ranjo Samantha, Carty Cara L., Hebert Luciana E., Waters Sara F., and Gartstein Maria A.. 2021. "Stressors, Coping, and Resources Needed during the COVID-19 Pandemic in a Sample of Perinatal Women." BMC Pregnancy and Childbirth 21 (1). 10.1186/s12884-021-03665-0.

Berkman Lisa F., Glass Thomas, Brissette Ian, and Seeman Teresa E.. 2000. "From Social Integration to Health: Durkheim in the New Millennium." Social Science and Medicine 51 (6): 843–57. 10.1016/S0277-9536(00)00065-4. [PubMed: 10972429]

Campos Belinda, Schetter Christine Dunkel, Abdou Cleopatra M., Hobel Calvin J., Glynn Laura M., and Sandman Curt A.. 2008. "Familialism, Social Support, and Stress: Positive Implications for Pregnant Latinas." Cultural Diversity and Ethnic Minority Psychology 14 (2): 155–62. 10.1037/1099-9809.14.2.155. [PubMed: 18426288]

Cohen S, Kamarck T, and Mermelstein R. 1983. "A Global Measure of Perceived Stress." Journal of Health and Social Behavior 24 (4): 385–96. 10.2307/2136404. [PubMed: 6668417]

Ding Xiuxiu, Liang Mingming, Wu Yile, Zhao Tianming, Qu Guangbo, Zhang Jian, Zhang Huimei, Han Tiantian, Ma Shaodi, and Sun Yehuan. 2021. "The Impact of Prenatal Stressful Life Events on Adverse Birth Outcomes: A Systematic Review and Meta-Analysis." Journal of Affective Disorders 287 (May): 406–16. 10.1016/J.JAD.2021.03.083. [PubMed: 33838476]

Eick Stephanie M., Goin Dana E., Izano Monika A., Cushing Lara, DeMicco Erin, Padula Amy M., Woodruff Tracey J., and Morello-Frosch Rachel. 2020. "Relationships between Psychosocial Stressors among Pregnant Women in San Francisco: A Path Analysis." PLoS ONE 15 (6). 10.1371/journal.pone.0234579.

Giurgescu Carmen, Fahmy Lara, Slaughter-Acey Jaime, Nowak Alexandra, Caldwell Cleopatra, and Misra Dawn P. 2018. "Can Support from the Father of the Baby Buffer the Adverse Effects of Depressive Symptoms on Risk of Preterm Birth in Black Families?" AIMS Public Health 5 (1): 89–98. 10.3934/publichealth.2018.1.89. [PubMed: 30083571]

Giurgescu Carmen, Zenk Shannon N., Engeland Christopher G., Garfield Lindsey, and Templin Thomas N.. 2017. "Racial Discrimination and Psychological Wellbeing of Pregnant Women." MCN. The American Journal of Maternal Child Nursing 42 (1): 8. 10.1097/NMC.0000000000000297. [PubMed: 27749288]

Glynn Laura M., Schetter Christine Dunkel, Hobel Calvin J., and Sandman Curt A.. 2008. "Pattern of Perceived Stress and Anxiety in Pregnancy Predicts Preterm Birth." Health Psychology 27 (1): 43–51. 10.1037/0278-6133.27.1.43. [PubMed: 18230013]

Goletzke J, Kocalevent RD, Hansen G, Rose M, Becher H, Hecher K, Arck PC, and Diemert A. 2017. "Prenatal Stress Perception and Coping Strategies: Insights from a Longitudinal Prospective Pregnancy Cohort." Journal of Psychosomatic Research 102 (November): 8–14. 10.1016/j.jpsychores.2017.09.002. [PubMed: 28992901]

Green Josephine M., Kafetsios Konstantinos, Statham Helen E., and Snowdon Claire M.. 2003. "Factor Structure, Validity and Reliability of the Cambridge Worry Scale in a Pregnant Population." Journal of Health Psychology 8 (6): 753–64. 10.1177/13591053030086008. [PubMed: 14670208]

Hawkins Melissa, Misra Dawn, Zhang Liying, Price Mercedes, Dailey Rhonda, and Giurgescu Carmen. 2021. "Family Involvement in Pregnancy and Psychological Health among Pregnant

Black Women." Archives of Psychiatric Nursing 35 (1): 42–48. 10.1016/j.apnu.2020.09.012. [PubMed: 33593514]

Jiang Hong, Jin Longmei, Qian Xu, Xiong Xu, La Xuena, Chen Weiyi, Yang Xiaoguang, et al. 2021. "Maternal Mental Health Status and Approaches for Accessing Antenatal Care Information during the COVID-19 Epidemic in China: Cross-Sectional Study." Journal of Medical Internet Research 23 (1). 10.2196/18722.

Kolker Sabrina, Biringer Anne, Bytautas Jessica, Kukan Sahana, and Carroll June. 2022. "Psychological Distress and Behavioral Changes in Pregnant and Postpartum Individuals during the Covid-19 Pandemic." Journal of Obstetrics and Gynaecology Canada, June. 10.1016/J.JOGC.2022.06.008.

Mann Joshua R., Mannan Jana, Quiñones Luis Antonio, Palmer Allyson A., and Torres Myriam. 2010. "Religion, Spirituality, Social Support, and Perceived Stress in Pregnant and Postpartum Hispanic Women." Journal of Obstetric, Gynecologic & Neonatal Nursing 39 (6): 645–57. 10.1111/J.1552-6909.2010.01188.X.

Martin-West Stacia. 2019. "The Role of Social Support as a Moderator of Housing Instability in Single Mother and Two-Parent Households." Social Work Research 43 (1): 31–42. 10.1093/swr/svy028.

Medina-Jimenez Virginia, de la Luz Bermudez-Rojas Maria, Murillo-Bargas Hector, Rivera-Camarillo Ana Claudia, Muñoz-Acosta Jairo, Ramirez-Abarca Tania Gabriela, Esparza-Valencia Diana Magdalena, et al. 2020. "The Impact of the COVID-19 Pandemic on Depression and Stress Levels in Pregnant Women: A National Survey during the COVID-19 Pandemic in Mexico." Journal of Maternal-Fetal and Neonatal Medicine. 10.1080/14767058.2020.1851675.

Moser André, Stuck Andreas E., Silliman Rebecca A., Ganz Patricia A., and Clough-Gorr Kerri M.. 2012. "The Eight-Item Modified Medical Outcomes Study Social Support Survey: Psychometric Evaluation Showed Excellent Performance." Journal of Clinical Epidemiology 65 (10): 1107–16. 10.1016/j.jclinepi.2012.04.007. [PubMed: 22818947]

Moyer Cheryl A., Compton Sarah D., Kaselitz Elizabeth, and Muzik Maria. 2020. "Pregnancy-Related Anxiety during COVID-19: A Nationwide Survey of 2740 Pregnant Women." Archives of Women's Mental Health 23 (6): 757–65. 10.1007/S00737-020-01073-5/TABLES/4.

Navarrete Laura, Nieto Lourdes, and Lara Ma Asunción. 2021. "Intimate Partner Violence and Perinatal Depression and Anxiety: Social Support as Moderator among Mexican Women." Sexual and Reproductive Healthcare 27 (February). 10.1016/j.srhc.2020.100569.

Preis Heidi, Mahaffey Brittain, Heiselman Cassandra, and Lobel Marci. 2020. "Pandemic-Related Pregnancy Stress and Anxiety among Women Pregnant during the Coronavirus Disease 2019 Pandemic." American Journal of Obstetrics & Gynecology MFM 2 (3): 100155. 10.1016/j.ajogmf.2020.100155. [PubMed: 32838261]

Razurel Chantal, Kaiser Barbara, Sellenet Catherine, and Epiney Manuela. 2013. "Relation Between Perceived Stress, Social Support, and Coping Strategies and Maternal Well-Being: A Review of the Literature." 10.1080/03630242.2012.732681.

Shannon Megan M., Clougherty Jane E., McCarthy Clare, Elovitz Michal A., Nguemeni Tiako Max Jordan, Melly Steven J., and Burris Heather H.. 2020. "Neighborhood Violent Crime and Perceived Stress in Pregnancy." International Journal of Environmental Research and Public Health 17 (15): 1–11. 10.3390/ijerph17155585.

Shaw Sara H., Herbers Janette E., and Cutuli JJ. 2019. "Medical and Psychosocial Risk Profiles for Low Birthweight and Preterm Birth." Women's Health Issues 29 (5): 400–406. 10.1016/j.whi.2019.06.005. [PubMed: 31353098]

Solivan Amber E., Xiong Xu, Harville Emily W., and Buekens Pierre. 2015. "Measurement of Perceived Stress Among Pregnant Women: A Comparison of Two Different Instruments." Maternal and Child Health Journal 19 (9): 1910–15. 10.1007/s10995-015-1710-5. [PubMed: 25652063]

Staneva Aleksandra, Bogossian Fiona, Pritchard Margo, and Wittkowski Anja. 2015. "The Effects of Maternal Depression, Anxiety, and Perceived Stress during Pregnancy on Preterm Birth: A Systematic Review." Women and Birth. 10.1016/j.wombi.2015.02.003.

Stepowicz Anna, Wencka Barbara, Bieńkiewicz Jan, Horzelski Wojciech, and Grzesiak Mariusz. 2020. "Stress and Anxiety Levels in Pregnant and Post-Partum Women during the COVID-19

Pandemic." International Journal of Environmental Research and Public Health 17 (24): 1–9. 10.3390/ijerph17249450.

Surkan Pamela J., Dong Liming, Ji Yuelong, Hong Xiumei, Ji Hongkai, Kimmel Mary, Tang Wan Yee, and Wang Xiaobin. 2019. "Paternal Involvement and Support and Risk of Preterm Birth: Findings from the Boston Birth Cohort." Journal of Psychosomatic Obstetrics and Gynecology 40 (1): 48–56. 10.1080/0167482X.2017.1398725. [PubMed: 29144191]

Vittinghoff Eric, Glidden David V., Shiboski Stephen C., and McCulloch Charles E.. 2012. "Regression Methods in Biostatistics," Statistics for Biology and Health, . 10.1007/978-1-4614-1353-0.

Wainstock Tamar, Anteby Eyal, Glasser Saralee, Shoham-Vardi Ilana, and Lerner-Geva Liat. 2013. "The Association between Prenatal Maternal Objective Stress, Perceived Stress, Preterm Birth and Low Birthweight." Journal of Maternal-Fetal and Neonatal Medicine 26 (10): 973–77. 10.3109/14767058.2013.766696. [PubMed: 23339660]

Wheeler Jenna M, Misra Dawn P, and Giurgescu Carmen. 2021. "Stress and Coping among Pregnant Black Women during the COVID-19 Pandemic." Public Health Nursing, April. 10.1111/phn.12909.

Woods Sarah M., Melville Jennifer L., Guo Yuqing, Fan Ming Yu, and Gavin Amelia. 2010. "Psychosocial Stress during Pregnancy." American Journal of Obstetrics and Gynecology 202 (1): 61.e1–61.e7. 10.1016/j.ajog.2009.07.041.
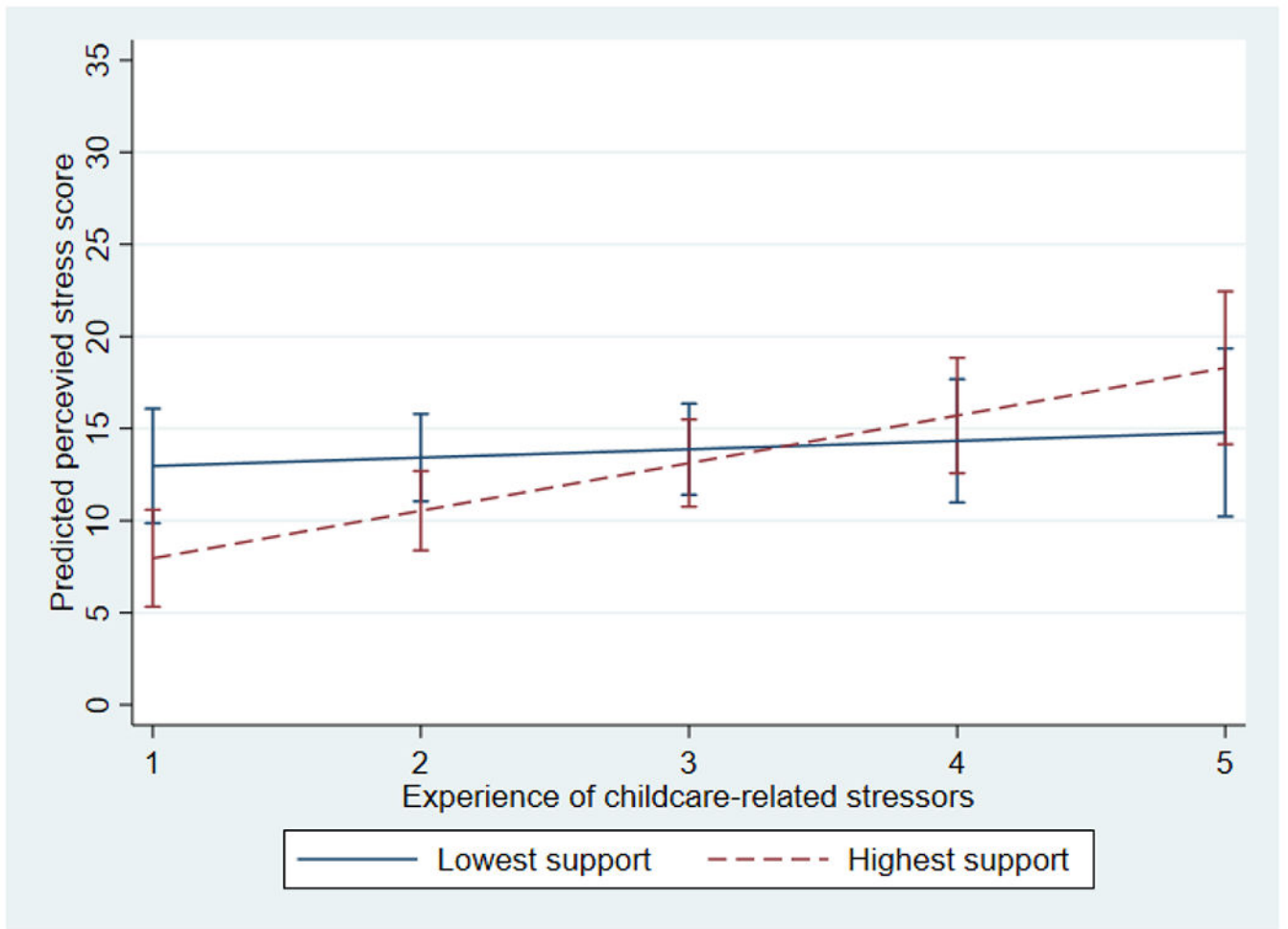
Figure 1.
The moderating effect of social support on the relationship between perceived stress and COVID-19-related stressors during the third trimester (model 3).

Table 1.

Distribution of sample characteristics.

Sociodemographic characteristics	n	%
Age (years)		
15-24	30	39.0
25-34	39	50.7
35	8	10.4
Race/Ethnicity		
Latinx	48	62.3
Black	6	7.8
White	11	14.3
Other (Asian, Biracial, and AI/AN)	12	15.6
Educational attainment		
< High school	23	29.9
High school graduate	21	27.3
> High school	33	42.9
Relationship status		
Married or living with partner	57	74.0
Significantly involved but not living with partner	11	14.3
Single/not significantly involved	9	11.7
Foreign-born	23	29.9
Income dependents[1]		
1 to 2	22	28.6
3 to 4	37	48.1
5 or more	18	23.4

AI/AN: American Indian/Alaska Native

[1] Total number of individuals who rely on household income (including participant).

Table 2.

Unadjusted associations between perceived stress, COVID-19-related stressors, social support and sociodemographic characteristics.

	β	95% CI	p-value
COVID-19-related stressors			
Food insecurity	0.7	−0.4 - 1.8	0.182
Job loss	1.4	0.5 - 2.3	0.003
Loss of childcare	1.8	0.9 - 2.7	**< 0.001**
Tension at home	2.3	1.2 - 3.4	**< 0.001**
COVID-19 worry	0.9	0.4 - 1.9	**0.002**
Perceived social support			
Highest social support (ref = lowest)	−0.1	−0.1 - 0.02	0.142
Age (ref = 35+ years)			
18-24	2.3	−3.6 - 8.1	0.446
25-34	3.1	−2.6 - 8.9	0.277
Race/Ethnicity (ref= White)			
Latinx	−3.0	−7.9 - 1.8	0.216
Black	3.2	−4.2 - 10.5	0.397
Other (Asian, biracial, NA/AI)	−1.2	−7.2 - 4.9	0.699
Relationship Status (ref = Single)			
Married/living with partner	−3.5	−6.1 - 6.9	0.907
Significantly involved but not living with partner	0.3	−8.7 - 1.7	0.184
Education (ref = < High school)			
High school graduate	0.6	−3.8 - 5.0	0.788
> High school	3.4	−0.6 −7.3	0.092
Foreign-born	−4.8	−8.3 - −1.3	**0.008**
Income dependents (ref = 1 - 2)			
3 - 4	−0.1	−4.1 - 3.9	0.950
5+	−2.1	−6.8 - 2.6	0.369

AI/AN: American Indian/Alaska Native. β: The unstandardized beta coefficient estimates the difference in Perceived Stress Scale scores compared to each reference group, or in the presence of each COVID-19-related stressor. CI: Confidence interval.

Table 3.

Adjusted linear regression estimates of the association between perceived stress, COVID-19-related stressors, and social support during pregnancy.

	Model 1[a]		Model 2[b]		Model 3[c]	
	β (CI)	p- value	β (CI)	p-value	β (CI)	p-value
COVID-19-related stressors						
Food insecurity	0.6 (−0.6 - 1.8)	0.31	--		−0.4 (−1.5 - 0.7)	0.51
Job loss	1.3 (0.3 - 2.3)	**0.009**	--		−0.5 (−1.6 - 0.7)	0.42
Loss of childcare	1.7 (0.7 - 2.8)	**0.001**	1.0 (0.1 - 2.1)	**0.050**	−0.3 (−1.8 - 1.2)	0.65
Tension at home	2.6 (1.5 - 3.8)	**< 0.001**	2.1 (0.9 - 3.4)	**0.001**	2.0 (0.7 - 3.3)	**0.003**
COVID-19 worry	0.7 (0.3 - 1.8)	**0.008**	--		0.6 (−0.2 - 1.4)	0.16
Perceived social support						
Highest support (ref = lowest)					−8.0 (−13.5 - −2.6)	**0.005**
Perceived social support (ref = lowest) x COVID-19 stressor						
Food insecurity x Highest social support					--	
Job loss x Highest social support					--	
Loss of childcare x Highest social support					2.4 (0.5 - 4.3)	**0.014**
Tension at home x Highest social support					--	
COVID-19 worry x Highest social support					--	

β: unstandardized regression coefficient estimating relationship change in perceived stress and COVID-19 related stressors.CI: Confidence Interval.

[a]Model 1 adjusts for each COVID-19 related stressor and covariates (age, race/ethnicity, education, relationship status, nativity, and household income dependents).

[b]Model 2 adjusts for covariates and all COVID-19-related stressors.

[c]Model 3 adjusts all COVID-19 stressors, sociodemographic factors and social support. Stepwise backwards elimination was used to eliminate main effects and interaction terms that did not meet criteria in Models 2 and 3 respectively.